

Novell Portal Services 1.0

Technical White Paper

Overview

Novell® Portal Services is software that you can use to create an enterprise portal that integrates with your business structure as it leverages the power of the directory. Novell Portal Services is the face of your one Net experience: unlike some portals that perform a specific task such as accessing e-mail or an intranet, an enterprise portal built with Novell Portal Services consolidates enterprise applications and information resources from all over the Net into a single view.

As a directory-enabled portal, Novell Portal Services helps you:

- **Simplify** and personalize the use of your everyday business information and applications so you can do business smarter and faster.
- **Secure** and extend highly personalized content through any Web-enabled device to your employees, customers and partners, based on attribute, role, group membership or organization.
- **Accelerate** the deployment of enterprise-class portals by utilizing the time and effort already invested in your existing directory and leveraging the information in your intranet.

Creating a Personalized one Net Experience

Novell is in the business of helping customers create one Net by removing the barriers between intranets, extranets, the Internet and wired and wireless networks. Novell makes information easy to access so you can put it to work immediately, regardless of platform or application.

An enterprise portal captures the vision of the one Net experience because a portal acts as a desktop or “Webtop” for your employees. A portal will help you focus your employees’ work environment by providing them with their e-mail in-boxes, corporate news, links to commonly used applications and folders, a help desk and other information your employees need. Because employees can access this page from any browser, you can now provide your employees with all the corporate network resources they need, whether at work, at home or on the road.

You can also create a customized portal for each of your business partners, a portal for suppliers that shows your inventory levels or a portal for customers that provides company news, product promotions and access to corporate white pages. And the content for these personalized portals can come from any source: your corporate network, your extranet or the Internet.

Novell Portal Services is very flexible and extensible—instead of changing your business processes to accommodate the latest e-business solution, you can create a solution that conforms to the way you do business. Novell Portal Services is itself a simple solution to deploy: its core component, the Novell Portal Services servlet, is platform independent, and its other components are written to open, widely used industry standards. Standards are at the heart of the one Net vision and Novell Portal Services was built entirely on industry standards such as Extensible Markup Language (XML), Extensible Stylesheet Language (XSL), Lightweight Directory Access Protocol, version 3 (LDAP v3), Java® and Hypertext Transfer Protocol (HTTP).

Delivering Dynamic Content

Dynamic content is what separates sophisticated enterprise portals from ordinary Web pages. Most Web pages are static: that is, the content does not change unless someone manually updates the page. To provide dynamic content, you need an application that retrieves data at regular intervals. At Novell, we call these applications “gadgets.” (Other portal vendors use terms such as “Web parts,” “portlets,” “channels” and “content delivery agents.”) For example, if you want a portal to display current temperature, you can use a gadget to access the current temperature from a weather service and display the information in the portal interface. The user can then personalize the location and display of this information.

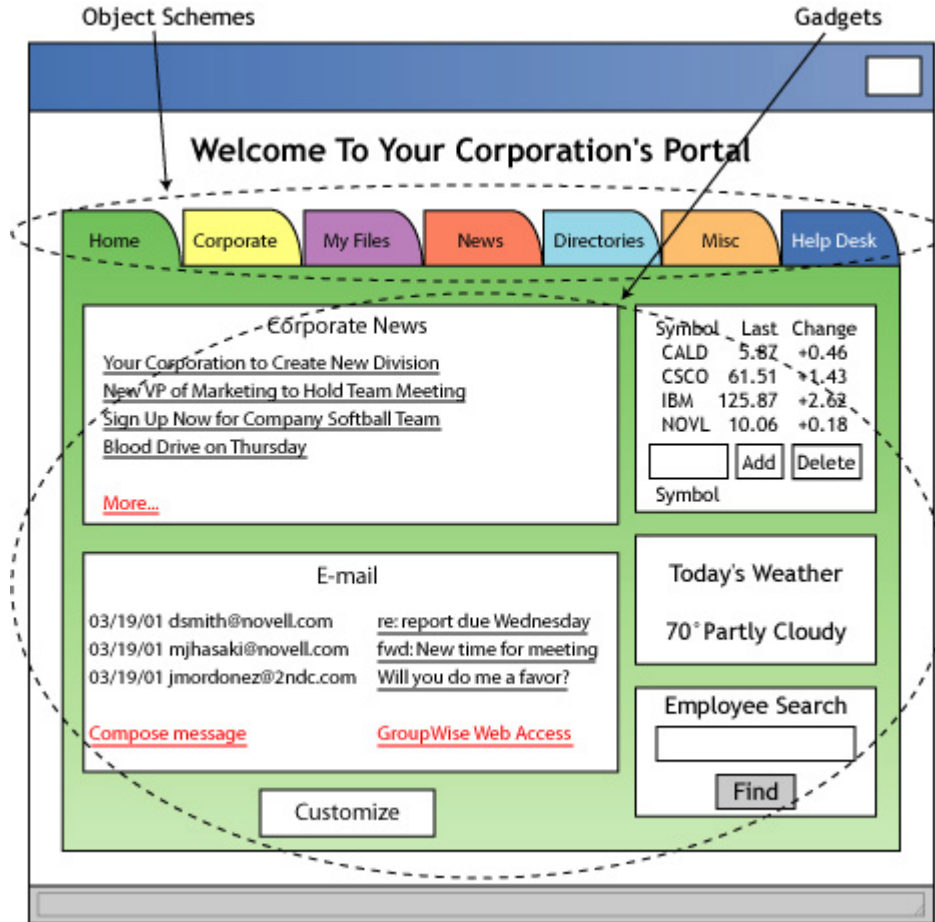


Figure 1: A portal consists of several “object schemes” and many different gadgets.

Figure 1 is an example of an employee's view of a corporate portal built with Novell Portal Services. On the page are several types of dynamic content such as the employee's e-mail in-box, corporate news and a stock ticker. Each of these types of information is the work of a different gadget: one connects to the e-mail server, one to the corporate intranet and the other to a financial services Web site. The other elements on the page—the Customize button, the weather report and the search engine—are also created with gadgets. The tabs on the page represent different “object schemes,” which are views or layouts for the gadgets. When the user chooses the Help Desk tab, for example, the portal will display the Help Desk object scheme, which contains forms for help desk tickets and other technical support information.

HTML Content

HTML content can be retrieved from any uniform resource locator (URL) that produces HTML-encoded data. The HTML may be generated by Active Server Page (ASP), Java Server Page (JSP) or another scripting language or it may be a standard HTML page.

You can choose to do several things with HTML content:

- **Present the whole page**

A gadget can retrieve an entire HTML page and present it as is. This means that your existing Web data and content can easily be brought into the portal. Novell Portal Services controls the delivery of that information by securing it with directory access controls—only those to whom the administrator grants access can see it. You can also bring in existing Web applications that already have a Web interface, and Novell Portal Services can provide single sign-on for many of these Web applications. In this way, you can simplify the user's access to applications by making them available through the portal. (See the "Single Sign-On" section later in this paper.)

- **Present some of the page**

A gadget can parse the HTML to extract only the relevant material—such as a table—and leave behind advertisements, navigational buttons and other unwanted material. In this way, administrators and users can select only the information that they need to access. This simplified presentation of data accelerates decision-making and increases productivity. Administrators can even allow end users to select content from any page. Imagine picking out the soccer schedule for your child's team from your city's Web site while leaving the rest of the league schedules behind. With a gadget you can be that selective.

- **Personalize the content**

A gadget can retrieve the user's name or other information from the directory and insert it where you designate. Personalizing a user's portal experience is extremely easy, because the LDAP attribute name that you want to include can be enclosed in ordinary HTML tags. For example, `<bh>%cn%</bh>` presents the user's common name as part of the Web page.

XML Content

XML content can be retrieved from any URL that produces XML-encoded data generated by ASP, JSP or another scripting language. Retrieval of this kind of content requires only two parameters: the URL of the XML data and the location of an XSL stylesheet to render the XML data. As Novell Portal Services receives the XML stream, it automatically formats the XML data according to the XSL stylesheet. This allows Novell Portal Services to receive data from any source that generates XML. (See the "XML and XSL" sidebar.)

- **Rich Site Summary (RSS)** (also called Resource Description Framework [RDF] Site Summary) is an XML specification used for distributing news, product announcements, discussion threads and other content. The content is organized into “channels.” The content of each channel is updated either on a regular basis or when there is new content for the channel. Hundreds of RSS channels already exist, and you can make some or all of them available to your users. Novell and many other vendors support this standard on their public Web sites. To learn more about what Novell offers, visit <http://www.novell.com/newsfeeds>.

Accessing Content Using Java

Java gadgets are the most robust kind of gadget. They are able to access back-end resources such as databases and applications and convert the data into an XML stream for the portal servlet. Java gadgets can also perform complex tasks by interacting with several network components to retrieve data. For example, on the back end a Java gadget accesses data sources such as databases by calling the Java Database Connectivity (JDBC™) API. On the front end, the Java code accesses the Novell Portal Services API, which enables the gadget to read settings and access information from the directory.

Java gadgets can also perform authentication tasks, as demonstrated in Figure 2.

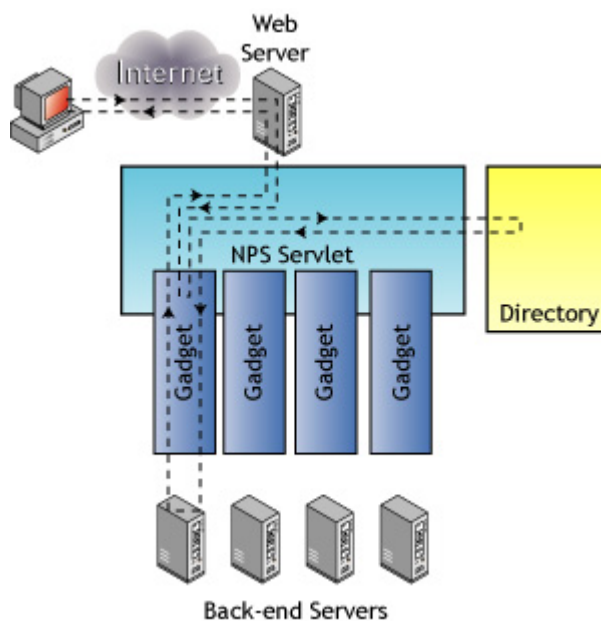


Figure 2: A Java gadget can retrieve authentication credentials from the directory to log on to the application.

In Figure 2, a client requests information stored in a database that requires users to log on. The request goes first to the gadget responsible for that information. The gadget in this

example is programmed to perform sign-on services, so it accesses the client's logon information from the directory. With this information the gadget logs on to the back-end database, retrieves the information and presents it to the Novell Portal Services servlet as an XML stream.

Where to Get Gadgets

Novell Portal Services ships with more than one dozen gadgets that provide a wide variety of functionality. (See the "Types of Gadgets" sidebar.) However, most companies will require more gadgets than these to address their particular needs. There are three methods for acquiring more gadgets: third parties, in-house development and consultation services.

Third-Party

Novell is working with third-party companies to develop Novell Portal Services gadgets, which Novell will make available. Gadgets will also be developed and released independently of Novell Portal Services. As these gadgets become available, Novell customers will be able to access the new gadgets and incorporate them into their portal systems.

In-House Development

You probably have several resources on your network that are unique to your business processes. Perhaps you have already designed a portal of sorts for accessing your intranet, or you may have applications that were built in-house. If these resources are already in HTML or if they produce data using a scripting language such as ASP or JSP, you can easily design your own gadget to bring that data into the portal. Likewise, if you have in-house Java, XML and XSL resources, you can create gadgets for back-end data sources. Novell provides a software developer's kit (SDK) that includes the API to enable gadgets to communicate with the Novell Portal Services framework. The SDK also provides examples of gadget code, software to test the gadgets (without having to install them in Novell Portal Services) and an installation utility to install the completed gadget. You can download the Novell Portal Services SDK (Leading Edge 137) from <http://developer.novell.com/ndk/leadedge.htm>.

Consultation Services

If you do not have the resources to develop a gadget, and the gadget you need is not available, you can arrange for a consultant trained in using the Novell Portal Services SDK to create the gadget for you.

Designing and Customizing Your Portal

Because directories effectively store and organize large amounts of information, they are ideal for organizing portal data. (See the “Directories Defined” sidebar.) More than any other portal solution on the market, Novell Portal Services leverages the full power of directory technology. Novell Portal Services makes no NDS-specific calls, so it supports any directory that is fully compliant with LDAP v3, including NDS® eDirectory™ 8.5 and higher. (Currently, only NDS eDirectory has been tested for full LDAP v3 compliance. Microsoft and Netscape directories are still being tested.)

Being fully directory-enabled means that Novell Portal Services capitalizes on your existing directory structure, making it easier to customize a portal based on a person’s role in the organization. If your directory structure mirrors your organizational structure—groups nested in departments nested in divisions—you can use that directory structure to fine-tune the customization of the portal. For example, you could determine that everyone in the company can access e-mail, only the engineering division gets access to a particular database, and users in the design, programming and testing departments each have access to task-specific applications. Therefore, a user in the design department would have access to a CAD application, the engineering database and e-mail, and a user in testing would have a testing application, the engineering database and e-mail.

The Portal Configuration Object

When you install Novell Portal Services, the installation program extends the directory schema to include new objects: the portal configuration object (PCO), gadget objects and a public portal user (for the page users see before they log on). The PCO is the central portal management object and references all information for the portal. Only one PCO exists for each portal, even when multiple servers host the portal.

Having a single point of management for the portal ensures that the user will always have access to the most up-to-date information. For example, most portal deployments involve redundant Web servers at the front end, with a router or other device sending user requests to the Web servers in a round-robin fashion. The Novell Portal Services portal servlet on each Web server gets data from the same PCO, as shown in Figure 3, so you can synchronize all the portal servlets from the same location. Because of this single point of management, portal users will never be directed to a portal you have not yet updated.

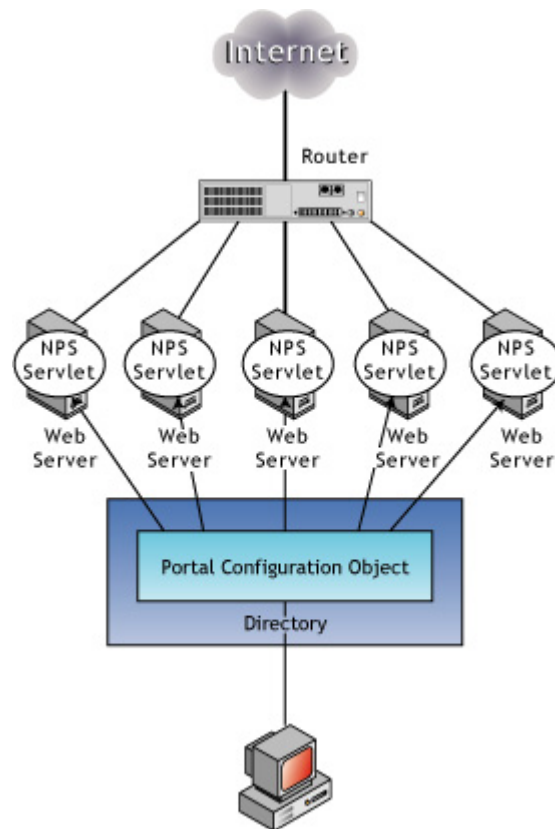


Figure 3: All instances of the Novell Portal Services servlet are managed through a single directory object.

Branding and Inheritance

The “real estate” or space on a Novell Portal Services portal is divided into two categories: the branding area and the inheritable area. The branding area contains elements of the portal that you want to be present on all portal pages, such as the corporate logo or a logoff gadget. The inheritable area contains elements that are specific to the user, group or container, such as task-specific object schemes or object schemes designed by the user or the user’s department. Figure 4 shows an example of how branding and inherited areas might be configured on a portal.

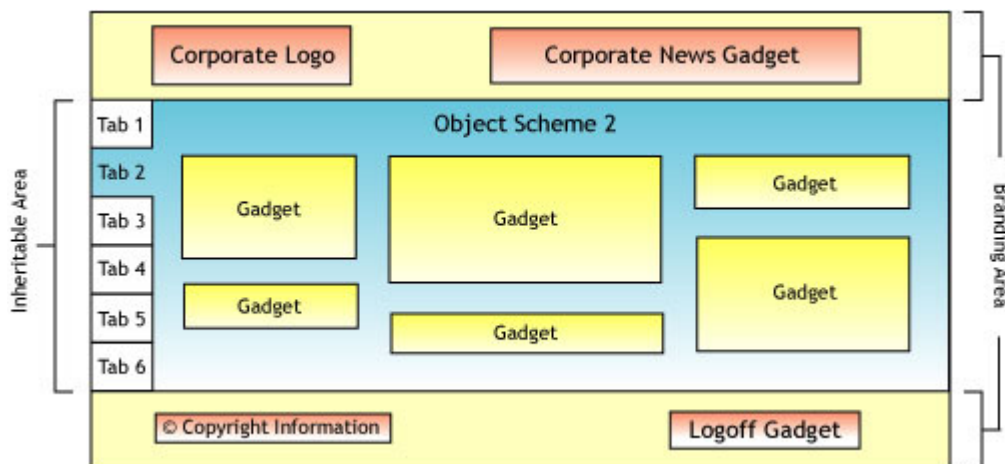


Figure 4: In this example, the branding area is at the top and bottom of the page, and the inheritable area is in the middle, with the tabs on the left. You can create any variation on this layout that you want.

You can create one branding area for each object in your company's directory tree. This feature is especially useful for application service providers (ASPs) that create and manage portals for other companies. For example, if you are an ASP that manages portals for 200 clients, and you have created a separate object in your directory tree for each client, you can design 200 different branding areas and place each one in its corresponding object. Furthermore, if all 200 clients want to have a stock ticker gadget in their branding areas, you do not need to install 200 stock ticker gadgets. Instead, you install one gadget, then you associate that gadget object with all 200 branding areas. Alternately, if all your clients' objects are in a single container, you can put the gadget in the top container, and all the portals will have that gadget, as shown in Figure 5.

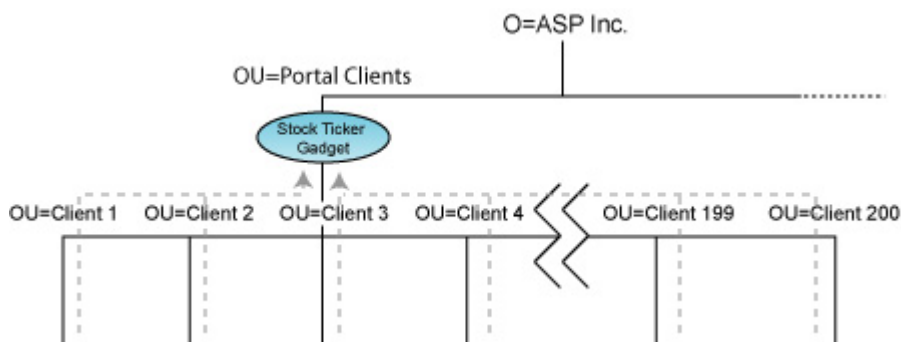


Figure 5: A single gadget object can serve an infinite number of object schemes.

You can design as many object schemes as you want—one (or more) for each type of user, group or organization that will be using the portal. For example, you could design one set of object schemes for employees, one for customers and one for partners. If your directory is organized so that each type of user is in a different container, you only need to store the

object scheme in the container object, and all the subordinate objects will inherit that object scheme. Object schemes can also be stored in user and group objects.

By storing object schemes in directory objects, you can easily control who sees what according to the user's place in the directory. For example, if you want to make a particular application available only to members of the accounting department, you create an object scheme in the Accounting organizational unit (OU) that has a gadget for accessing the application. Only those users in Accounting will have access to the object scheme with that gadget. When a user is transferred in or out of the Accounting department, that user will automatically gain or lose access to the application—the only action needed is to move the user's object from one organizational unit to another.

To customize what users see, Novell Portal Services leverages the inheritance structure of your current directory. When a user opens the portal, Novell Portal Services begins reading portal configuration information in the user's object, then it continues to read portal-related information in each parent container until it reaches a flag that tells it to stop. (If there is no flag, Novell Portal Services reads all the way up to the root object.) Novell Portal Services then checks for information in group objects before creating the customized portal display. Figure 6 shows an example of how Novell Portal Services uses the directory to control what each user sees.

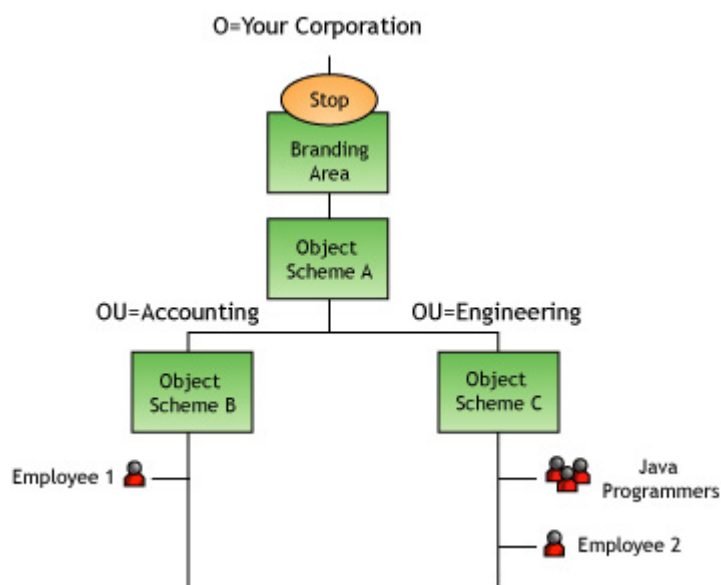


Figure 6: Users inherit the object schemes in the containers above them.

When Employee 1 opens her portal, Novell Portal Services begins reading layout information at her user object and continues to read layout information up through the tree until it reaches the flag that tells it to stop. Employee 1 therefore inherits Object Scheme B

in the Accounting container, Object Scheme A in the Your Corporation container and the branding area for Your Corporation. She will not, however, inherit Object Scheme C in the Engineering container. When Employee 2 opens his portal, Novell Portal Services reads layout information from his user object, the Engineering object, the Your Corporation object and the Java Programmers group object. The resulting portals are shown in Figure 7.

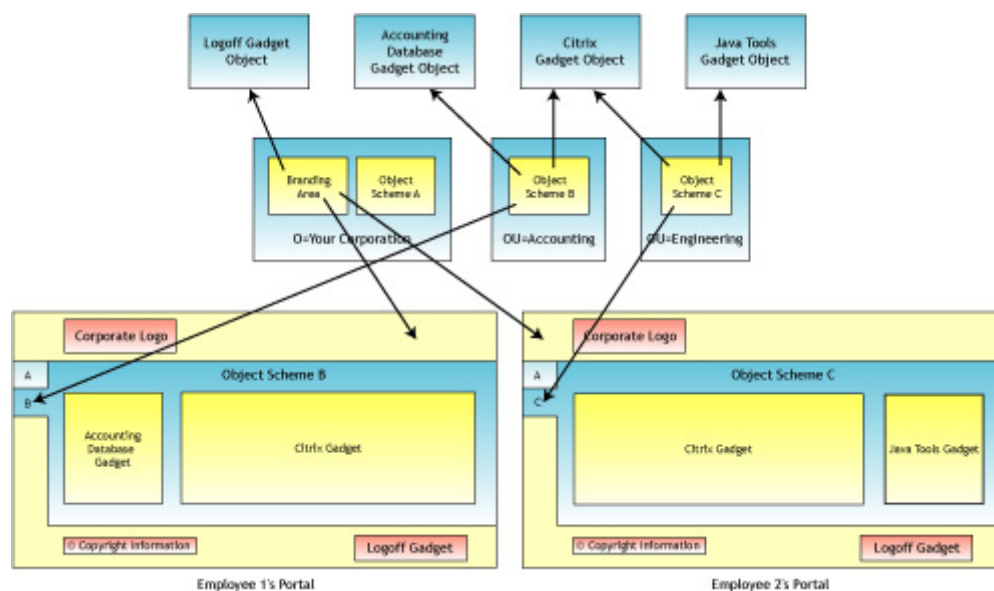


Figure 7: The Relationship between Gadgets, Object Schemes and Portal Views

Notice that because Object Scheme C contains the Java Tools gadget, the employee in Engineering has access to it, but the employee in Accounting does not. Likewise, the Engineering employee cannot access the accounting database.

Stylesheets

Of course, you will want a portal that is customized to reflect the visual style of your company. Fortunately, it is easy to create a consistent, professional look and feel for your portal with the schemes that are included with Novell Portal Services. Each scheme is a stylesheet that defines elements such as the size and color of the header and footer, the shape and color of the buttons, and whether you navigate between object schemes with tabs, buttons, icons, drop-down menus or text. If you want to modify a style to include your company logo, for example, you only need to modify the scheme's file.

You can further customize your portal by altering how each type of content looks. The included gadgets each have their own stylesheets, which can be modified to achieve the desired look and feel.

Personalization Settings

Other modifications that you can make to the portal are settings, which affect portal characteristics other than appearance. For example, a portal administrator can specify that the world news gadget will display five headlines. If users are allowed to customize this setting, they can make the gadget display more headlines or fewer. Other settings users can be allowed to change are the column where a gadget is located or its position in the column. Gadgets can also be minimized, removed or added.

The settings are stored in the user's directory object and are read by the portal when it is opened. However, if you do not want users to modify a setting, you can prevent it. For example, if you do not want users to change the location of the corporate news gadget, you can lock down its location setting. When Novell Portal Services reads layout information up through the directory, the setting you have locked down will override settings in subordinate objects.

Portal Groups

Portal groups are created dynamically by specifying that the members of the group consist of users whose X attribute has a value of Y. For example, if each of your partner's user objects has an attribute called "Status," one portal group could be created for everyone whose Status attribute was "Preferred," a second group might consist of those with "Gold" in the Status attribute and a third group could be formed by those who had "Platinum." You would then create one or more object schemes for each of these groups. As soon as a partner's status changed, the object schemes for that partner's portal would change automatically.

Because you can create a portal group based on any attribute or set of attributes—from job title to shoe size—you can create specialized object schemes for any category of user: return customers, customers with outstanding payments, suppliers who sell 3/4-inch bolts, students on the honor roll, employees on the fourth floor, new clients, old clients, potential clients or any other category you need.

The dynamic nature of portal groups makes them easy to manage. Instead of creating a group and manually adding and deleting users, you create the group and designate which attribute value or values will be the basis for group membership. When those attributes change (as the result of new input, an event or other factor) users automatically join or drop out of the group without administrator intervention.

Implementing a Secure, Manageable Portal

Businesses have been hesitant to make their network resources available to the public for one primary reason: security. And once the portal is up and running, the portal's effectiveness is directly related to how manageable it is. Fortunately, security and manageability are two hallmarks of directory-enabled solutions.

Security

Novell Portal Services harnesses the security controls inherent to directories—access control and authentication—and the simplicity of portal technology to prevent your portal from becoming an entryway to uninvited guests.

Novell Portal Services strictly limits the degree to which your network is exposed to users. You determine exactly which parts of your network are available by providing gadgets for those parts. If you do not want anyone to access a particular database through a portal, for example, you do not provide a gadget for it.

Novell Portal Services also restricts what users can do: they can follow links, click on buttons and check boxes, but they cannot send commands or executables through the portal—there simply is no means for them to do so.

Single Sign-On

Novell Portal Services simplifies logging on to the Net with single sign-on technology. Instead of providing separate “credentials” (user ID and password) for each of the various applications, servers, Web sites and directories on the Net, you only log on to the portal once, and all subsequent authentication is done for you. Novell Portal Services can accomplish single sign-on using two types of authentication.

- **Basic authentication** must accompany every packet that travels across the medium. Some applications require this type of authentication.
- **Form-fill authentication** is input once by a user at the beginning of a session so that a secure channel can be established. You encounter form-fill authentication when you visit a Web site that requires user registration, for example. The first time Novell Portal Services encounters this type of Web site, it will prompt you for your user ID and password. These credentials will be stored by Novell Portal Services in the directory so that the next time you visit the Web site, Novell Portal Services will automatically log you on.

Each type of authentication uses one of two types of credentials.

- **Directory credentials** are those that you use to log in to the directory. These credentials may also be used to access other parts of the directory, servers, applications or other resources, provided that the resources have been configured to accept directory credentials.
- **Unique credentials** are those that are not directory credentials. They are used by servers, applications, Web sites and other resources that have not been configured to accept directory credentials.

Novell Portal Services can perform these types of single sign-on out of the box. If you are using or want to use another type of authentication solution such as Novell iChain™, it can easily plug in to Novell Portal Services.

To protect authentication credentials, Novell Portal Services stores the credentials in the directory as an attribute of a user's object. Each entry is encrypted and stored separately in a "credential store." If someone attempts to reset your password to gain unauthorized access to your portal, the entire credential store will become locked and the unauthorized user will not be able to use your single sign-on credentials to access your sensitive information. For example, if you have a gadget that logs on to your 401K account, the unauthorized user will not be able to steal your password from the store to access your 401K account. This locking mechanism prevents even network administrators from accessing your credentials.

Once the store has been locked, the next time you try to log on to the portal, you will be notified that the store is locked. You can then choose to reset the credential store, which erases every credential, or you can unlock the store by entering your original user ID and password.

Firewall Friendly

Because HTTP is the universal standard for sending and receiving Web pages over the Internet, you can access Novell Portal Services from any standard Web browser. This makes Novell Portal Services extremely firewall friendly—because most firewalls already allow HTTP communications to pass through securely, using Novell Portal Services does not require that you open another port on your firewall. Novell Portal Services uses only two ports: port 80 for HTTP and port 443 for Secure Sockets Layer (SSL).

Management

An administrator gadget that ships with Novell Portal Services provides you with all the tools you need to create, modify and manage your portal from inside the portal itself. This means that from any browser, administrators can quickly create, manage and support users in Novell Portal Services.

The administration gadget also supports SNMP alerts, which allows administrators to integrate Novell Portal Services management and monitoring into their enterprise management consoles. Because current monitoring structures are easily supported, you will have simpler integration and more reliable services.

Tracking

Novell Portal Services includes gadgets that provide the administrator with real-time data, which helps the administrator identify current trends or health issues on the server. However, to make decisions about how layouts and gadgets are being utilized, you need more tools. Therefore, Novell Portal Services provides several JavaBeans™ that track the following information:

- User logon and logoff
- Schemes selected
- Gadgets used

This information can help you determine how to improve portal performance. For example, if you know which schemes and gadgets are most used, you can make better decisions about which resources are needed for employees to be productive.

Conclusion

An enormous amount of information has been made available by networking technology, and much more will be available in the future. Companies risk being buried under the weight of too much information until they learn how to prioritize relevant information and focus their resources. Novell Portal Services presents the ideal solution to the problem of excess information by providing a simple, flexible platform on which companies can gather and present needed information, thereby increasing the value of information for their employees, customers and partners.

The primary advantage of using Novell Portal Services for your portal solution lies in its solid integration with directory technology. By capitalizing on your directory's current structure, Novell Portal Services makes it easy to control who sees what. A directory's centralized structure also makes it easy to manage, and the security features already inherent in directories enhance the security of a Novell Portal Services portal. Additionally, Novell Portal Services is built to open standards, which makes it platform independent, interoperable and easy to adapt to future technologies.

Some industry commentators call portals the "next killer app," a technology that will radically change the way computing is done. Some anticipate that portals will partly or completely

replace the familiar Windows® desktop. Others see portals as the key to B2B commerce. Whatever the eventual role portals play in the larger Net economy, portals now promise a viable, practical way to leverage the vast information resources furnished by intranets, extranets and the Internet. There really is only one Net—see it all through Novell Portal Services.

Summary of Novell Portal Services Advantages		
Feature	Function	Advantage
Complete Directory Integration	– Store portal configuration information in the directory	– Provide content based on role – Leverage existing infrastructure – Deploy faster and more easily
LDAPv3 Compliance	– Access directory information	– Use on any server OS – Firewall friendly
Portal Configuration Object	– Configure portal	– Enjoy single point of management – Get redundant support for increased reliability via the directory
Java Gadgets	– Retrieve data from back-end data sources and convert it to XML	– Access data from an application or database anywhere on the Net
XML	– Define content of data – Separate content from presentation	– Retrieve data from any platform or application that generates XML – Customize presentation of XML data to employees, partners and customers
XSL Stylesheets	– Provide formatting for XML data	– Create separate stylesheets for different Web-access devices – Improve performance by sending a stylesheet once and only data streams thereafter
Single Sign-on	– Store authentication credentials for future use	– Enter passwords only once – Reduce or eliminate password-related help calls
SDK	– Provide API for the Novell Portal Services servlet	– Create gadgets in-house for any data source

Table 1: Summary of Novell Portal Services Advantages

The Complete Solution

Novell Portal Services is just one part of Novell's Net services software. To complete your portal solution, you will want to check out the following products:

- NDS eDirectory—The industry's most robust, scalable directory.
- Novell iChain—An end-to-end security solution for enterprise networks.
- DirXML—A means to synchronize and replicate the data in all the directories on your network.
- Novell Account Management—Integrates user accounts from Windows, Solaris® and Linux® operating systems into eDirectory.

With these Net services software solutions, as well as others offered by Novell, you can capitalize on the resources of the Net to increase productivity and enhance service for your company.

Additional Solution Resources

You may also want to read the following articles and white papers about portals, Novell Portal Services and Novell's one Net vision.

Read About It	Find It
What Novell Portal Services customers have to say	http://www.novell.com/products/portal/customers/
About one Net	http://www.novell.com/news/onenet/index.html
About more e-Business solutions from Novell	http://www.novell.com/consulting/bsol/
About NDS eDirectory	http://www.novell.com/products/nds/productinfo.html
About the NDS Advantage	http://www.novell.com/competitive/nds/
About DirXML	http://www.novell.com/products/nds/dirxml/productinfo.html
About iChain	http://www.novell.com/products/ichain/productinfo.html

System Requirements

To operate Novell Portal Services, you must be running the following software:

- An LDAP v3-compliant directory to which you have administrative access
- A JVM, version 1.2.2 or higher

- A Web server
- A Web application server or servlet engine
- A Web browser

Compatible Systems

The following systems have been tested for compatibility with Novell Portal Services. You can use other systems, but you might need to make slight alterations if they are not 100 percent compliant with LDAP v3, Java, XML, XSL and HTTP.

JVM and Operating Systems

- JVM 1.2.2 or higher
- NetWare 5.1 with Service Pack 2
- Red Hat® Linux 7
- Solaris
- Windows 2000 and Windows NT® 4.0

Web Servers

- Novell Enterprise Web Server 5.10
- Apache Software Foundation Apache Server 1.3.14
- Microsoft® Internet Information Server (IIS) 4.0 and 5.0
- Sun-Netscape® iPlanet® Application Server (with servlet engine)

Web Application Servers and Servlet Engines

- Apache Software Foundation Jakarta Tomcat 3.2

LDAP v3-Compliant Directories

- Novell NDS eDirectory 8.5

Browsers

- Microsoft Internet Explorer (IE) 4.01 or higher
To make IE 4.01 XML compatible, you need Service Pack 1 and the MSXML parser. The parser can be downloaded from Microsoft's Web site at <http://msdn.microsoft.com/Downloads/tools/xmlparser/xmlidl.asp>.
- Macintosh® IE 4 or higher
- Netscape Communicator 4.5 or higher

For More Information

[appropriate division name and address]

[appropriate global Novell office addresses]

Please contact your local Novell Authorized Reseller or system house. Or visit us at <http://www.novell.com/products/portal> today.

You may also call Novell at:

1-888-321-4272 (U.S. and Canada)

1-801-861-4272 (worldwide)

Fax: 1-801-861-5376

© 2001 Novell Inc., All rights reserved.

The following are registered trademarks of Novell Inc. in the United States and other countries: Novell, NetWare, GroupWise, NDS.

The following are trademarks of Novell Inc.: eDirectory, iChain.

Citrix is a registered trademark of Citrix Systems Inc.

iPlanet, Java and Solaris and are registered trademarks of Sun Microsystems Inc. in the United States and other countries. JavaBeans and JDBC are trademarks of Sun Microsystems Inc.

Linux is a registered trademark of Linus Torvalds.

Macintosh is a registered trademark of Apple Computer Inc. in the United States and other countries.

Microsoft, Windows and Windows NT are registered trademarks of Microsoft Corporation.

Netscape is a registered trademark of Netscape Communications Corporation in the United States and other countries.

Red Hat is a registered trademark of Red Hat Inc. in the United States and other countries.

All other brand and product names are trademarks or registered trademarks of their respective companies.