

Novell® Teaming 2

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Bringing Together the Right People with the Right Skills in Secure Online Workspaces

Novell Teaming 2 provides digital workspaces that give organizations a simple and powerful way to unite the people, information and resources required to address an undertaking of any size.

Face-to-face collaboration between colleagues provides a great medium to spark creativity, innovation and productivity. However, productive interaction shouldn't be limited by locality. In today's scattered environments, the people with skills and expertise needed to solve problems and drive business success might be on the other side of the campus, city, state or world. To leverage these valuable resources, organizations need the ability to easily create environments that foster dynamic collaboration and breakthrough productivity between team members—no matter where they work.

Novell® Teaming 2 brings the right people with the right skills together in secure online workspaces where they can interact easily. The Teaming workspace serves as a digital "office" where team members, working locally or dispersed geographically, can gather to coordinate their efforts, information, resources and skillsets toward the completion or maintenance of a project, purpose or topic of interest. Novell Teaming ensures that the collective knowledge of any skilled group is never lost, and leverages the synergies of skills, ideas and inspiration to accomplish goals quickly and effectively.

Unlike some collaboration solutions, Novell Teaming 2 doesn't require an army of Web designers or programmers to be effective. Once it's deployed, users can immediately create and control their Teaming environments to:

- *Create high-performance teams*
- *Streamline business processes*
- *Leverage organizational knowledge*

Create High-performance Teams

The most powerful ideas come from a broad set of diverse minds. Novell Teaming 2 provides digital workspaces that give organizations a simple and powerful way to unite the people, information and resources required to address an undertaking of any size. These can be small projects that last only a few days and involve a handful of members, or they can be multi-year ventures that span continents and require thousands of team members. Members can be brought into teams from multiple organizations. Novell Teaming facilitates the creation of virtual teams based on the match between expertise, skills, availability and business need, rather than proximity or organizational charts.

Project leaders and team members can leverage Novell Teaming 2 workspaces to store and organize all information related to a specific project, such as ideas, plans, research, milestones, tasks, expected outcomes, work in progress and more. In addition, through the use of metadata, Novell Teaming 2 enables teams to digitally connect data from different collaboration sources—including wikis, blogs, forums, e-mail, calendars, documents and Web pages—and aggregate relevant information based on the contextual needs of a specific project. Novell Teaming provides a consolidation and integration of collaboration tools into one secure, powerfully indexed solution that empowers team members to work together more intelligently, creatively and productively.

Streamline Business Processes

Novell Teaming 2 is all about empowering people to collaborate and work together more effectively. Part of that empowerment comes from its built-in workflow capabilities that enable process automation that saves time, eliminates errors and improves overall efficiency. The workflow capabilities in Novell Teaming 2 streamline business processes by enabling organizations to create a more formal structure for collaboration processes, giving them precise control over how information flows through their organization. Novell Teaming provides the ability to enhance and streamline processes that are vital to the success of business operations.

Unlike other collaboration solutions that offer workflow, Novell Teaming 2 doesn't require programmers or developers in order to deploy its workflow capabilities. Not only is it simple to implement and use, but it also employs an easy-to-understand structure. It is composed of six main elements that include states, transitions, entries (also known as forms), folders, notifications and on-entry/on-exit settings, and access control.

The workflow engine in Novell Teaming 2 has the ability to handle and facilitate everything from simple workflows to extremely complex business process workflows. Additionally, organizations don't have to start from scratch to take advantage of workflows in Novell Teaming 2. Novell provides the Novell Teaming Library, an online library of existing entry forms and workflows that have been designed to solve specific business problems. Novell Teaming users can easily download the custom forms and workflows, and then import them into their Teaming environment. Additionally, any of the default user interface screens for entries such as blogs, discussions, wikis, photos or folders can be used as templates to create custom entries or forms for a workflow. Novell Teaming also makes it easy to modify and adjust workflows to optimize their execution.

To help teams monitor and manage their workflows, Novell Teaming 2 offers the ability to create custom workflow dashboards that allow authorized workflow participants or managers to get a summary view of the current state of all pertinent workflows. For example, business managers can get an at-a-glance view of all the workflows under their responsibility. Or, dashboards can give helpdesk managers a summary view of how many trouble tickets are in the queue, how long tickets have been waiting to be assigned, and how many have been resolved.

Leverage Organizational Knowledge

Just like time is money, knowledge is power. It's what employers pay for. Novell Teaming 2 makes it easy to find the relevant knowledge and resources that team members need to do their jobs. They can easily navigate through the system to contextually see how projects and other collections of information relate to each other. To enable this, Novell Teaming 2 adds a layer of metadata to published data that establishes contextual links among relevant pieces of information. It also fosters contextual interactions among people and their ideas, research, work and knowledge. Together, Novell Teaming 2 workspaces and metadata relationships make it easy for organizations to connect with the people and information that can bring the most value to any project, task or relationship.

In Novell Teaming 2 workspaces, it's easy to identify the specific talents, expertise and knowledge of the different contributors to a team. When corporate managers can know who does what exceptionally well, it becomes easy to build powerful teams for further projects. It's like tailoring a dream team to tackle whatever problem, goal or task the organization gives it, knowing that this particular collection of skills is optimized to get it done quickly, productively and successfully.

Together, Novell Teaming 2 workspaces and metadata relationships make it easy for organizations to connect with the people and information that can bring the most value to any project, task or relationship.

When someone leaves the group—or the organization—knowledge doesn't sit on a hard drive that could be re-imaged at any moment. It's right where it should be—in the team workspace—where existing and new team members can access it at any time.

Additionally, the knowledge retention and sharing capabilities inherent in Novell Teaming 2 workspaces can also help ensure that the collective knowledge of any skilled group is never lost, and is always available to the organization. When someone leaves the group—or the organization—that knowledge doesn't sit on a hard drive that could be re-imaged at any moment. It's right where it should be—in the team workspace—where existing and new team members can access it at any time.

Key Features

Key features in Novell Teaming 2 include the following:

- **Team workspaces** provide a digital “office” where the members of physically distributed teams can gather online to coordinate their efforts and bring together the right information, resources and skillsets for a project, purpose or topic of interest. A team workspace can include team members, goals, timelines, tasks, documents, images, blogs, wikis and more.
- **Personal workspaces** give individual members of the team a place that each member can use personally. Just as the team workspace is the digital “office,” personal workspaces can be considered the digital “cubicles” where individuals create their own personal online work environment. Personal workspaces can leverage all of the functionality available to other workspaces in Teaming (i.e., blogs, wikis, folders, documents, images, tasks, work in progress), but the individuals have personal control over whether any of their elements are private or available for public viewing. Organizations also have the flexibility to configure personal workspaces to restrict their usage or make them completely open.
- **Global workspaces** provide enterprises a digital “gathering place” for all employees or members of an organization as a whole. They contain information that might be of interest to everyone within an organization. A workspace might primarily contain static documents, such as organizational policies, procedures, mission statements, reporting structures, news, HR bulletins, corporate or divisional goals, or anything else that upper management might want its employees to know about. A global workspace might also have a more dynamic side that serves as a forum for company surveys, the corporate comment box or an executive blog addressed to employees. Global workspaces also provide an excellent venue for communities of practice to foster and share knowledge across an organization through discussion forums and posted information.
- **Folders** hold the information a team needs to be productive. File sharing can provide a simple means of document collection and version control. Work in progress collects in these folders. Types of folders include files, wikis, discussions, calendars, tasks, milestones, blogs, surveys, photo albums and custom folders. Each folder is an optimal place to describe and refine expected outcomes and constraints. Through the creation of custom accessories, folders also have the ability to reference and display data from varied sources, including e-mail, office productivity applications and databases.
- **Team member lists** allow teams to be formed from anywhere in the organization, or even between organizations. Team members can see everyone involved, and the workspace manager can set access control rights for each member to ensure that sensitive information is always secured.

- **Global searches** let users quickly find information in almost any format in any workspace that they're authorized to access. These searches make discussions, documents, attachments and any other information posted in a workspace easy to find and use. Team leaders and members can also use the search tool to find people with specific talents and skills, as well as their contributions to team projects.
- **Workflow automation** enables team members to create customized workflows to automate specific processes to save time, eliminate errors and improve overall efficiency.
- **Web Access and compatibility** gives team members access to team workspaces through standard Web browsers. Unlike competing teaming solutions, Novell Teaming 2 works with multiple server and desktop operating systems, directories, office productivity software and databases.

New Features

The following represent new features in the latest release of Novell Teaming 2:

- **New improved and more intuitive user interface** that presents users with a consistent look and feel.
- **Faster navigation**—with the elimination of the Liferay portal, pages download much faster.
- **Relevance dashboard** keeps users abreast of everything going on in their organization, teams and locations that are of interest to them. Its What's Hot area shows the most popular blogs, discussions, documents, workspaces or content in the environment. It provides a quick view of What's New with the people or places that a user is tracking. The Recent Entries tab shows users the entries they've recently posted or the entries they've recently visited. The Task and Calendar tabs present a summary of site-wide events and the status

of tasks. The relevance dashboard helps team members easily collaborate, as well as automatically stay up-to-date and get access to the information they need as soon as it becomes available.

- **Workflow improvements** include histories, folder-relative entry designs and workflows, workflow callouts, chaining and group lists.
- **Custom workspace branding** allows users to provide a custom graphic or text on the header of a workspace that enables it and its sub-workspaces to be quickly and visually associated with an organization, team or user.
- **Micro-blogs** keep someone who is tracking other team members up to date on what's going with them and vice versa.
- **Landing pages** offer team members the ability to create custom Web page workspaces where users can come to get the relevant and important information they need.
- **Advanced search form** provides the ability to search on text, authors, tags, workflows, attributes, activity, creation dates, modification dates, item types and specific workspace paths.
- **New administration-related enhancements** include multi-tenants, indexing server failover, mirror folder improvements, multi-LDAP search queries and a built-in e-mail server for incoming e-mail. The installation of Novell Teaming 2 has been improved, making the process simpler and much faster. Additionally, it provides a smooth and easy upgrade from the previous version.

In addition to features inherent in Novell Teaming 2, Novell offers as a new resource to Teaming customers an online library of frequently used custom forms and workflows for processes such as procurement, conference room scheduling, document review and more. This resource is referred to as the Novell Teaming Library.

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Novell Teaming 2 Security

Novell Teaming 2 implements a standard role-based access control mechanism for access to both objects and functions. At the design level there are six basic rights: read, add comments, create entries, change structure, modify/delete content and change access. The basic rights can be manifested in a variety of ways to provide different levels of granularity and can be grouped together to create named roles. Novell Teaming ships with several predefined roles that include visitor, participant, workspace designer, team member and site administrator.

Access to a particular object is determined by the following conditions:

- *Roles are applied to a folder or workspace and then a set of users or groups is assigned to populate the role.*
- *Role membership can be inherited from parent object (e.g., entries inherit roles from folders; folders can inherit access from their parent workspace).*
- *A group contains a set of one or more users and/or other groups (i.e., group memberships can be nested).*
- *Access is defined by mapping the current user to the object's roles. (The highest level of access wins.)*

The Spring Security framework provides the authentication layer for all user interface transactions, providing a variety of authentication mechanisms. Users can log into Novell Teaming 2 by direct username/password or via a single sign-on facility such as Novell Access Manager™. In terms of network firewall protection, Teaming can take advantage of the following three configurations:

- **Basic firewall.** *Entire server is placed behind a firewall allowing only port 80/443.*
- **Tomcat server isolation.** *An Apache Web server is placed in the DMZ and the AJP protocol is used to communicate with*

the application server through a single dedicated connection.

- **Reverse proxy**

Novell Teaming 2 Definition System

Novell Teaming 2 uses a concept called “definitions” to shape the basic objects that govern the organizational structure of information within the system. The set of definitions that ship with Novell Teaming 2 create much of what users see when using Teaming, but these definitions can be modified—or new ones can be created—to better address an organization’s needs. The main goal behind the definition system is to accomplish the following:

- *Show how to render and form the view of an object*
- *Determine what data should be captured when filling out a form*

Essentially, a definition is an XML file that maps out what elements will make up an entry or binder, how the elements will be displayed and how to build the form that will be used to enter data into an entry or binder. Entries and binders are the two most basic objects in Novell Teaming 2. Entries are the basic unit of information storage within Teaming and are used to bind together content (text, attached files, etc.) with metadata. Examples of entries include discussion entries, blog entries, comments, user profiles and group profiles. Binders are basically collection objects that contain zero or more entry objects or other binder objects. Workspaces, folders and profile lists are all considered binders.

Every object in Novell Teaming 2 has a definition. The definition governs what data is stored with the object and basic information about how it is rendered within the user interface. The definitions enrich the basic binder and entry objects with the following:

- **Attributes.** Basic data items such as text strings, numbers, etc.
- **Attachments.** Arbitrary files (documents, photographs, any binary data)
- **Events.** Temporal information for the object (calendars, repeat frequencies, etc.)
- **Workflows.** State information linked with a workflow definition that governs how state transitions can occur.

In addition to its primary goals, the definition system in Novell Teaming 2 serves additional purposes as well. As already mentioned, the definition system makes Novell Teaming 2 inherently field extensible, enabling organizations to customize the Teaming environment—even at the most basic level—to fit their specific needs. The definition system also facilitates the translation of objects and forms

into different languages. Additionally, since all definitions are simply XML files, they are portable from one system to another.

Standard Three-tier Architecture

Novell Teaming 2 is a 100-percent J2EE* (Java 2 Enterprise Edition) Tomcat application that employs a standard three-tier design model composed of a presentation tier, business tier and data access tier. This design pattern isolates the logic used to interact with the browser from the business logic and data management. It utilizes an “interface-based design” approach to separate out the implementation of components from their interface. This creates an implementation that allows for substitution of modules with minimum impact on the overall design of the product.

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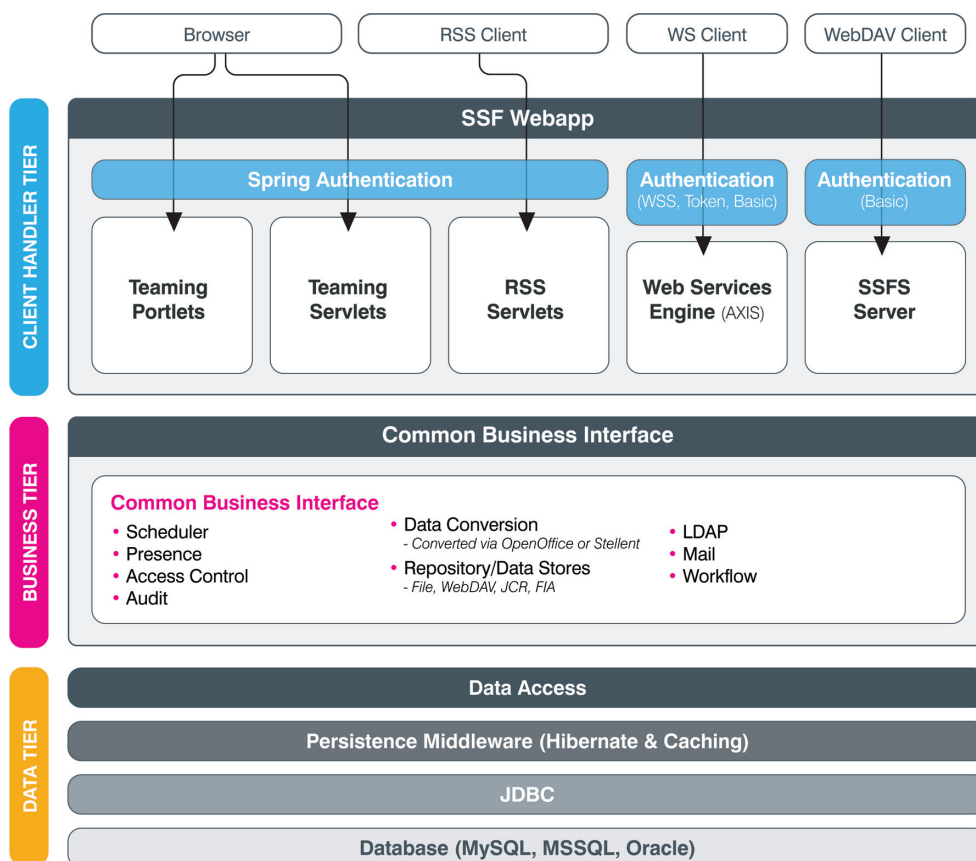


Figure 1. Teaming Domain Model

Presentation Tier

Novell Teaming 2 supports multiple client devices and interfaces, including browsers, RSS, Web services clients and WebDAV. Since Teaming employs interactions that go beyond typical browser transactions, Novell often refers to the presentation tier more generically as the client handler tier.

For browser and RSS clients, Teaming uses the Spring Security framework to give it a wide variety of authentication mechanisms and integration options, which include LDAP, X.509 certificates, digest authentication and single sign-on authorities such as SiteMinder.

Novell Teaming 2 includes two Web service interfaces. The primary Web service interface uses the Apache Axis3 toolkit to interpret SOAP requests and then make calls to the Teaming Web services facade, a very thin layer that provides access to the business tier. These services use WS-Security for authentication. The second Web service interface enables the integration of remote applications and uses a token-based authentication.

Novell Teaming 2 also exposes a standard WebDAV interface for clients such as Windows* Explorer, Microsoft* Office and OpenOffice.org. WebDAV allows desktop applications to directly manipulate files stored in attachments. Novell Teaming uses the Jakarta Slide WebDAV Construction Kit (WCK) to create a WebDAV file server called "SSFS." It utilizes cross-context invocation to translate WebDAV requests into Teaming business interface requests.

As Teaming receives requests from the various client devices or interfaces, the services in this tier interact with the business tier, which in turn calls upon the data tier to retrieve any required data. The business tier then passes the information back to the client handler tier, which then properly formats it and passes it back to the client interface.

Business Tier

The business tier holds the application logic for Novell Teaming 2, meaning the individual behaviors and rules that determine how Teaming operates. The components that make up the business tier include business implementation modules, data converters, repository managers, business implementation modules, and a variety of other managers and services. Many of the components in the business tier are modular in nature such that they can be replaced very easily with other software. For example, Novell Teaming 2 utilizes Stellent for document conversion, while the Kablink® open source version of Teaming utilizes OpenOffice.org for document conversion.

Access to the business tier modules is provided entirely through the common business interface. This includes access to the business implementation classes referred to more commonly as modules. These modules implement major functionality such as administration, workspace and folder operations, calendar support, workflows and reporting. The modules, in turn, make use of services and managers within the business tier. These are capabilities that are shared between the modules such as access control, scheduling, workflow and content indexing via Lucene.

File Management

The business tier also provides functionality related to data management outside of the basic object store handled by the data access tier. In particular, the business tier has the responsibility to create repositories for files that are arbitrarily uploaded into the Novell Teaming system. The repository manager in the business tier provides an abstract interface to a variety of on-disk storage locations and mechanisms using the following repository types:

- **Simple file system.** *A cluster-safe interface to a local file system*

- **WebDAV.** *A cluster-safe access to a WebDAV server via Apache Slide*
- **Java Content Repository (JCR).** *Used to store files in a JSR-170 compliant server via Apache Jackrabbit*
- **File integration.** *Used to retrieve and/or store files managed “outside” of Teaming (either on a folder in a local file system or a WebDAV folder). This mechanism can provide mirrored folder functionality*

Except for file integration repositories, Teaming assumes it has full ownership and control over the repository resources and can use it to implement features such as versioning.

Lucene Index Server

In many ways the Lucene search engine is the heart of Novell Teaming 2. Nearly all transactions, not just search requests, run through the search engine. For example, folder listings, blog pages and workspaces all involve one or more search engine queries. In every entry, Teaming indexes all content and metadata. Novell Teaming has added specialized field update logic to Lucene to avoid whole-entry re-indexing for certain types of metadata changes, such as access control updates.

Due to the large amount of data flowing through the search engine, Novell Teaming 2 has been designed to explicitly separate the search engine as a separate computational entity. By default the search engine shares the same address space as the rest of the application, but it is possible to install and configure Teaming so that a separate, dedicated, Lucene server is used. Communication with the server is done via RMI.

Data Access Tier

The data access tier uses a data access interface to isolate how objects are stored and retrieved. This level of abstraction allows future implementations to substitute new, presumably faster, object storage systems.

Currently the data access implementation stores the objects as POJOs (Plain Old Java Objects) and uses Hibernate as the mapping facility between the POJOs’ internal representations and the relational database. Novell Teaming employs Hibernate’s Ehcache plugin with different settings depending on whether the deployment is on a single server or distributed in a cluster.

Besides ease of programming and performance, Hibernate allows Teaming to be reasonably database-independent. It provides the Java Database Connectivity (JDBC) interface that enables Teaming to support Microsoft SQL server, MySQL* and Oracle* SQL databases. Novell Teaming allows these databases to be either on the same server as Teaming, or they can be placed (remoted) onto other servers to increase performance.

The data access tier only has responsibility for the persistence of the objects (e.g., binders, entries) that reside in the SQL databases. The business tier manages other data, such as attached files and searchable content, which is arbitrarily entered into the system.

Deployment Considerations

Some of the primary questions that organizations have when deploying Novell Teaming 2 deal with high availability, sizing and scalability, and LDAP integration. The following sections provide a brief discussion of these issues.

High Availability

To provide high availability and load balancing, organizations can run multiple instances of Novell Teaming 2 on multiple systems in a cluster and then front-end it with a high availability Web application such as Apache Web Server, Linux* Virtual Server, Novell Access Manager or Microsoft Internet Information Services. The Web application can be configured with the Teaming site URL. This will

allow the URL to remain constant for Teaming users regardless of which Teaming server they access at any given time, while spreading the workload between the multiple instances of Teaming.

Since Novell Teaming 2 expects to connect with a single database, it only allows one instance of the database to run. However, the database can be run in a cluster environment. Since all the nodes in the cluster will share the same database server, the database-initialization SQL scripts should not be executed more than once. Running the database initialization script on multiple cluster nodes can cause the database to be overwritten. To configure the script to initialize only once, the installer's Full Install option should be used on the first cluster node and then the Update option should be used on all other cluster nodes. The database connection settings on each node also need to be configured to use the same database.

Novell Teaming 2 has incorporated a new feature that allows the running of multiple instances of the Lucene index server in order to provide high availability and load balancing. To accomplish this, Novell Teaming 2 wraps the Lucene index with a server wrapper that allows it to run on a different Java Virtual Machine (JVM) and service requests from multiple Teaming instances through Java RMI communications.

Sizing and Scalability

Due to the wide variety of uses for Novell Teaming 2 it is difficult to provide hard guidelines for determining system sizing. Factors such as number of users, concurrency patterns, and the amount and type of data being handled should all be considered when planning a deployment.

The number of users and their expected concurrent use of the system play a key factor in the amount of CPU "horsepower"

and RAM that is needed. For example, even though an organization might have upwards of 50,000 users, its Novell Teaming 2 resource requirements could be very small if its system only gets 500 or so hits per day. By contrast, a smaller organization that has 1,000 users who each access the system 500 times a day would require significantly more resources.

Content usage and type also affects sizing. For instance, an organization that plans to leverage Novell Teaming 2 extensively for the sharing and storage of large documents (i.e., CAD and multimedia) will require significantly more disk storage than an organization that primarily utilizes Teaming for making blog or discussion forum entries.

Additionally, the amount of processing required for any single transaction varies to a wide degree. For example, blogs, wikis and calendars tend to have a high "read to write" ratio. In other words, every time someone writes a blog entry it can result in hundreds of viewings of that single entry. Still, viewing entries requires fewer resources than issuing a search for a large number of documents, which in turn is far less resource intensive than adding a large document.

Attachments can be major resource consumers in Novell Teaming 2. Unlike other data stored in Teaming, attachments have a number of characteristics that factor in to server performance:

- *Attachments tend to have more data (sometimes thousands of times more) than normal entries (like a blog posting). Moving this data around consumes network bandwidth and disk space.*
- *Like other entry data, Novell Teaming 2 fully indexes the content of attachments. Since attachments are larger and there is more to index, they will require longer indexing times and larger indexes. This translates to higher CPU and disk consumption than normal entries.*

- *Unlike normal entries that primarily contain plain text, the contents of attachments are not usually in a format that is easy to index. This can require document conversion, which can consume significant system resources depending on the document type and size, and the number of documents.*
- *To provide a richer user experience, attachments are also converted to an image format for thumbnails and also to HTML for browser-only viewing. These operations are done "on demand" when the attachment is viewed for the first time. So while this doesn't factor into upload performance, it can generate bursts of heavy CPU usage during the conversion process.*

Sizing Scenarios

The following represent potential deployment scenarios based on normal usage of 10 percent or less concurrent usage of the user base. Actual deployment requirements will vary depending on an organization's specific usage practices.

Minimal (1–5 users)—

Suitable for evaluation or testing

(Single server, 1–2 2 GHz CPUs, 1–2 GB RAM)

This is an "out of the box" deployment that is configured to use minimal RAM (2 GB) and is suitable for single-person evaluation or light usage by a small group. All of the components are on a single server. This environment can handle a small concurrent load of no more than five users. If the number of registered users exceeds 10, the RAM should be increased to 4 MB.

Small (1–500 users)—

Basic workgroup configuration

(Single server, 2–4 2 GHz CPUs, 4–8 GB RAM)

This is an "out of the box" deployment suitable for a workgroup, department or small company. All of the components are on a single server, but are running at more typical RAM allocations. Typical user load on a deployment of this size would be one to 500 users at normal usage.

Medium (500–1,500 users)—

Separate database server

(Multiple servers, 4 3 GHz CPUs, 4–8 GB RAM)

In this configuration, the database server is split out to a separate server to increase the amount of parallel processing in the system. While Novell Teaming 2 does not store a large amount of data in the SQL database, the database server can still consume significant resources caching data, handling transactions, etc. Different database servers have different requirements, but generally speaking the application server would require more resources (CPU and RAM) than the database server.

The application server should be configured to use at least 4 GB of RAM. Additional processing power can be obtained by using 64-bit systems and larger RAM. This scenario would support between 500 and 1,500 users.

Large (1,500–8,000 users)—

Separate database and index servers

(Multiple servers, 4–8 3 GHz CPUs, 4–8 GB RAM)

This deployment should use 64-bit servers to allow the use of large RAM caches. This deployment employs load balancing across four Novell Teaming 2 servers with at least 4 GB of RAM with a minimum 3 GHz processor. The database and index servers should be split out onto separate servers to allow for parallel processing and finer system tuning for each of the functions.

Separating the index (Lucene) server from the application server allows it to better utilize physical RAM. The RAM utilization of the index server is proportional to the index size, which is directly related to the number and size of documents and entries stored. As the number and size of documents and entries stored increase, RAM should be increased accordingly. Additionally, for this size of deployment Novell recommends using a separate database server with a two or more node cluster.

SANs or other non-local file management systems will typically be used in this large of a deployment. File and archive repositories can be configured to use different dedicated data services.

Organizations might also choose to run the Web server on a separate server as well. The Web server does not necessarily need the same amount of RAM as the application server, but it might require hardware accelerators to better handle SSL encryption.

**Large II (8,000+ users)—
Separate database, index and Web servers**

(Multiple servers, CPU and RAM requirements vary)

This deployment is similar to a deployment with 1,500 to 8,000 users, with a few key differences. Deployments of this size “must” use 64-bit servers. The database, index and Web servers should all run on separate servers. This deployment employs load balancing across 4 or more Novell Teaming 2 servers with 4–8 GB of RAM with high-speed multi-core processors. For this size of deployment Novell recommends running the separate database server on a large cluster.

LDAP Integration

While Novell Teaming 2 allows administrators to create groups and users locally within the solution, if an organization is already using an LDAP directory, it makes sense to leverage it. Novell Teaming provides the ability to synchronize user information from both Novell eDirectory™ and Microsoft Active Directory*.

In the case of eDirectory, before configuring LDAP authentication with the LDAP synchronization tool provided by Novell Teaming 2, an administrator will need to know the following:

- *The host name of an LDAP server where an eDirectory replica is available*
- *The port number used for LDAP connections to the server, which is usually 389 for non-SSL or 636 for SSL communication*

- *The eDirectory context location of the users that will have Teaming accounts created for them (LDAP format)*
- *An eDirectory user name and password with sufficient rights to read the user objects in the specified eDirectory context*

Extending Novell Teaming 2

Novell Teaming 2 features an open development model that invites innovation from a broad community of developers and users. Key to this innovation and open development model is the Kablink open source project. Customers or partners can make changes to Novell Teaming 2 code and submit those changes to the Kablink community. The changes can then be included in later releases of the product, allowing all customers to benefit from the innovations driven by the community.

Novell Teaming 2 also provides organizations a number of ways to extend or customize the solution to their unique needs, including the following:

- *Web services*
- *Custom JSPs*
- *Remote applications*
- *Workflow extensions*

Web Services

Novell Teaming 2 includes Java Web services that provide a set of operations that client programs can use to exchange information with Teaming. The Web services are exposed through the Apache Axis toolkit, which provides access to Teaming functions through SOAP remote procedure calls. Novell Teaming 2 supports authentication to the Web services through either Web Services Security (WSS) authentication or HTTP basic authentication.

The current set of Web services allows the creation and manipulation of entries, attachments, navigation of the workspace and folder tree, creation of folders, and retrieval

of principal and team memberships. Novell Teaming 2 provides explicit object definitions through WSDL and through a generated Java library. Additionally, the open source Kablink community provides sample clients in its product code base that can further assist developers in mastering the use of Teaming Web services.

Custom JSPs

While the form and view designers in Novell Teaming 2 provide the ability to add standard HTML or Teaming elements to an entry, organizations can gain greater levels of formatting control and customization by taking advantage of the JavaServer Page (JSP) customizations provided in Teaming. Custom JSPs can be defined as part of an XML definition and are relied upon to provide the user interface component with what's necessary to render some part of an XML definition for a binder or entry.

JSP customizations can be applied to the following three types of Novell Teaming 2 pages:

- **Form.** *Used to create a workspace, folder, entry or comment*
- **View.** *Displays the content of the created workspace, folder, entry or comment*
- **Mail.** *E-mail message that Teaming sends as a result of the send mail footer toolbar function*

There are two common approaches typically taken when using JSPs to customize an entry. The first approach uses a JSP file to customize selected elements within the page segment, and is followed up by using the Teaming designers to customize the remaining, non-JSP elements. In the second approach, the JSP files are used to define almost the entire page segment, while using the designers to include desirable Teaming tools, such as the ability to subscribe to the entry, the send mail

feature, workflow, attachments or comments. Novell Teaming 2 provides sample JSP files that can be utilized to learn different ways to take advantage of JSP customizations.

Remote Applications

To gain even more control over format and content than is provided by the designers or JSP customization files, Novell Teaming 2 allows for the creation of remote applications. Remote applications interact with the Teaming Web services interface to deliver significant power and flexibility in extending and enhancing an organization's collaboration environment.

Remote applications provide organizations a way to add third party content to Novell Teaming 2 in a highly customizable and secure manner. Remote applications run on another server, pulling data from teaming workspaces and other sources, and then merging and presenting that data to address specific needs. Remote applications can even be called directly from a workflow during a state transition. This allows developers or administrators to integrate with other systems via workflow.

In its simplest form, a remote application is simply an HTML fragment that has been provided via a remote Web application, but which can also do some very sophisticated integrations as well. Remote applications are comparable to Facebook Apps in that the applications run on another system, but have the ability to call back into Teaming for data.

Remote applications can be written in any language that supports handling HTTP. Once created, the Novell Teaming 2 administrator makes a remote application available and then it is run using the permissions of the user loading the application. This means a remote application only has access to the data in the system that the user has access to.

Workflow Extensions

One of the most powerful features in Novell Teaming 2 is its workflow capability, including the ability to add workflow processing to entries. This means that an approval process can be created for a blog or a custom entry. Any entry can have one or more workflows assigned to it. A powerful new addition to Novell Teaming 2 comes from its ability to extend workflows to integrate with other third-party systems, such as SAP, Salesforce.com, or an Asterisk server.

Each state in Novell Teaming 2 can have custom actions defined for the On Entry or On Exit events. The new workflow extensions allow Teaming to call into a custom Java class to perform unique developer-definable actions as a workflow transitions into or out of any specific state. This includes the ability to talk to, launch, pass data or receive data from external workflows.

Conclusion

Of all the choices available, only Novell Teaming 2 empowers users directly with the tools to easily build and use the workspaces and interactions they need to be productive. Novell Teaming gives organizations the

flexibility and interoperability they need to deploy the solution in their heterogeneous environments, as well as the custom extensibility to allow it to connect and interact with their other systems as needed.

Once IT deploys Novell Teaming 2 and configures its powerful access controls, users are free to immediately begin creating workspaces, sharing information, coordinating activities and moving business forward. No one has to wait for someone else to create a Web page. Users can create their own teams, file sharing, discussion groups, wikis, blogs, surveys, Web landing pages and much more.

Novell Teaming 2 facilitates the ability of team members to coordinate their efforts, information, resources and skillsets toward the completion or maintenance of a project, purpose or topic of interest. Whether it's leveraged for project collaboration, document management, business automation or as a knowledge repository, Novell Teaming 2 brings the right people with the right skills together in a secure online workspace where they can interact effectively, immediately and successfully.



Contact your local Novell Solutions Provider, or call Novell at:

1 800 714 3400 U.S./Canada
1 801 861 1349 Worldwide
1 801 861 8473 Facsimile

Novell, Inc.
404 Wyman Street
Waltham, MA 02451 USA