# JNDI

Java Naming and Directory Interface

See also:
http://java.sun.com/products/jndi/tutorial/trailmap.html

## Naming service

**A naming service is an entity that**
**•associates names with objects.We call this *binding* names to objects.** *This is similar to a telephone company 's associating a person 's name with a specific residence 's telephone number*

**•provides a facility to find an object based on a name.We call this *looking up* or *searching* for an object.** *This is similar to a telephone operator finding a person 's telephone number based on that person 's name and connecting the two people.*

*In general,a naming service can be used to find any kind of generic object, like a file handle on your hard drive or a printer located across the network.*

## Directory service

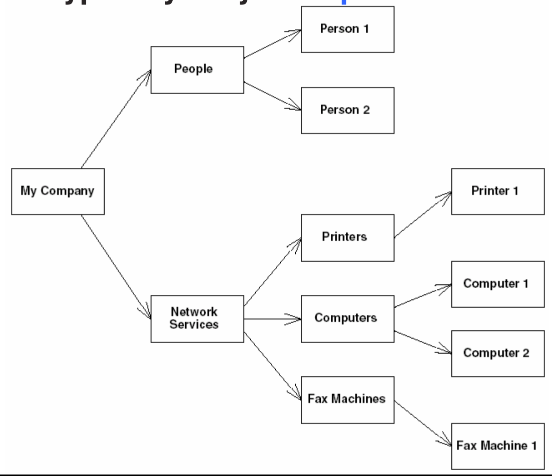
**A *directory object* differs from a generic object because you can store *attributes* with directory objects.** *For example,you can use a directory object to represent a user in your company.You can store information about that user,like the user 's password,as attributes in the directory object.*

**A *directory service* is a naming service that has been extended and enhanced to provide directory object operations for manipulating attributes.**

**A *directory* is a system of directory objects that are all connected.** *Some examples of directory products are Netscape Directory Server and Microsoft 's Active Directory.*

## Directory service

**Directories are similar to DataBases, except that they typically are organized in a hierarchical tree-like structure. Typically they are optimized for reading.**



## Examples of Directory services

*Netscape Directory Server*

*Microsoft 's Active Directory*

*Lotus Notes (IBM)*

*NIS (Network Information System) by Sun*

*NDS (Network Directory Service) by Novell*

*LDAP (Lightweight Directory Access Protocol)*

## JNDI concepts

*JNDI is a system for Java-based clients to interact with naming and directory systems. JNDI is a bridge over naming and directory services, that provides one common interface to disparate directories.*

*Users who need to access an LDAP directory use the same API as users who want to access an NIS directory or Novell's directory. All directory operations are done through the JNDI interface, providing a common framework.*

## JNDI advantages

-You only need to learn a single API to access all sorts of directory service information, such as security credentials, phone numbers, electronic and postal mail addresses, application preferences, network addresses, machine configurations, and more.

-JNDI insulates the application from protocol and implementation details.

-You can use JNDI to read and write whole Java objects from directories.

- You can link different types of directories, such as an LDAP directory with an NDS directory, and have the combination appear to be one large, federated directory.

## JNDI advantages

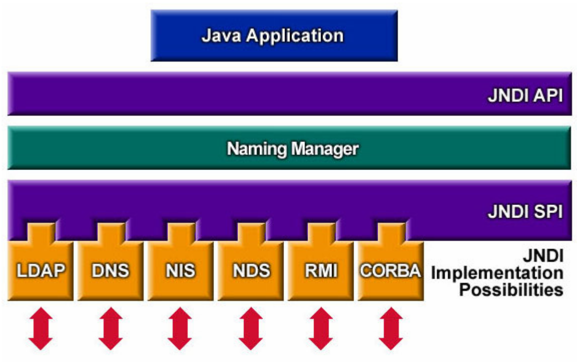
Applications can store factory objects and configuration variables in a global naming tree using the JNDI API.

JNDI, the Java Naming and Directory Interface, provides a global memory tree to store and lookup configuration objects. JNDI will typically contain configured Factory objects.

JNDI lets applications cleanly separate configuration from the implementation. The application will grab the configured factory object using JNDI and use the factory to find and create the resource objects.

In a typical example, the application will grab a database DataSource to create JDBC Connections. Because the configuration is left to the configuration files, it's easy for the application to change databases for different customers.

## JNDI Architecture



**The JNDI homepage**
**http://java.sun.com/products/jndi**
**has a list of service providers.**

## JNDI concepts

*An **atomic name** is a simple,basic,indivisible component of a name.For example,in the string /etc/fstab ,etc and fstab are atomic names.*

*A **binding** is an association of a name with an object.*

*A **context** is an object that contains zero or more bindings. Each binding has a distinct atomic name. Each of the mtab and exports atomic names is bound to a file on the hard disk.*

*A **compound name** is zero or more atomic names put together. e.g. the entire string /etc/fstab is a compound name. Note that a compound name consists of multiple bindings.*

## JNDI names

*JNDI names look like URLs.*
*A typical name for a database pool is java:comp/env/jdbc/test. The java: scheme is a memory-based tree. comp/env is the standard location for Java configuration objects and jdbc is the standard location for database pools.*

*Other URL schemes are allowed as well, including RMI (rmi://localhost:1099) and LDAP. Many applications, though will stick to the java:comp/env tree.*

***Examples***

| | |
|---|---|
| *java:comp/env* | *Configuration environment* |
| *java:comp/env/jdbc* | *JDBC DataSource pools* |
| *java:comp/env/ejb* | *EJB remote home interfaces* |
| *java:comp/env/cmp* | *EJB local home interfaces (non-standard)* |
| *java:comp/env/jms* | *JMS connection factories* |
| *java:comp/env/mail* | *JavaMail connection factories* |
| *java:comp/env/url* | *URL connection factories* |
| *java:comp/UserTransaction* | *UserTransaction interface* |

## JNDI names

*There are three commonly used levels of naming scope in JBoss:*
*names under java:comp,*
*names under java:,*
*any other name.*

*java:comp context and its subcontexts are only available to the application component associated with that particular context.*

*Subcontexts and object bindings directly under java: are only visible within the JBoss server virtual machine and not to remote clients.*

*Any other context or object binding is available to remote clients, provided the context or object supports serialization.*

*An example of where the restricting a binding to the java: context is useful would be a javax.sql.DataSource connection factory that can only be used inside of the JBoss server where the associated database pool resides. On the other hand, an EJB home interface would be boung to a globally visible name that should accessible by remote client.*

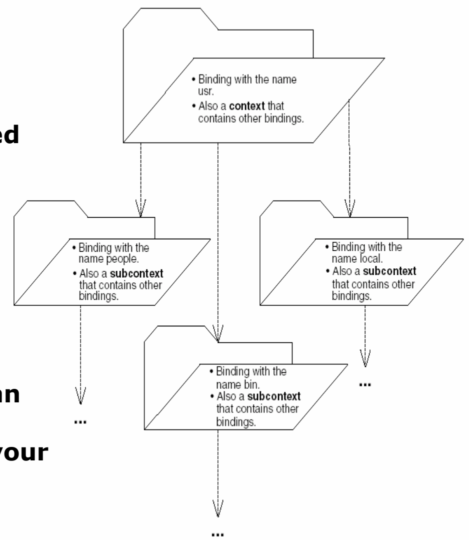
## Contexts and Subcontexts

**A *naming system* is a connected set of contexts.**

**A *namespace* is all the names contained within naming system.**

**The starting point of exploring a namespace**
**is called an *initial context*. An initial context**
**is the first context you happen to use.**

**To acquire an initial context, you use an *initial context factory*.**
**An initial context factory basically *is* your JNDI driver.**


• Binding with the name usr.
• Also a **context** that contains other bindings.
• Binding with the name people.
• Also a **subcontext** that contains other bindings.
• Binding with the name local.
• Also a **subcontext** that contains other bindings.
• Binding with the name bin.
• Also a **subcontext** that contains other bindings.
...
...
...

## Acquiring an initial context

*When you acquire an initial context, you must supply the necessary information for JNDI to acquire that initial context.*

*For example, if you're trying to access a JNDI implementation that runs within a given server, you might supply:*
*- The IP address of the server*
*- The port number that the server accepts*
*- The starting location within the JNDI tree*
*- Any username/password necessary to use the server*

## Acquiring an initial context

```
package examples;

public class InitCtx {
  public static void main(String args[]) throws Exception {
    // Form an Initial Context
    javax.naming.Context ctx =
        new javax.naming.InitialContext();
    System.err.println("Success!");
    Object result = ctx.lookup("PermissionManager");
  }
}
```

```
java
-Djava.naming.factory.initial=org.jnp.interfaces.NamingContextFactory
-Djava.naming.provider.url=jnp://193.205.194.162:1099
-Djava.naming.factory.url.pkgs=org.jboss.naming:org.jnp.interfaces
examples.InitCtx
```

## Acquiring an initial context

**java.naming.factory.initial:** The name of the environment property for specifying the initial context factory to use. The value of the property should be the fully qualified class name of the factory class that will create an initial context.

**java.naming.provider.url:** The name of the environment property for specifying the location of the JBoss JNDI service provider the client will use. The NamingContextFactory class uses this information to know which JBossNS server to connect to. The value of the property should be a URL string. For JBossNS the URL format is
jnp://host:port/[jndi_path].
Everything but the host component is optional. The following examples are equivalent because the default port value is 1099.
jnp://www.jboss.org:1099/
www.jboss.org:1099
www.jboss.org

## Acquiring an initial context

**java.naming.factory.url.pkgs:**
**The name of the environment property for specifying the list of package prefixes to use when loading in URL context factories. The value of the property should be a colon-separated list of package prefixes for the class name of the factory class that will create a URL context factory. For the JBoss JNDI provider this must be org.jboss.naming:org.jnp.interfaces.**
**This property is essential for locating the jnp: and java: URL context factories of the JBoss JNDI provider.**

## Another example

```
import javax.naming.Context;
import javax.naming.InitialContext;
import javax.naming.NamingException;
import java.util.Hashtable;
class Lookup {
   public static void main(String[] args) {
    // Check that user has supplied name of file to lookup
    if (args.length != 1) {
        System.err.println("usage: java Lookup <filename>");
        System.exit(-1);
    }
    String name = args[0];
    // Identify service provider to use
    Hashtable env = new Hashtable(11);
    env.put(Context.INITIAL_CONTEXT_FACTORY,
        "com.sun.jndi.fscontext.RefFSContextFactory");
```

```
    try {
       // Create the initial context
       Context ctx = new InitialContext(env);
       // Look up an object
       Object obj = ctx.lookup(name);
       // Print it out
       System.out.println(name +
                          " is bound to: " + obj);
       // Close the context when we're done
       ctx.close();
    } catch (NamingException e) {
       System.err.println("Problem looking up "
                                 + name + ": " + e);
    }
  }
}
```

## LDAP example

```
package jndiaccesstoldap;
import javax.naming.Context;
import javax.naming.directory.InitialDirContext;
import javax.naming.directory.DirContext;
import javax.naming.directory.Attributes;
import javax.naming.NamingException;
import java.util.Hashtable;
public class Getattr {
  public static void main(String[] args) {
    // Identify service provider to use
    Hashtable env = new Hashtable(11);
    env.put(Context.INITIAL_CONTEXT_FACTORY,
      "com.sun.jndi.ldap.LdapCtxFactory");
  //env.put(Context.PROVIDER_URL, "ldap://ldap.unitn.it:389/o=JNDITutorial");
  env.put(Context.PROVIDER_URL, "ldap://ldap.unitn.it:389/o=personale");
```

```
    try {
        // Create the initial directory context
        DirContext ctx = new InitialDirContext(env);

        // Ask for all attributes of the object
        Attributes attrs = ctx.getAttributes("cn=Ronchetti
    Marco");

        // Find the surname ("sn") and print it
        System.out.println("sn: " + attrs.get("sn").get());

        // Close the context when we're done
        ctx.close();
      } catch (NamingException e) {
        System.err.println("Problem getting attribute: " + e);
}}}
```

## Operations on a JNDI context

***list()*** *retrieves a list of contents available at the current context.This typically includes names of objects bound to the JNDI tree,as well as subcontexts.*

***lookup()*** *moves from one context to another context,such as going from c:\ to c:\windows. You can also use lookup()to look up objects bound to the JNDI tree.The return type of lookup()is JNDI driver specific.*

***rename()*** *gives a context a new name*

## Operations on a JNDI context

***createSubcontext()****creates a subcontext from the current context,such as creating c:\foo \bar from the folder c:\foo.*

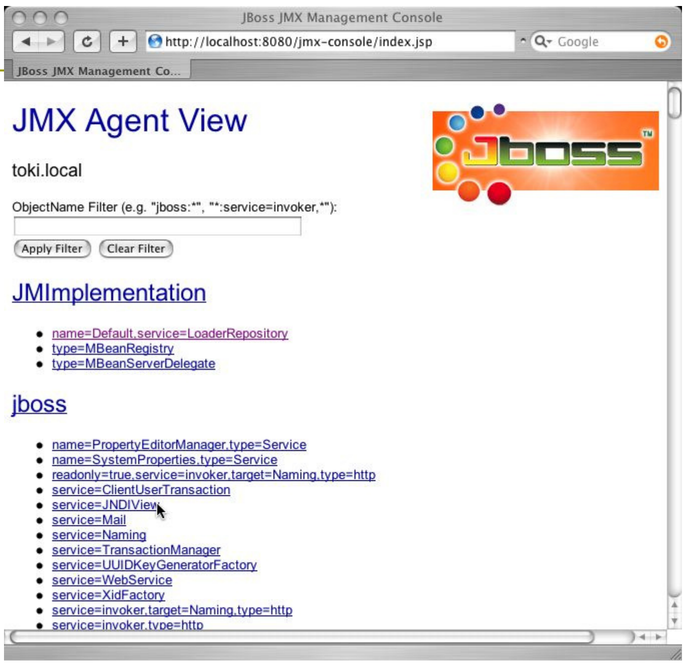
***destroySubcontext()****destroys a subcontext from the current context,such as destroying c:\foo \bar from the folder c:\foo.*

***bind()****writes something to the JNDI tree at the current context.As with lookup(),JNDI drivers accept different parameters to bind().*

***rebind()****is the same operation as bind,except it forces a bind even if there is already something in the JNDI tree with the same name.*

## JNDI in JBoss

*The JNDIView MBean allows the user to view the JNDI namespace tree as it exists in the JBoss server using the JMX agent view interface.*


JBoss JMX Management Console
http://localhost:8080/jmx-console/index.jsp
Google
JBoss JMX Management Co...
Apply Filter
Clear Filter

JMX Agent View

toki.local

ObjectName Filter (e.g. "jboss:*", "*:service=invoker,*"):

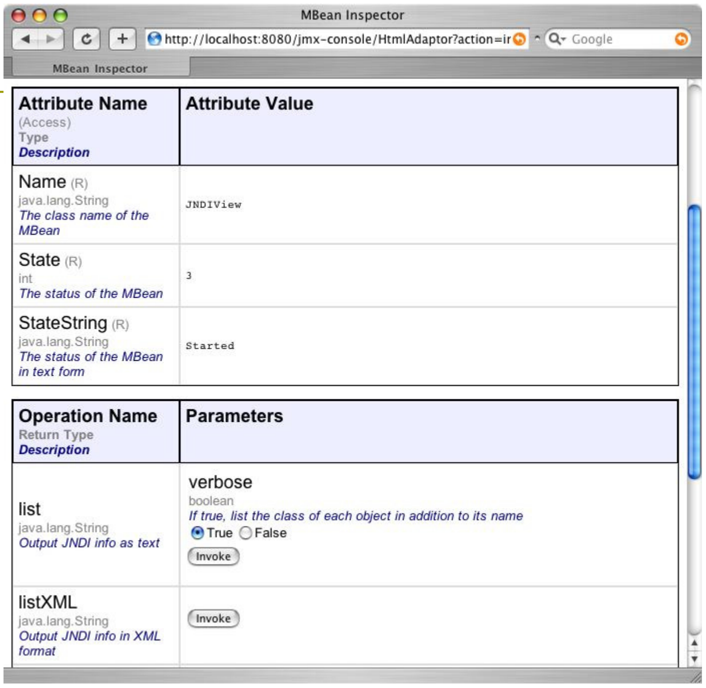
JMImplementation

- name=Default,service=LoaderRepository
- type=MBeanRegistry
- type=MBeanServerDelegate

jboss

- name=PropertyEditorManager,type=Service
- name=SystemProperties,type=Service
- readonly=true,service=invoker,target=Naming,type=http
- service=ClientUserTransaction
- service=JNDIView
- service=Mail
- service=Naming
- service=TransactionManager
- service=UUIDKeyGeneratorFactory
- service=WebService
- service=XidFactory
- service=invoker,target=Naming,type=http
- service=invoker,type=http

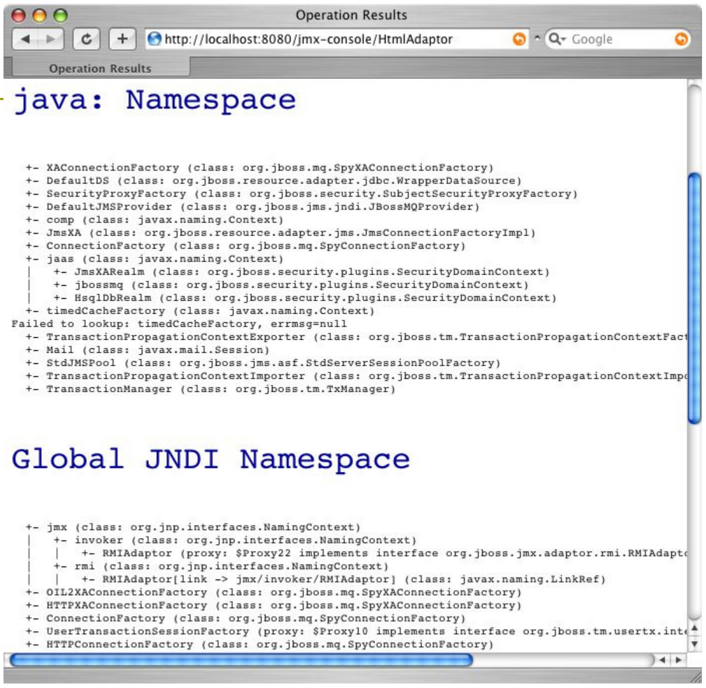
## JNDI in JBoss



| Attribute Name (Access) Type *Description* | Attribute Value |
|---|---|
| Name (R) java.lang.String *The class name of the MBean* | JNDIView |
| State (R) int *The status of the MBean* | 3 |
| StateString (R) java.lang.String *The status of the MBean in text form* | Started |

| Operation Name Return Type *Description* | Parameters |
|---|---|
| list java.lang.String *Output JNDI info as text* | verbose boolean *If true, list the class of each object in addition to its name* [✓ True] False Invoke |
| listXML java.lang.String *Output JNDI info in XML format* | Invoke |

## JNDI in JBoss



### java: Namespace

```
  +- XAConnectionFactory (class: org.jboss.mq.SpyXAConnectionFactory)
  +- DefaultDS (class: org.jboss.resource.adapter.jdbc.WrapperDataSource)
  +- SecurityProxyFactory (class: org.jboss.security.SubjectSecurityProxyFactory)
  +- DefaultJMSProvider (class: org.jboss.jms.jndi.JBossMQProvider)
  +- comp (class: javax.naming.Context)
  +- JmsXA (class: org.jboss.resource.adapter.jms.JmsConnectionFactoryImpl)
  +- ConnectionFactory (class: org.jboss.mq.SpyConnectionFactory)
  +- jaas (class: javax.naming.Context)
  |   +- JmsXARealm (class: org.jboss.security.plugins.SecurityDomainContext)
  |   +- jbossmq (class: org.jboss.security.plugins.SecurityDomainContext)
  |   +- HsqlDbRealm (class: org.jboss.security.plugins.SecurityDomainContext)
  +- timedCacheFactory (class: javax.naming.Context)
Failed to lookup: timedCacheFactory, errmsg=null
  +- TransactionPropagationContextExporter (class: org.jboss.tm.TransactionPropagationContextFact
  +- Mail (class: javax.mail.Session)
  +- StdJMSPool (class: org.jboss.jms.asf.StdServerSessionPoolFactory)
  +- TransactionPropagationContextImporter (class: org.jboss.tm.TransactionPropagationContextImpo
  +- TransactionManager (class: org.jboss.tm.TxManager)
```

### Global JNDI Namespace

```
  +- jmx (class: org.jnp.interfaces.NamingContext)
  |   +- invoker (class: org.jnp.interfaces.NamingContext)
  |   |   +- RMIAdaptor (proxy: $Proxy22 implements interface org.jboss.jmx.adaptor.rmi.RMIAdapto
  |   +- rmi (class: org.jnp.interfaces.NamingContext)
  |   |   +- RMIAdaptor[link -> jmx/invoker/RMIAdaptor] (class: javax.naming.LinkRef)
  +- OIL2XAConnectionFactory (class: org.jboss.mq.SpyXAConnectionFactory)
  +- HTTPXAConnectionFactory (class: org.jboss.mq.SpyXAConnectionFactory)
  +- ConnectionFactory (class: org.jboss.mq.SpyConnectionFactory)
  +- UserTransactionSessionFactory (proxy: $Proxy10 implements interface org.jboss.tm.usertx.inte
  +- HTTPConnectionFactory (class: org.jboss.mq.SpyConnectionFactory)
```

## JNDI e EJB: definizione di proprietà in configuration

**An example ejb-jar.xml env-entry fragment**

```
<!-- ... -->
<session>
<ejb-name>ASessionBean</ejb-name>
<!-- ... -->
<env-entry>
<description>The maximum number of tax exemptions allowed </description>
<env-entry-name>maxExemptions</env-entry-name>
<env-entry-type>java.lang.Integer</env-entry-type>
<env-entry-value>15</env-entry-value>
</env-entry>
<env-entry>
<description>The tax rate </description>
<env-entry-name>taxRate</env-entry-name>
<env-entry-type>java.lang.Float</env-entry-type>
<env-entry-value>0.23</env-entry-value>
</env-entry>
</session>
<!-- ... -->
```

## JNDI e EJB: accesso alle proprietà in configuration

**env-entry access code fragment**

```
InitialContext iniCtx = new InitialContext();
Context envCtx = (Context) iniCtx.lookup("java:comp/env");
Integer maxExemptions = (Integer) envCtx.lookup("maxExemptions");
Float taxRate = (Float) envCtx.lookup("taxRate");
```

## JNDI e EJB: definizione di proprietà in configuration

**An example ejb-jar.xml ejb-ref descriptor fragment**

```
<session>
<ejb-ref>
<ejb-name>ShoppingCartUser</ejb-name>
<!--...-->
<ejb-ref-name>ejb/ShoppingCartHome</ejb-ref-name>
<ejb-ref-type>Session</ejb-ref-type>
<home>org.jboss.store.ejb.ShoppingCartHome</home>
<remote> org.jboss.store.ejb.ShoppingCart</remote>
<ejb-link>ShoppingCartBean</ejb-link>
</ejb-ref>
</session>
```

```
InitialContext iniCtx = new InitialContext();
Context ejbCtx = (Context) iniCtx.lookup("java:comp/env/ejb");
ShoppingCartHome home =
                    (ShoppingCartHome) ejbCtx.lookup("ShoppingCartHome");
```

## JNDI e Servlets: definizione di proprietà in configuration

```
<web>
<!-- ... -->
<servlet> <servlet-name>AServlet</servlet-name> <!-- ... --> </servlet>
<!-- ... -->
<!-- JavaMail Connection Factories (java:comp/env/mail) -->
<resource-ref>
<description>Default Mail</description>
<res-ref-name>mail/DefaultMail</res-ref-name>
<res-type>javax.mail.Session</res-type>
<res-auth>Container</res-auth>
```

```
Context initCtx = new InitialContext();
javax.mail.Session s = (javax.mail.Session)
                  initCtx.lookup("java:comp/env/mail/DefaultMail");
```