

Installing DSpace

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For the Impatient

Since some users might want to get their test version up and running as fast as possible, offered below is an *unsupported* outline of getting DSpace to run quickly in a Unix-based environment using the DSpace source release.

Only experienced unix admins should even attempt the following without going to the detailed [Installation Instructions](#)

```
useradd -m dspace
gzip xzf dspace-5.x-src-release.tar.gz
createuser --username=postgres --no-superuser --pwprompt dspace
createdb --username=postgres --owner=dspace --encoding=UNICODE dspace
cd [dspace-source]
vi build.properties
mkdir [dspace]
chown dspace [dspace]
su - dspace
cd [dspace-source]
mvn package
cd [dspace-source]/dspace/target/dspace-installer
ant fresh_install
cp -r [dspace]/webapps/* [tomcat]/webapps
/etc/init.d/tomcat start
[dspace]/bin/dspace create-administrator
```

Hardware Recommendations

You can install and run DSpace on most modern PC, laptop or server hardware. However, if you intend to run DSpace for a large community of potential end users, carefully review the [Hardware Recommendations](#) in the [User FAQ](#).

Prerequisite Software

The list below describes the third-party components and tools you'll need to run a DSpace server. These are just guidelines. Since DSpace is built on open source, standards-based tools, there are numerous other possibilities and setups.

Also, please note that the configuration and installation guidelines relating to a particular tool below are here for convenience. You should refer to the documentation for each individual component for complete and up-to-date details. Many of the tools are updated on a frequent basis, and the guidelines below may become out of date.

UNIX-like OS or Microsoft Windows

- UNIX-like OS (Linux, HP/UX, Mac OSX, etc.) : Many distributions of Linux/Unix come with some of the dependencies below pre-installed or easily installed via updates. You should consult your particular distribution's documentation or local system administrators to determine what is already available.
- Microsoft Windows: After verifying all prerequisites below, see the [Windows Installation](#) section for Windows tailored instructions

Oracle Java JDK 7 or OpenJDK 7

OpenJDK download and installation instructions can be found here <http://openjdk.java.net/install/>. Most operating systems provide an easy path to install OpenJDK. Just be sure to install the full JDK (development kit), and not the JRE (which is often the default example).

Oracle's Java can be downloaded from the following location: <http://www.oracle.com/technetwork/java/javase/downloads/index.html>. Make sure to download the appropriate version of the Java SE JDK.

Make sure to install the JDK and not just the JRE

At this time, DSpace requires the full JDK (Java Development Kit) be installed, rather than just the JRE (Java Runtime Environment). So, please be sure that you are installing the full JDK and not just the JRE.

Be aware that Tomcat 7 uses Java 1.6 to compile JSPs by default. See information about Tomcat below on how to configure it to use Java 1.7 for JSPs. Tomcat 8 uses Java 1.7 for JSPs by default. If you use another Servlet Container please refer to its documentation on this matter.

DSpace 5 is not officially tested with Java 8

server for this macro. It may be due to Application Link configuration.

on the testing efforts are available at:

Unable to locate Jira

Elasticsearch requirements for Java

Elasticsearch (used in DSpace for [Elasticsearch Usage Statistics](#), an optional feature) has its own recommendations regarding Java flavour and version:

<http://www.elasticsearch.org/guide/en/elasticsearch/reference/current/setup.html>

"Elasticsearch is built using Java, and requires at least [Java 7](#) in order to run Only Oracle's Java and the OpenJDK are supported.

We recommend installing the **Java 8 update 20 or later** , or **Java 7 update 55 or later** . Previous versions of Java 7 are known to have bugs that can cause index corruption and data loss."

Apache Maven 3.0.5+ (Java build tool)

Maven is necessary in the first stage of the build process to assemble the installation package for your DSpace instance. It gives you the flexibility to customize DSpace using the existing Maven projects found in the `[dspace-source]/dspace/modules` directory or by adding in your own Maven project to build the installation package for DSpace, and apply any custom interface "overlay" changes.

Maven can be downloaded from the following location: <http://maven.apache.org/download.html>

It is recommended to use the latest available Maven version for your platform, preferably one higher than 3.2, even though DSpace 5 builds are tested and reported to work with 3.0.5 as well.

Configuring a Proxy

You can configure a proxy to use for some or all of your HTTP requests in Maven. The username and password are only required if your proxy requires basic authentication (note that later releases may support storing your passwords in a secured keystore, in the mean time, please ensure your `settings.xml` file (usually `$(user.home)/.m2/settings.xml`) is secured with permissions appropriate for your operating system).

Example:

```
<settings>
.
.
<proxies>
  <proxy>
    <active>true</active>
    <protocol>http</protocol>
    <host>proxy.somewhere.com</host>
    <port>8080</port>
    <username>proxyuser</username>
    <password>somepassword</password>
    <nonProxyHosts>www.google.com|*.somewhere.com</nonProxyHosts>
  </proxy>
</proxies>
.
.
</settings>
```

Apache Ant 1.8 or later (Java build tool)

Apache Ant is required for the second stage of the build process. It is used once the installation package has been constructed in *[dSPACE-source]/dSPACE/target/dSPACE-installer* and still uses some of the familiar ant build targets found in the 1.4.x build process.

Ant can be downloaded from the following location: <http://ant.apache.org>

Relational Database: (PostgreSQL or Oracle)

- **PostgreSQL 9.0 or later:** PostgreSQL can be downloaded from <http://www.postgresql.org/>. Unicode (specifically UTF-8) support must be enabled (but this is enabled by default). Once installed, you need to enable TCP/IP connections (DSpace uses JDBC):
 - In `postgresql.conf`: uncomment the line starting: `listen_addresses = 'localhost'`. This is the default, in recent PostgreSQL releases, but you should at least check it.
 - Then tighten up security a bit by editing `pg_hba.conf` and adding this line: `host dspace dspace 127.0.0.1 255.255.255.255 md5`. This should appear *before* any lines matching all databases, because the first matching rule governs.
 - Then restart PostgreSQL.
- **Oracle 10g or later:** Details on acquiring Oracle can be downloaded from the following location: <http://www.oracle.com/database/>. You will need to create a database for DSpace. Make sure that the character set is one of the Unicode character sets. DSpace uses UTF-8 natively, and it is suggested that the Oracle database use the same character set. You will also need to create a user account for DSpace (e.g. *dSPACE*) and ensure that it has permissions to add and remove tables in the database. Refer to the Quick Installation for more details.
 - **NOTE:** If the database server is not on the same machine as DSpace, you must install the Oracle client to the DSpace server and point `tnsnames.ora` and `listener.ora` files to the database the Oracle server.
 - **NOTE:** DSpace uses sequences to generate unique object IDs — beware Oracle sequences, which are said to lose their values when doing a database export/import, say restoring from a backup. Be sure to run the script *etc/oracle/update-sequences.sql* after importing.
 - For people interested in switching from Postgres to Oracle, I know of no tools that would do this automatically. You will need to recreate the community, collection, and eperson structure in the Oracle system, and then use the item export and import tools to move your content over.

Servlet Engine (Apache Tomcat 7 or 8, Jetty, Caucho Resin or equivalent)

Tomcat 7 Version

 If you are using Tomcat 7, we recommend running Tomcat 7.0.30 or above. Tomcat 7.0.29 and lower versions suffer from a memory leak. As a result, those versions of tomcat require an unusual high amount of memory to run DSpace. This has been resolved as of Tomcat 7.0.30. More information can be found in [DS-1553](#)

Tomcat 8 Support

 Tomcat 8 may encounter issues with JAR loading order if you are actively customizing classes in `"/modules/additions"`. See <https://github.com/DSpace/DSpace/issues/5798> for details. This issue was fixed in DSpace 6.

- **Apache Tomcat 7 or 8.** Tomcat can be downloaded from the following location: <http://tomcat.apache.org>.
 - *The Tomcat owner* (i.e. the user that Tomcat runs as) **must have read/write access** to the DSpace installation directory (i.e. `[dSPACE]`). There are a few common ways this may be achieved:
 - One option is to specifically give the Tomcat user (often named "tomcat") ownership of the `[dSPACE]` directories, for example:

```
# Change [dSPACE] and all subfolders to be owned by "tomcat"
chown -R tomcat:tomcat [dSPACE]
```

- Another option is to have Tomcat itself *run* as a new user named "dSPACE" (see installation instructions below). Some operating systems make modifying the Tomcat "run as" user easily modifiable via an environment variable named `TOMCAT_USER`. This option may be more desirable if you have multiple Tomcat instances running, and you do not want all of them to run under the same Tomcat owner.

- You need to ensure that Tomcat has a) enough memory to run DSpace and b) uses UTF-8 as its default file encoding for international character support. So ensure in your startup scripts (etc) that the following environment variable is set: `JAVA_OPTS="-Xmx512M -Xms64M -Dfile.encoding=UTF-8"`
- **Modifications in `[tomcat]/conf/server.xml`** : You also need to alter Tomcat's default configuration to support searching and browsing of multi-byte UTF-8 correctly. You need to add a configuration option to the `<Connector>` element in `[tomcat]/conf/server.xml`: `URIEncoding="UTF-8"`e.g. if you're using the default Tomcat config, it should read:

```
<!-- Define a non-SSL HTTP/1.1 Connector on port 8080 -->
<Connector port="8080"
    minSpareThreads="25"
    enableLookups="false"
    redirectPort="8443"
    connectionTimeout="20000"
    disableUploadTimeout="true"
    URIEncoding="UTF-8"/>
```

You may change the port from 8080 by editing it in the file above, and by setting the variable `CONNECTOR_PORT` in `server.xml`.

- Tomcat 8 and above is using at least Java 1.7 for JSP compilation. However, by default, Tomcat 7 uses Java 1.6 for JSP compilation. If you want to use Java 1.7 in your .jsp files, you have to change the configuration of Tomcat 7. Edit the file called `web.xml` in the configuration directory of your Tomcat instance (`${CATALINA_HOME}/conf` in Tomcat notation). Look for a servlet definition using the `org.apache.jasper.servlet.JSPServlet` servlet-class and add two init parameters `compilerSourceVM` and `compilerTargetVM` as you see it in the example below. Then restart Tomcat.

`${CATALINA_BASE}/conf/web.xml`

```
<servlet>
  <servlet-name>jsp</servlet-name>
  <servlet-class>org.apache.jasper.servlet.JspServlet</servlet-class>
  <init-param>
    <param-name>fork</param-name>
    <param-value>>false</param-value>
  </init-param>
  <init-param>
    <param-name>xpoweredBy</param-name>
    <param-value>>false</param-value>
  </init-param>
  <init-param>
    <param-name>compilerSourceVM</param-name>
    <param-value>1.7</param-value>
  </init-param>
  <init-param>
    <param-name>compilerTargetVM</param-name>
    <param-value>1.7</param-value>
  </init-param>
  <load-on-startup>3</load-on-startup>
</servlet>
```

- **Jetty or Caucho Resin** DSpace will also run on an equivalent servlet Engine, such as Jetty (<http://www.mortbay.org/jetty/index.html>) or Caucho Resin (<http://www.caucho.com/>). Jetty and Resin are configured for correct handling of UTF-8 by default.

Perl (only required for `[dspace]/bin/dspace-info.pl`)

Installation Instructions

Overview of Install Options

Two different distributions are available for DSpace, both of which require you to build the distribution using Apache Maven 3. The steps that are required to execute the build are identical. In a nutshell, the binary release build will download pre-compiled parts of DSpace, while the building the source release will compile most of DSpace's source code on your local machine.

It's important to notice that both releases will require outgoing internet connections on the machine or server where you are executing the build, because maven needs to download 3rd party dependencies that are not even included in the DSpace source release distribution.

- **Binary Release** (`dspace-<version>-release.zip`)
 - This distribution will be adequate for most cases of running a DSpace instance. It is intended to be the quickest way to get DSpace installed and running while still allowing for customization of the themes and branding of your DSpace instance.
 - This method allows you to customize DSpace configurations (in `dspace.cfg`) or user interfaces, using basic pre-built interface "overlays".
 - It downloads "precompiled" libraries for the core `dspace-api`, supporting servlets, taglibraries, aspects and themes for the `dspace-xmlui`, `dspace-xmlui` and other webservice/applications.

- This approach only exposes selected parts of the application for customization. All other modules are downloaded from the 'Maven Central Repository'. The directory structure for this release is the following:
 - `[dspace-source]`
 - `dspace/` - DSpace 'build' and configuration module
- Source Release (`dspace-<version>-src-release.zip`)
 - This method is recommended for those who wish to develop DSpace further or alter its underlying capabilities to a greater degree.
 - It contains **all** dspace code for the core `dspace-api`, supporting servlets, taglibraries, aspects and themes for Manakin (`dspace-xmlui`), and other webservice/applications.
 - Provides all the same capabilities as the binary release. The directory structure for this release is more detailed:
 - `[dspace-source]`
 - `dspace/` - DSpace 'build' and configuration module
 - `dspace-api/` - Java API source module
 - `dspace-jspuil/` - JSP-UI source module
 - `dspace-lni` - Lightweight Network Interface source module (*deprecated as of 5.0*)
 - `dspace-oai` - OAI-PMH source module
 - `dspace-rdf` - RDF source module
 - `dspace-rest` - REST API source module
 - `dspace-services` - Common Services module
 - `dspace-sword` - SWORD (Simple Web-serve Offering Repository Deposit) deposit service source module
 - `dspace-swordv2` - SWORDv2 source module
 - `dspace-xmlui` - XML-UI (Manakin) source module
 - `dspace-xmlui-mirage2` - Mirage 2 theme for the XMLUI
 - `pom.xml` - DSpace Parent Project definition

Overview of DSpace Directories

Before beginning an installation, it is important to get a general understanding of the DSpace directories and the names by which they are generally referred. (Please attempt to use these below directory names when asking for help on the DSpace Mailing Lists, as it will help everyone better understand what directory you may be referring to.)

DSpace uses three separate directory trees. Although you don't need to know all the details of them in order to install DSpace, you do need to know they exist and also know how they're referred to in this document:

1. **The installation directory**, referred to as `[dspace]`. This is the location where DSpace is installed and running. It is the location that is defined in the `dspace.cfg` as `"dspace.dir"`. It is where all the DSpace configuration files, command line scripts, documentation and webapps will be installed.
2. **The source directory**, referred to as `[dspace-source]`. This is the location where the DSpace release distribution has been unpacked. It usually has the name of the archive that you expanded such as `dspace-<version>-release` or `dspace-<version>-src-release`. Normally it is the directory where all of your "build" commands will be run.
3. **The web deployment directory**. This is the directory that contains your DSpace web application(s). This corresponds to `[dspace]/webapps` by default. However, if you are using Tomcat, you may decide to copy your DSpace web applications from `[dspace]/webapps/` to `[tomcat]/webapps/` (with `[tomcat]` being wherever you installed Tomcat, also known as `$CATALINA_HOME`). For details on the contents of these separate directory trees, refer to `directories.html`. *Note that the `[dspace-source]` and `[dspace]` directories are always separate!*

If you ever notice that many files seems to have duplicates under `[dspace-source]/dspace/target`, do not worry about it. This "target" directory will be used by Maven for the build process and you should not change any file in it unless you know exactly what you are doing.

Installation

This method gets you up and running with DSpace quickly and easily. It is identical in both the Default Release and Source Release distributions.

1. **Create the DSpace user (optional)**. As noted in the prerequisites above, Tomcat (or Jetty, etc) **must run as** an operating system user account that has full read/write access to the DSpace installation directory (i.e. `[dspace]`). Either you must ensure the Tomcat owner also owns `[dspace]`, OR you can create a new "dspace" user account, and ensure that Tomcat also runs as that account:

```
useradd -m dspace
```

2. **Download the latest DSpace release**. There are two version available with each release of DSpace: (`dspace-n.x-release`, and `dspace-n.x-src-release.zzz`); you only need to choose one. If you want a copy of all underlying Java source code, you should download the `dspace-n.x-src-release.xxx`. Within each version, you have a choice of compressed file format. Choose the one that best fits your environment.
 - a. Alternatively, you may choose to check out the latest release from the [DSpace GitHub Repository](#). In this case, you'd be checking out the full Java source code. You'd also want to be sure to checkout the appropriate tag (e.g. `dspace-5.0`) or branch. For more information on using / developing from the GitHub Repository, see: [Development with Git](#)
3. **Unpack the DSpace software**. After downloading the software, based on the compression file format, choose one of the following methods to unpack your software:
 - a. **Zip file**. If you downloaded `dspace-5.x-release.zip` do the following:

```
unzip dspace-5.x-release.zip
```

- b. **.gz file**. If you downloaded `dspace-5.x-release.tar.gz` do the following:

```
gunzip -c dspace-5.x-release.tar.gz | tar -xf -
```

- c. **.bz2 file.** If you downloaded `_dspace-5.x-release.tar.bz2` do the following:

```
bunzip2 dspace-5.x-release.tar.bz2 | tar -xf -
```

For ease of reference, we will refer to the location of this unzipped version of the DSpace release as *[dspace-source]* in the remainder of these instructions. After unpacking the file, the user may wish to change the ownership of the *dspace-5.x-release* to the "dspace" user. (And you may need to change the group).

4. Database Setup

- Also see "[Relational Database](#)" prerequisite notes above
- PostgreSQL:
 - A PostgreSQL JDBC driver is configured as part of the default DSpace build. You no longer need to copy any PostgreSQL jars to get PostgreSQL installed.
 - Create a dspace database user. This is entirely separate from the dspace operating-system user created above (*you are still logged in as "root"*):

```
createuser --username=postgres --no-superuser --pwprompt dspace
```

You will be prompted (twice) for a password for the new dspace user. Then you'll be prompted for the password of the PostgreSQL superuser (postgres).

- Create a dspace database, owned by the dspace PostgreSQL user (*you are still logged in as 'root'*):

```
createdb --username=postgres --owner=dspace --encoding=UNICODE dspace
```

You will be prompted for the password of the PostgreSQL superuser (postgres).

- Oracle:
 - Setting up DSpace to use Oracle is a bit different now. You will still need to get a copy of the Oracle JDBC driver, but instead of copying it into a lib directory you will need to install it into your local Maven repository. (You'll need to download it first from this location: <http://www.oracle.com/technetwork/database/enterprise-edition/jdbc-112010-090769.html>.) Run the following command (all on one line):

```
mvn install:install-file
-Dfile=ojdbc6.jar
-DgroupId=com.oracle
-DartifactId=ojdbc6
-Dversion=11.2.0.4.0
-Dpackaging=jar
-DgeneratePom=true
```

- You need to compile DSpace with an Oracle driver (ojdbc6.jar) corresponding to your Oracle version - update the version in *[dspace-source]/pom.xml* E.g.:

```
<dependency>
  <groupId>com.oracle</groupId>
  <artifactId>ojdbc6</artifactId>
  <version>11.2.0.4.0</version>
</dependency>
```

- Create a database for DSpace. Make sure that the character set is one of the Unicode character sets. DSpace uses UTF-8 natively, and it is required that the Oracle database use the same character set. Create a user account for DSpace (e.g. *dspace*) and ensure that it has permissions to add and remove tables in the database.
- Uncomment and edit the Oracle database settings in *[dspace-source]/build.properties* (see below for more information on the build.properties file):

```
db.driver = oracle.jdbc.OracleDriver
db.url = jdbc:oracle:thin:@host:port/SID
```

Where SID is the SID of your database defined in *tnsnames.ora*, default Oracle port is 1521. Alternatively, you can use a full SID definition, e.g.:

```
db.url = jdbc:oracle:thin:@(description=(address_list=(address=(protocol=TCP)
(host=localhost)(port=1521)))(connect_data=(service_name=DSPACE)))
```

- Later, during the Maven build step, don't forget to specify `mvn -Ddb.name=oracle package`
5. **Initial Configuration:** Edit `[dspace-source]/build.properties`. This properties file contains the basic settings necessary to actually build/install DSpace for the first time (see [build.properties Configuration](#) for more detail). In particular you'll need to set these properties -- examples or defaults are provided in the file:

- `dspace.install.dir` - must be set to the `[dspace]` (installation) directory (*On Windows be sure to use forward slashes for the directory path!* For example: "C:/dspace" is a valid path for Windows.)
- `dspace.hostname` - fully-qualified domain name of web server.
- `dspace.baseUrl` - complete URL of this server's DSpace home page but without any context eg. `/xmlui`, `/oai`, etc.
- `dspace.name` - "Proper" name of your server, e.g. "My Digital Library".
- `solr.server` - complete URL of the Solr server. DSpace makes use of [Solr](#) for indexing purposes.
- `default.language`
- `db.driver`
- `db.url`
- `db.username` - the database username used in the previous step.
- `db.password` - the database password used in the previous step.
- `mail.server` - fully-qualified domain name of your outgoing mail server.
- `mail.from.address` - the "From:" address to put on email sent by DSpace.
- `mail.feedback.recipient` - mailbox for feedback mail.
- `mail.admin` - mailbox for DSpace site administrator.
- `mail.alert.recipient` - mailbox for server errors/alerts (not essential but very useful!)
- `mail.registration.notify` - mailbox for emails when new users register (optional)

The "build.properties" file is provided as a convenient method of setting only those configurations necessary to install/upgrade DSpace. Any settings changed in this file, will be automatically copied over to the full "dspace.cfg" file (which is held in `[dspace-source]/dspace/config/dspace.cfg`). Refer to the [General Configuration](#) section for a fuller explanation.

It is also worth noting that you may choose to copy/rename the "build.properties" under a different name for different environments (e.g. "development.properties", "test.properties", and "production.properties"). You can choose which properties file you want to build DSpace with by passing a "-Denv" (environment) flag to the "mvn package" command (e.g. "mvn package -Denv=test" would build using "test.properties"). See [General Configuration](#) section for more details.

Do not remove or comment out settings in build.properties

When you edit the "build.properties" file (or a custom *.properties file), take care not to remove or comment out any settings. Doing so, may cause your final "dspace.cfg" file to be misconfigured with regards to that particular setting. Instead, if you wish to remove/disable a particular setting, just clear out its value. For example, if you don't want to be notified of new user registrations, ensure the "mail.registration.notify" setting has no value, e.g.

`mail.registration.notify=`

6. **DSpace Directory:** Create the directory for the DSpace installation (i.e. `[dspace]`). As *root* (or a user with appropriate permissions), run:

```
mkdir [dspace]
chown dspace [dspace]
```

(Assuming the `dspace` UNIX username.)

7. **Build the Installation Package:** As the `dspace` UNIX user, generate the DSpace installation package.

```
cd [dspace-source]
mvn package
```

Building with Oracle Database Support

Without any extra arguments, the DSpace installation package is initialized for PostgreSQL. If you want to use Oracle instead, you should build the DSpace installation package as follows:

```
mvn -Ddb.name=oracle package
```

Enabling and building the DSpace 5 Mirage 2 theme

Mirage 2 is a responsive theme for the XML User Interface, added as a new feature in DSpace 5. It has not yet replaced the Mirage 1 theme as the XMLUI default theme.

The Mirage 2 build requires **git** to be installed on your server. Install git before attempting the Mirage 2 build.

To enable Mirage 2, add the following to the `<themes>` section of `src/dspace/config/xmlui.xconf`, replacing the currently active theme:

```
<theme name="Mirage 2" regex=".*" path="Mirage2/" />
```

It is important to do this before executing the maven build.

Mirage 2 is not yet activated in the default "mvn package" build. To include it as part of the build, run:

```
mvn package -Dmirage2.on=true
```

The speed of this specific step of the build can be increased by installing local copies of the specific dependencies required for building Mirage 2. The [Mirage 2 developer documentation](#) provides detailed instructions for these installations. After the installation of these dependencies, you can choose to run:

```
mvn package -Dmirage2.on=true -Dmirage2.deps.included=false
```

Warning: The Mirage 2 build process should NOT be run as "root". It must be run as a non-root user. For more information see: [Mirage 2 Common Build Issues](#)

Defaults to building installation package with settings from "build.properties"

 Without any extra arguments, the DSpace installation package will be initialized using the settings in the [dspace-source]/build.properties file. However, if you want it to build using a custom properties file, you may specify the "-Denv" (environment) flag as follows:

```
mvn -Denv=test package (would build the installation package using a custom [dspace-source]/test.properties file)
```

```
mvn -Denv=local package (would build the installation package using a custom [dspace-source]/local.properties file)
```

See [General Configuration](#) section for more details.

8. **Install DSpace:** As the *dspace* UNIX user, install DSpace to [dspace]:

```
cd [dspace-source]/dspace/target/dspace-installer
ant fresh_install
```

To see a complete list of build targets, run: `ant help` *The most likely thing to go wrong here is the test of your database connection. See the [Common Problems](#) Section below for more details.*

9. **Decide which DSpace Web Applications you want to install.** DSpace comes with a variety of web applications (in [dspace]/webapps), each of which provides a different "interface" to your DSpace. Which ones you install is up to you, but there are a few that we highly recommend (see below):
 - a. "xmlui" = This is the [XML-based User Interface \(XMLUI\)](#), based on Apache Cocoon. It comes with a variety of out-of-the-box themes, including [Mirage 1](#) (the default) and [Mirage 2](#) (based on [Bootstrap](#)). *Between the "xmlui" and "jspui", you likely only need to choose one.*
 - b. "jspui" = This is the [JSP-based User Interface \(JSPUI\)](#), which is based on [Bootstrap](#). *Between the "xmlui" and "jspui", you likely only need to choose one.*
 - c. "solr" (*required*) = This is Apache Solr web application, which is used by the "xmlui" and "jspui" (for search & browse functionality), as well as the OAI-PMH interface. **It must be installed in support of either UI.**
 - d. "oai" = This is the [DSpace OAI interface](#). It allows for Metadata and Bitstream (content-file) harvesting, supporting [OAI-PMH](#) (Protocol for Metadata Harvest) and [OAI-ORE](#) (Object Reuse and Exchange) protocols
 - e. "rdf" (*new*) = This is the DSpace RDF interface supporting [Linked \(Open\) Data](#).
 - f. "rest" = This is the [DSpace REST API](#)
 - g. "sword" = This is the DSpace [SWORDv1 interface](#). More info on [SWORD protocol and its usage](#).
 - h. "swordv2" = This is the DSpace [SWORDv2 interface](#). More info on [SWORD protocol and its usage](#).
 - i. "lni" (*deprecated*) = This is the DSpace [Lightweight Networking Interface](#) (LNI), supporting WebDAV / SOAP / RPC API. It is disabled by default as we recommend using REST or SWORD for most activities. In order to build it you must rebuild DSpace with the following flag:

```
mvn package -Ddspace-lni
```
10. **Deploy Web Applications:** Please note that in the first instance you should refer to the appropriate documentation for your Web Server of choice. The following instructions are meant as a handy guide. You have two choices or techniques for having Tomcat/Jetty/Resin serve up your web applications:
 - *Technique A.* Tell your Tomcat/Jetty/Resin installation where to find your DSpace web application(s). As an example, in the directory [tomcat]/conf/Catalina/localhost you could add files similar to the following (but replace [dspace] with your installation location):

DEFINE A CONTEXT FOR DSpace XML User Interface: xmlui.xml

```
<?xml version='1.0'?>
<Context
    docBase="[dspace]/webapps/xmlui"
    reloadable="true"
    cachingAllowed="false"/>
```

DEFINE A CONTEXT PATH FOR DSpace JSP User Interface: jspui.xml

```
<?xml version='1.0'?>
<Context
    docBase="[dspace]/webapps/jspui"
    reloadable="true"
    cachingAllowed="false"/>
```

DEFINE A CONTEXT PATH FOR DSpace Solr index: solr.xml

```
<?xml version='1.0'?>
<Context
    docBase="[dspace]/webapps/solr"
```

```
reloadable="true"
cachingAllowed="false"/>
```

DEFINE A CONTEXT PATH FOR DSpace OAI User Interface: oai.xml

```
<?xml version='1.0'?>
<Context
    docBase="[dspace]/webapps/oai"
    reloadable="true"
    cachingAllowed="false"/>
```

DEFINE ADDITIONAL CONTEXT PATHS FOR OTHER DSPACE WEB APPLICATIONS (REST, SWORD, RDF, LNI, etc.): [app].xml

```
<?xml version='1.0'?>
<!-- CHANGE THE VALUE OF "[app]" FOR EACH APPLICATION YOU WISH TO ADD -->
<Context
    docBase="[dspace]/webapps/[app]"
    reloadable="true"
    cachingAllowed="false"/>
```

The name of the file (not including the suffix ".xml") will be the name of the context, so for example `xmlui.xml` defines the context at `http://host:8080/xmlui`. To define the *root context* (`http://host:8080/`), name that context's file `ROOT.xml`.

Tomcat Context Settings in Production



The above Tomcat Context Settings show adding the following to each `<Context>` element:

```
reloadable="true" cachingAllowed="false"
```

These settings are extremely useful to have when you are first getting started with DSpace, as they let you tweak the DSpace XMLUI (XSLTs or CSS) or JSPUI (JSPs) and see your changes get automatically reloaded by Tomcat (without having to restart Tomcat). However, it is worth noting that the [Apache Tomcat](#) documentation recommends Production sites leave the default values in place (`reloadable="false" cachingAllowed="true"`), as allowing Tomcat to automatically reload all changes may result in "significant runtime overhead".

It is entirely up to you whether to keep these Tomcat settings in place. We just recommend beginning with them, so that you can more easily customize your site without having to require a Tomcat restart. Smaller DSpace sites may not notice any performance issues with keeping these settings in place in Production. Larger DSpace sites may wish to ensure that Tomcat performance is more streamlined.

- *Technique B.* Simple and complete. You copy only (or all) of the DSpace Web application(s) you wish to use from the `[dspace]/webapps` directory to the appropriate directory in your Tomcat/Jetty/Resin installation. For example:
cp -R [dspace]/webapps/* [tomcat]/webapps* (This will copy all the web applications to Tomcat).
cp -R [dspace]/webapps/jspui [tomcat]/webapps* (This will copy only the.jspui web application to Tomcat).

11. **Initialize the DSpace Database (optional):** While this step is optional (as the DSpace database will auto-initialize itself on first startup), it's always good to verify one last time that your database connection is working properly. To initialize the database run: (for more information on "database migrate" see [Database Utilities](#))

```
[dspace]/bin/dspace database migrate
```

12. **Administrator Account:** Create an initial administrator account from the command line:

```
[dspace]/bin/dspace create-administrator
```

13. **Initial Startup!** Now the moment of truth! Start up (or restart) Tomcat/Jetty/Resin. Visit the base URL(s) of your server, depending on which DSpace web applications you want to use. You should see the DSpace home page. Congratulations! Base URLs of DSpace Web Applications:
 - JSP User Interface - (e.g.) <http://dspace.myu.edu:8080/jspui>
 - XML User Interface (aka. Manakin) - (e.g.) <http://dspace.myu.edu:8080/xmlui>
 - OAI-PMH Interface - (e.g.) <http://dspace.myu.edu:8080/oai/request?verb=Identify> (Should return an XML-based response)

In order to set up some communities and collections, you'll need to login as your DSpace Administrator (which you created with `create-administrator` above) and access the administration UI in either the JSP or XML user interface.

Advanced Installation

The above installation steps are sufficient to set up a test server to play around with, but there are a few other steps and options you should probably consider before deploying a DSpace production site.

'cron' jobs / scheduled tasks

A few DSpace features **require** that a script is run regularly (via cron, or similar):

- the [e-mail subscription feature](#) that alerts users of new items being deposited;
- the ['media filter' tool](#), that generates thumbnails of images and extracts the full-text of documents for indexing;
- the ['checksum checker'](#) that tests the bitstreams in your repository for corruption;
- the [sitemap generator](#), which enhances the ability of major search engines to index your content and make it findable;
- the [curation system queueing feature](#), which allows administrators to "queue" tasks (to run at a later time) from the Admin UI;
- and [Discovery](#) (search & browse), [OAI-PMH](#) and [Usage Statistics](#) all receive performance benefits from regular re-optimization

For much more information on recommended scheduled tasks, please see [Scheduled Tasks via Cron](#).

Multilingual Installation

In order to deploy a multilingual version of DSpace you have to configure two parameters in `[dspace-source]/config/dspace.cfg`:

- `default.locale`, e.g. `default.locale = en`
- `webui.supported.locales`, e.g. `webui.supported.locales = en, de`

The Locales might have the form `country`, `country_language`, `country_language_variant`.

According to the languages you wish to support, you have to make sure that all the i18n related files are available. See the [Configuring Multilingual Support](#) section for the JSPUI or the [Multilingual Support](#) for XMLUI in the configuration documentation.

DSpace over HTTPS

If your DSpace is configured to have users login with a username and password (as opposed to, say, client Web certificates), then you should consider using HTTPS. Whenever a user logs in with the Web form (e.g. `dspace.myuni.edu/dspace/password-login`) their DSpace password is exposed in plain text on the network. This is a very serious security risk since network traffic monitoring is very common, especially at universities. If the risk seems minor, then consider that your DSpace administrators also login this way and they have ultimate control over the archive.

The solution is to use *HTTPS* (HTTP over SSL, i.e. Secure Socket Layer, an encrypted transport), which protects your passwords against being captured. You can configure DSpace to require SSL on all "authenticated" transactions so it only accepts passwords on SSL connections.

The following sections show how to set up the most commonly-used Java Servlet containers to support HTTP over SSL.

Enabling the HTTPS support in Tomcat itself (running on ports 8080 and 8443)

Loosely based on <http://tomcat.apache.org/tomcat-7.0-doc/ssl-howto.html>.

1. **For Production use:** Follow this procedure to set up SSL on your server. Using a "real" server certificate ensures your users' browsers will accept it without complaints. In the examples below, `$CATALINA_BASE` is the directory under which your Tomcat is installed.
 - a. Create a Java keystore for your server with the password *changeit*, and install your server certificate under the alias "tomcat". This assumes the certificate was put in the file *server.pem*:

```
$JAVA_HOME/bin/keytool -import -noprompt -v -storepass changeit -keystore $CATALINA_BASE/conf/keystore -alias tomcat -file myserver.pem
```

- b. Install the CA (Certifying Authority) certificate for the CA that granted your server cert, if necessary. This assumes the server CA certificate is in *ca.pem*:

```
$JAVA_HOME/bin/keytool -import -noprompt -storepass changeit -trustcacerts -keystore $CATALINA_BASE/conf/keystore -alias ServerCA -file ca.pem
```

- c. Optional – ONLY if you need to accept client certificates for the X.509 certificate stackable authentication module See the configuration section for instructions on enabling the X.509 authentication method. Load the keystore with the CA (certifying authority) certificates for the authorities of any clients whose certificates you wish to accept. For example, assuming the client CA certificate is in *client1.pem*:

```
$JAVA_HOME/bin/keytool -import -noprompt -storepass changeit -trustcacerts -keystore $CATALINA_BASE/conf/keystore -alias client1 -file client1.pem
```

- d. Now add another Connector tag to your *server.xml* Tomcat configuration file, like the example below. The parts affecting or specific to SSL are shown in bold. (You may wish to change some details such as the port, pathnames, and keystore password)

```
<Connector port="8443"
           URIEncoding="UTF-8"
```

```

minSpareThreads="25"
enableLookups="false"
disableUploadTimeout="true"
scheme="https" secure="true" sslProtocol="TLS"
keystoreFile="conf/keystore" keystorePass="changeit"
clientAuth="true" - ONLY if using client X.509 certs for authentication!
truststoreFile="conf/keystore" truststorePass="changeit" />

```

Also, check that the default Connector is set up to redirect "secure" requests to the same port as your SSL connector, e.g.:

```

<Connector port="8080"
    minSpareThreads="25"
    enableLookups="false"
    redirectPort="8443" />

```

2. **Quick-and-dirty Procedure for Testing:** If you are just setting up a DSpace server for testing, or to experiment with HTTPS, then you don't need to get a real server certificate. You can create a "self-signed" certificate for testing; web browsers will issue warnings before accepting it, but they will function exactly the same after that as with a "real" certificate. In the examples below, \$CATALINA_BASE is the directory under which your Tomcat is installed.
 - a. Create a new key pair under the alias name "tomcat". When generating your key, give the Distinguished Name fields the appropriate values for your server and institution. CN should be the fully-qualified domain name of your server host. Here is an example:

```

$JAVA_HOME/bin/keytool -genkey \
  -alias tomcat \
  -keyalg RSA \
  -keysize 1024 \
  -keystore $CATALINA_BASE/conf/keystore \
  -storepass changeit \
  -validity 365 \
  -dname 'CN=dspace.myuni.edu, OU=MIT Libraries, O=Massachusetts Institute of Technology, L=Cambridge, S=MA, C=US'

```

You should be prompted for a password to protect the private key.

Since you now have a signed server certificate in your keystore you can, obviously, skip the next steps of installing a signed server certificate and the server CA's certificate.

- b. Optional – ONLY if you need to accept client certificates for the X.509 certificate stackable authentication module See the configuration section for instructions on enabling the X.509 authentication method. Load the keystore with the CA (certifying authority) certificates for the authorities of any clients whose certificates you wish to accept. For example, assuming the client CA certificate is in *client1.pem*:

```

$JAVA_HOME/bin/keytool -import -noprompt -storepass changeit \
  -trustcacerts -keystore $CATALINA_BASE/conf/keystore -alias client1 \
  -file client1.pem

```

- c. Follow the procedure in the section above to add another Connector tag, for the HTTPS port, to your *server.xml* file.

Using SSL on Apache HTTPD in front of Tomcat (running on ports 80 and 443)

When using Apache 2.4.2 (and lower) in front of a DSpace webapp deployed in Tomcat, `mod_proxy_ajp` and possibly `mod_proxy_http` breaks the connection to the back end (Tomcat) prematurely leading to response mixups. This is reported as bug CVE-2012-3502 (<http://web.nvd.nist.gov/view/vuln/detail?vulnId=CVE-2012-3502>) of Apache and fixed in Apache 2.4.3 (see http://www.apache.org/dist/httpd/CHANGES_2.4). The 2.2.x branch hasn't shown this problem only the 2.4.x branch has.

Before following these instructions, it's *HIGHLY recommended* to first get DSpace running in standalone Tomcat on port 8080. Once DSpace is running, you can use the below instructions to add [Apache HTTP Server](#) in front of Tomcat in order to allow DSpace to run on port 80 and optionally port 443 (for SSL).

One of the easiest routes to both running DSpace on standard ports (80 and 443) as well as using HTTPS is to install [Apache HTTP Server](#) as your primary HTTP server, and use it to forward requests to Tomcat.

1. Install [Apache HTTP Server](#) alongside your Tomcat instance
2. In your Tomcat's *server.xml*, ensure that the [AJP Connector](#) is UNCOMMENTED. Usually this runs on port 8009, but you can decide to change the port if you desire

```

<!-- Define an AJP 1.3 Connector on port 8009 -->
<Connector port="8009" protocol="AJP/1.3" />

```

3. Choose how you'd like to redirect requests from Apache HTTP Server to Tomcat. There are two primary options (`mod_proxy` OR `mod_jk`), just choose ONE. (NOTE: "mod_proxy" is often the easier of the two):

- a. *OPTION 1:* Use "mod_proxy" and "mod_proxy_ajp" Apache modules to redirect requests to Tomcat (via AJP Connector) - RECOMMENDED

- i. Install "mod_proxy" and "mod_proxy_ajp" (usually they are installed by default with Apache HTTP Server)
- ii. Enable both "mod_proxy" and "mod_proxy_ajp" modules. How you do this is often based on your operating system
 1. In Debian / Ubuntu, there's an "a2enmod" command that enables Apache 2 modules. So, you can just run: `sudo a2enmod proxy proxy_ajp`
 2. In other operating systems, you may need to find the appropriate "LoadModule" configurations (in Apache HTTP Server's main config) and uncomment it. You'll then need to restart Apache HTTP Server
- iii. Create a new [Virtual Host](#) in Apache HTTP Server to represent your DSpace site. Here's a basic example of a Virtual Host responding to any port 80 requests for "my.dspace.edu":

```
<VirtualHost *:80>
# Obviously, replace the ServerName with your DSpace site URL
ServerName my.dspace.edu

## Apache HTTP Server Logging Settings - modify how you see fit
ErrorLog ${APACHE_LOG_DIR}/my.dspace.edu-error.log
CustomLog ${APACHE_LOG_DIR}/my.dspace.edu-access.log combined

# Possible values include: debug, info, notice, warn, error, crit, alert, emerg.
LogLevel warn

# There are many more configurations available for Virtual Hosts,
# see the documentation for more details
# http://httpd.apache.org/docs/2.4/vhosts/
</VirtualHost>
```

- iv. If you want your site to also respond to SSL requests, you'll need to install and enable "[mod_ssl](#)" and create a second [Virtual Host](#) to respond to port 443 requests. An example is provided below. But much more details are available in the [Apache HTTP SSL Documentation](#) and the [mod_ssl](#) documentation

```
<VirtualHost *:443>
# Obviously, replace the ServerName with your DSpace site URL
ServerName my.dspace.edu

# You can have SSL Apache logging settings here too (see the port 80 example above)

# Configure your SSL Certificate (you must create one, obviously)
# See the "keytool" instructions above for examples of creating this certificate
# There are also many good guides on the web for generating SSL certificates for Apache
SSLEngine on
SSLCertificateChainFile /path/to/your/chainfile.crt
SSLCertificateFile /path/to/your/public-cert.crt
SSLCertificateKeyFile /path/to/your/private-key.key

# More information on SSL configurations can be found in the mod_ssl documentation
# http://httpd.apache.org/docs/2.4/mod/mod_ssl.html
</VirtualHost>
```

Extra SSL Configurations for X.509 Client Certificates authentication

 **If you are using X.509 Client Certificates for authentication:** add these configuration options to the appropriate *httpd* configuration file, e.g. *ssl.conf*, and be sure they are in force for the virtual host and namespace locations dedicated to DSpace:

```
## SSLVerifyClient can be "optional" or "require"
SSLVerifyClient optional
SSLVerifyDepth 10
SSLCACertificateFile /path/to/your/client-CA-certificate
SSLOptions StdEnvVars ExportCertData
```

- v. In *each* of your Apache HTTP Virtual Hosts (see above), use "[ProxyPass](#)" configurations to configure the redirects from Apache HTTP Server to Apache Tomcat. The exact configurations depend on whether you want to redirect ALL requests to Tomcat, or just certain paths. Here's a basic example. But much more information and examples can be found in the [mod_proxy documentation](#)

```
# These are just examples. THEY LIKELY WILL NEED MODIFICATION.
# Again, remember to add these to your EXISTING <VirtualHost> settings

<VirtualHost>

... (existing settings) ...
```

```

# If there's a single path you do NOT want redirected, you can use ! to ignore it
# In this case any requests to "/ignored_path" will be handled by Apache HTTPD and NOT
forwarded to Tomcat
ProxyPass /ignored_path !

# These configurations say: By default, redirect ALL requests to port 8009
# (The port MUST match the port of your Tomcat AJP Connector. By default this usually is
8009)
ProxyPass          / ajp://localhost:8009/
ProxyPassReverse   / ajp://localhost:8009/

# You may also wish to provide additional "mod_proxy" configurations,
# for more examples and details see the documentation at
# http://httpd.apache.org/docs/2.4/mod/mod_proxy.html
</VirtualHost>

```

- b. OPTION 2: Alternatively, use "[mod_jk](#)" Apache module to redirect requests to Tomcat (via AJP Connector). For information on configuring `mod_jk`, please see the [Apache Tomcat Connector](#) documentation (specifically the "[How To](#)" on using the Tomcat Connector with Apache HTTP Server). You may also refer to our [wiki guide for installing DSpace with ModJk](#).
4. Finally, restart your Apache HTTP Server and test things out.
 - a. If you hit any issues, it is recommended to search around for guides to running Apache HTTP Server and Apache Tomcat using either "`mod_proxy`" or "`mod_jk`". DSpace does *not* require any unique configurations with regards to this redirection from Apache to Tomcat. So, any guides that generally explain how to redirect requests from Apache to Tomcat should also work for DSpace.

The Handle Server

First a few facts to clear up some common misconceptions:

- You don't **have** to use CNRI's Handle system. At the moment, you need to change the code a little to use something else (e.g PURLs) but that should change soon.
- You'll notice that while you've been playing around with a test server, DSpace has apparently been creating handles for you looking like *hdl:123456789/24* and so forth. These aren't really Handles, since the global Handle system doesn't actually know about them, and lots of other DSpace test installs will have created the same IDs. They're only really Handles once you've registered a prefix with CNRI (see below) and have correctly set up the Handle server included in the DSpace distribution. This Handle server communicates with the rest of the global Handle infrastructure so that anyone that understands Handles can find the Handles your DSpace has created. If you want to use the Handle system, you'll need to set up a Handle server. This is included with DSpace. Note that this is not required in order to evaluate DSpace; you only need one if you are running a production service. You'll need to obtain a Handle prefix from [the central CNRI Handle site](#).

A Handle server runs as a separate process that receives TCP requests from other Handle servers, and issues resolution requests to a global server or servers if a Handle entered locally does not correspond to some local content. The Handle protocol is based on TCP, so it will need to be installed on a server that can send and receive TCP on port 2641.

We recommend configuring your Handle Server **without a passphrase**, as the current DSpace `start-handle-server` scripts do not yet support `startup` with a passphrase.

If you choose to set a passphrase, you may need to start the Handle Server via: `[dspace]\bin\dspace dsrun net.handle.server.Main [dspace]\handle-server`

1. To configure your DSpace installation to run the handle server, run the following command:

```
[dspace]/bin/dspace make-handle-config [dspace]/handle-server
```

Ensure that `[dspace]/handle-server` matches whatever you have in `dspace.cfg` for the `handle.dir` property.

- a. If you are using Windows, the proper command is:

```
[dspace]/bin/dspace dsrun net.handle.server.SimpleSetup [dspace]/handle-server
```

Ensure that `[dspace]/handle-server` matches whatever you have in `dspace.cfg` for the `handle.dir` property.

2. Edit the resulting `[dspace]/handle-server/config.dct` file to include the following lines in the "`server_config`" clause:

```
"storage_type" = "CUSTOM"
"storage_class" = "org.dspace.handle.HandlePlugin"
```

This tells the Handle server to get information about individual Handles from the DSpace code.

3. Once the configuration file has been generated, you will need to go to <http://hdl.handle.net/4263537/5014> to upload the generated `sitebndl.zip` file. The upload page will ask you for your contact information. An administrator will then create the naming authority/prefix on the root service (known as the Global Handle Registry), and notify you when this has been completed. You will not be able to continue the handle server installation until you receive further information concerning your naming authority.

- When CNRI has sent you your naming authority prefix, you will need to edit the *config.dct* file. The file will be found in *[dspace]/handle-server*. Look for "300:0.NA/YOUR_NAMING_AUTHORITY". Replace *YOUR_NAMING_AUTHORITY* with the assigned naming authority prefix sent to you.
- Now start your handle server (as the dspace user):

```
[dspace]/bin/start-handle-server
```

- If you are using Windows, the proper command is (please replace "[dspace]\handle-server" with the full path of the handle-server directory):

```
[dspace]/bin/dspace dsrun net.handle.server.Main [dspace]/handle-server
```

Ensure that *[dspace]/handle-server* matches whatever you have in *dspace.cfg* for the *handle.dir* property.

Note that since the DSpace code manages individual Handles, administrative operations such as Handle creation and modification aren't supported by DSpace's Handle server.

Updating Existing Handle Prefixes

If you need to update the handle prefix on items created before the CNRI registration process you can run the *[dspace]/bin/dspace update-handle-prefix script*. You may need to do this if you loaded items prior to CNRI registration (e.g. setting up a demonstration system prior to migrating it to production). The script takes the current and new prefix as parameters. For example:

```
[dspace]/bin/dspace update-handle-prefix 123456789 1303
```

This script will change any handles currently assigned prefix 123456789 to prefix 1303, so for example handle 123456789/23 will be updated to 1303/23 in the database.

Google and HTML sitemaps

To aid web crawlers index the content within your repository, you can make use of sitemaps. There are currently two forms of sitemaps included in DSpace: Google sitemaps and HTML sitemaps.

Sitemaps allow DSpace to expose its content without the crawlers having to index every page. HTML sitemaps provide a list of all items, collections and communities in HTML format, whilst Google sitemaps provide the same information in gzipped XML format.

To generate the sitemaps, you need to run *[dspace]/bin/dspace generate-sitemaps* This creates the sitemaps in *[dspace]/sitemaps/*

The sitemaps can be accessed from the following URLs:

- <http://dspace.example.com/dspace/sitemap> - Index sitemap
 - <http://dspace.example.com/dspace/sitemap?map=0> - First list of items (up to 50,000)
 - <http://dspace.example.com/dspace/sitemap?map=n> - Subsequent lists of items (e.g. 50,0001 to 100,000) etc...
- HTML sitemaps follow the same procedure:
- <http://dspace.example.com/dspace/htmlmap> - Index HTML based sitemap
 - etc...

When running *[dspace]/bin/dspace generate-sitemaps* the script informs Google that the sitemaps have been updated. For this update to register correctly, you must first register your Google sitemap index page (*[dspace]/sitemap*) with Google at <http://www.google.com/webmasters/sitemaps/>. If your DSpace server requires the use of a HTTP proxy to connect to the Internet, ensure that you have set *http.proxy.host* and *http.proxy.port* in *[dspace]/config/dspace.cfg*

The URL for pingging Google, and in future, other search engines, is configured in *[dspace]/config/dspace.cfg* using the *sitemap.engineurls* setting where you can provide a comma-separated list of URLs to 'ping'.

You can generate the sitemaps automatically every day using an additional cron job:

```
# Generate sitemaps at 6:00 am local time each day
0 6 * * * [dspace]/bin/dspace generate-sitemaps
```

More information on why we **highly recommend** enabling sitemaps can be found at [Search Engine Optimization \(SEO\)](#).

Statistics

DSpace uses the Apache Solr application underlaying the statistics. There is no need to download any separate software. All the necessary software is included. To understand all of the configuration property keys, the user should refer to [DSpace Statistic Configuration](#) for detailed information.

Windows Installation

Essentially installing on Windows is the same as installing on Unix so please refer back to the main [Installation Instructions](#) section.

- Download the DSpace source from [SourceForge](#) and unzip it ([WinZip](#) will do this)
- If you install PostgreSQL, it's recommended to select to install the pgAdmin III tool. It provides a nice User Interface for interacting with PostgreSQL databases.
- For all path separators use forward slashes (e.g. "/"). For example: "C:/dspace" is a valid Windows path. But, be warned that "C:\dspace" IS INVALID and will cause errors.

Checking Your Installation

The administrator needs to check the installation to make sure all components are working. Here is list of checks to be performed. In brackets after each item, it the associated component or components that might be the issue needing resolution.

- System is up and running. *User can see the DSpace home page. [Tomcat/Jetty, firewall, IP assignment, DNS]*
- Database is running and working correctly. *Attempt to create a user, community or collection. [PostgreSQL, Oracle]* Run the database connection testing command to see if other issues are being reported: `[dspace]/bin/dspace database test`
- Email subsystem is running. The user can issue this command to test the email system: `[dspace]/bin/dspace test-email` It attempts to send a test email to the email address that is set in `dspace.cfg` (`mail.admin`). If it fails, you will get messages informing you as to why, referring you to the DSpace documentation.

Known Bugs

In any software project of the scale of DSpace, there will be bugs. Sometimes, a stable version of DSpace includes known bugs. We do not always wait until every known bug is fixed before a release. If the software is sufficiently stable and an improvement on the previous release, and the bugs are minor and have known workarounds, we release it to enable the community to take advantage of those improvements.

The known bugs in a release are documented in the `KNOWN_BUGS` file in the source package.

Please see the [DSpace bug tracker](#) for further information on current bugs, and to find out if the bug has subsequently been fixed. This is also where you can report any further bugs you find.

Common Problems

In an ideal world everyone would follow the above steps and have a fully functioning DSpace. Of course, in the real world it doesn't always seem to work out that way. This section lists common problems that people encounter when installing DSpace, and likely causes and fixes. This is likely to grow over time as we learn about users' experiences.

Common Installation Issues

- **Database errors occur when you run `ant fresh_install`:** There are two common errors that occur.
 - If your error looks like this:

```
[java] 2004-03-25 15:17:07,730 INFO
      org.dspace.storage.rdbms.InitializeDatabase @ Initializing Database
[java] 2004-03-25 15:17:08,816 FATAL
      org.dspace.storage.rdbms.InitializeDatabase @ Caught exception:
[java] org.postgresql.util.PSQLException: Connection refused. Check
      that the hostname and port are correct and that the postmaster is
      accepting TCP/IP connections.
[java]      at
      org.postgresql.jdbc1.AbstractJdbc1Connection.openConnection(AbstractJd
bc1Connection.java:204)
[java]      at org.postgresql.Driver.connect(Driver.java:139)
```

it usually means you haven't yet added the relevant configuration parameter to your PostgreSQL configuration (see above), or perhaps you haven't restarted PostgreSQL after making the change. Also, make sure that the `db.username` and `db.password` properties are correctly set in `[dspace]/config/dspace.cfg`. An easy way to check that your DB is working OK over TCP/IP is to try this on the command line:

```
psql -U dspace -W -h localhost
```

- Enter the `dspace` database password, and you should be dropped into the `psql` tool with a `dspace=>` prompt.
- Another common error looks like this:

```
[java] 2004-03-25 16:37:16,757 INFO
      org.dspace.storage.rdbms.InitializeDatabase @ Initializing Database
[java] 2004-03-25 16:37:17,139 WARN
      org.dspace.storage.rdbms.DatabaseManager @ Exception initializing DB
      pool
```

```
[java] java.lang.ClassNotFoundException: org.postgresql.Driver
[java]     at java.net.URLClassLoader$1.run(URLClassLoader.java:198)
[java]     at java.security.AccessController.doPrivileged(Native
Method)
[java]     at
java.net.URLClassLoader.findClass(URLClassLoader.java:186)
```

This means that the PostgreSQL JDBC driver is not present in `[dspace]/lib`. See above.

- **GeoLiteCity Database file fails to download or install, when you run `ant fresh_install`:** There are two common errors that may occur:
 - If your error looks like this:

```
[get] Error getting http://geolite.maxmind.com/download/geoip/database/GeoLiteCity.dat.gz to /usr
/local/dspace/config/GeoLiteCity.dat.gz

BUILD FAILED
/dspace-release/dspace/target/dspace-installer/build.xml:931: java.net.ConnectException:
Connection timed out
```

it means that you likely either (a) don't have an internet connection to download the necessary GeoLite Database file (used for DSpace Statistics), or (b) the GeoLite Database file's URL is no longer valid.

- Another common message looks like this:

```
[echo] WARNING : FAILED TO DOWNLOAD GEOLITE DATABASE FILE
[echo]           (Used for DSpace Solr Usage Statistics)
```

Again, this means the GeoLite Database file cannot be downloaded or is unavailable for some reason. You should be able to resolve this issue by following the ["Manually Installing/Updating GeoLite Database File"](#) instructions.

General DSpace Issues

- **Tomcat doesn't shut down:** If you're trying to tweak Tomcat's configuration but nothing seems to make a difference to the error you're seeing, you might find that Tomcat hasn't been shutting down properly, perhaps because it's waiting for a stale connection to close gracefully which won't happen.
 - To see if this is the case, try running: `ps -ef | grep java` and look for Tomcat's Java processes. If they stay around after running Tomcat's `shutdown.sh` script, trying running `kill` on them (or `kill -9` if necessary), then starting Tomcat again.
- **Database connections don't work, or accessing DSpace takes forever:** If you find that when you try to access a DSpace Web page and your browser sits there connecting, or if the database connections fail, you might find that a 'zombie' database connection is hanging around preventing normal operation.
 - To see if this is the case, try running: `ps -ef | grep postgres`
 - You might see some processes like this:

```
dspace 16325  1997  0  Feb 14  ?           0:00 postgres: dspace dspace  127.0.0.1 idle in
transaction
```

This is normal. DSpace maintains a 'pool' of open database connections, which are re-used to avoid the overhead of constantly opening and closing connections. If they're 'idle' it's OK; they're waiting to be used.

- However sometimes, if something went wrong, they might be stuck in the middle of a query, which seems to prevent other connections from operating, e.g.:

```
dspace 16325  1997  0  Feb 14  ?           0:00 postgres: dspace dspace  127.0.0.1 SELECT
```

This means the connection is in the middle of a *SELECT* operation, and if you're not using DSpace right that instant, it's probably a 'zombie' connection. If this is the case, try running `kill` on the process, and stopping and restarting Tomcat.