

Imagel/O EXT – Setup Guide

V. 1.0



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1 – Introduction

This simple guide will provide you some instructions about how to setup all the libraries and tools needed to proficiently use the Imagel/O Ext Project.

2 – Requirements

The Imagel/O Ext project requires the same tools for both Windows and Linux OSs. However, the set of operations needed to properly configure all of them or specific versions of a tool may be different for one OS with respect to the other one. For this reason, these instructions have been split in two main chapters to differentiate the two typologies of setup procedures in order to provide all the OS specific instructions into a stand-alone section. By this way, Windows Users may read the proper chapter while Linux Users may skip it and go on to the linux dedicated chapter and viceversa although some instructions may result duplicated.

3 – Windows instructions

In some of the following sections, we are assuming you have Visual Studio 2003 properly installed.

3.1 – JAVA

First of all, you need your machine has JAVA 1.5.0_14 installed.

You may download it from this site: http://java.sun.com/javase/downloads/index_jdk5.jsp

Select the JDK 5.0 Update 14 and download the Windows Offline Installation. Download it on your hard-disk and run the installer.

Finally, be sure to properly set a `JAVA_HOME` environment variable¹ referring to the location of the JDK (As an instance, `C:\ProgramFiles\Java\jdk.1.5.0_14`)

On Windows Vista you will need to choose an install location other than the default (the program files folder has access restrictions on it which will prevent maven from installing additional DLL files as part of our build process). As an example `C:\java\jdk.1.5.0_14` will work just fine.

3.2 – ANT

Apache ANT is another needed tool. You can download it from: <http://ant.apache.org/>

When you downloaded it (as an instance, on `C:\ProgramFiles\Apache-ant-1.7.0`), be sure to properly set an `ANT_HOME` environment variable referring to that location.

¹To set an environment variable on Windows XP, open the Control Panel -> System. Then, in the “Advanced” tab, click “Environment Variables”. Lastly, click the “NEW” button from the System variables box to add a new Environment Variable. Define the name of the Environment Variable (as an instance: `JAVA_HOME`) and provide a value for this variable (as an instance, the path of your JDK -> `C:\ProgramFiles\Java\jdk.1.5.0_14`). Note that if you open a windows command line or the Visual Studio Command Prompt prior to change or set new environment variables via the Control Panel, these changes will not be updated on your command line window. Thus you need to close your command line and open a new one.



Then, edit the `PATH` environment variable by adding the Ant's `bin` directory to (As an instance, `C:\ProgramFiles\Apache-ant-1.7.0\bin`).

3.3 – MAVEN 2

Maven 2 (in the following instructions it will be simply called “Maven”) is another important tool needed by the Image I/O ext project. You can download it from <http://maven.apache.org/download.html>

Download the last `maven-xxx-bin.zip` version and unzip it somewhere on your hard-disk, as an instance on `C:\ProgramFiles\Apache-maven-2.0.7`.

Then, edit the `PATH` environment variable by adding the Maven's `bin` directory to (As an instance, `C:\ProgramFiles\Apache-maven-2.0.7\bin`).

3.4 – JAI

Go to <https://jai.dev.java.net/binary-builds.html> and select the daily builds link. Then, download the proper windows version. After you downloaded it, extract the content of the `lib` folder on your `JAVA_HOME\lib` folder as well as on your `JAVA_HOME\JRE\lib`. (where `JAVA_HOME` defines your JDK, as an instance, `c:\programFiles\java\jdk1.5.0_14`).

3.5 – JAI-ImageIO Toolkit

Go to <https://jai-imageio.dev.java.net/binary-builds.html> and select the daily builds link. Then, download the proper Linux version. After you downloaded it, extract the content of the `lib` folder on your `JAVA_HOME\lib` folder and on your `JAVA_HOME\JRE\lib`. (where `JAVA_HOME` defines your JDK, as an instance, `c:\programFiles\java\jdk1.5.0_14`).

3.6 – SWIG

Be sure you have properly downloaded SWIG, the Simplified Wrapper and Interface Generator which allows to produce JAVA bindings for C/C++ code. You can obtain it at this site:

<http://www.swig.org/download.html>

You should download the last `swigwin` version which includes a prebuilt executable. (When this guide has been released, the last available `swigwin` version was 1.3.31 available at:

<http://prdownloads.sourceforge.net/swig/swigwin-1.3.31.zip>)

After you downloaded it, extract the zipped file on your hard-disk (as an instance on `C:\ProgramFiles\Swig`)

3.7 – GDAL

This is one of the most important sections. GDAL is the Geospatial Data Abstraction Layer which provides data access to several data formats. Image I/O Ext deeply leverages on this complex library which need to be properly configured.



3.7.1 – GDAL requirements

Depending on the format you wish to support, you need to properly download and setup several libraries prior to build GDAL. The following instructions describe how to achieve this for these formats:

- Kakadu (v. 5.2.6)
- MrSID (v 6.0.7)
- ECW (v 3.3)
- HDF4 (v. 4.2r1)

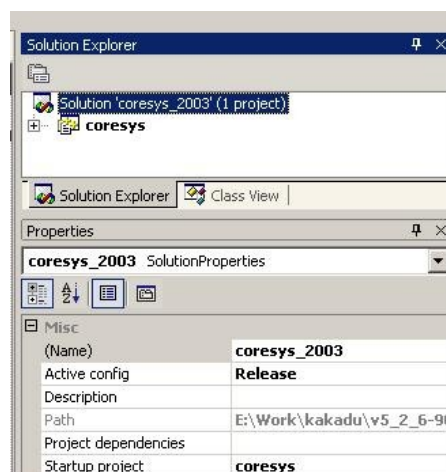
NOTE: If you have no time to follow all the instructions contained in the following sections or you encountered several problems which you cannot solve, you may leverage on the ready-to-use DLLs available with the ImageIO-EXT project using the deploy module. This module will deploy ALL the DLL in the proper location (In such a case, the available GDAL DLL is built to support Kakadu, MrSID, ECW and HDF4). **However** it is worth to point out that this approach is not recommended and it should be used only as last resort. Furthermore, the deploy module does not contain the Kakadu and the ECW DLLs and testing ImageIO-Ext may fail in case these DLLs are not found. Anyway, the instructions to auto deploy DLL are contained in section 3.9.1

3.7.1.1 – Kakadu

Supposing you have your own Kakadu licensed source code, you need to build the Kakadu DLL.

The visual studio solution for kakadu building allows to build a shared Debug DLL. We need to change some settings to build a shared Release DLL. Otherwise, sometimes, memory allocations errors could occur especially when you build GDAL with support for several external formats (which need additional DLLs) since some libs may use MSVCRT71D and some others MSVCR71.

First step is opening the proper ready-to-use Visual Studio Solution² of kakadu coresys (located in `kakadu\VERSION\coresys`) and change the solution properties (right click on the solution -> Properties). Select “*Configuration Properties*” and switch the *Configuration* value from “*Debug*” to “*Release*”.



Then, you are ready to build your solution. After you done this, open the Kakadu apps solution (located in `kakadu\VERSION\apps`). Change the Configuration properties to Release in the same

²As an instance, if you are using Visual Studio .Net 2003, open the `coresys_2003.sln` solution file.



way you just do it for Coresys solution and build this solution. If some errors occur for a specific project, rebuild that one. Once your build has done, copy the produced .obj files in the kakadu\VERSION\apps\make folder. The required .obj and the location from where to get them are listed in the following table.

File	Originating location
args.obj	\v5_generated\v_compress\release
jp2.obj	\v5_generated\v_compress\release
mj2.obj	\v5_generated\v_compress\release
image_in.obj	\v5_generated\compress\release
palette.obj	\v5_generated\compress\release
roi_sources.obj	\v5_generated\compress\release
kdu_tiff.obj	\v5_generated\compress\release
jpx.obj	\v5_generated\compress\release
kdu_stripe_decompressor.obj	\v5_generated\buffer_expand\release
image_out.obj	\v5_generated\expand\release

3.7.1.2 – MrSID

As a first requirement, you need the LizardTech Decoding Software Development Kit (DSDK). You can download it free of charge from this site: <http://developer.lizardtech.com> (You need to be registered in order to download it). After logged in, select “Download” -> “Software Development Kits” -> “Download SDK’s”. Select the proper version of SDK to be downloaded (select the **GeoExpress SDK for Windows - VC7.1**).

When your download is completed, unzip the DSDK somewhere on your hard disk, as an instance, on C:\ExternalLibraries\MrSid

3.7.1.3 – ECW

Download the Image Compression SDK (source code) from ER Mapper site at this address:

<http://www.ermapper.com> (You need to be registered in order to download it).

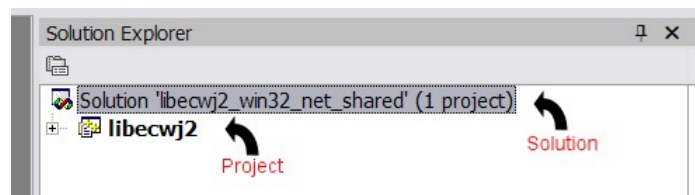
From the main site, select the menu “products & downloads” -> “Image Compression SDK” from the Desktop section. Download the *Image Compression SDK Source Code 3.3* file and extract this somewhere on your hard disk, as an instance on C:\ExternalLibraries\libecwj2-3.3.

Be sure you have *Microsoft Windows® Server 2003 R2 Platform SDK installed*. If not yet installed, download it from this location: <http://www.microsoft.com/downloads/details.aspx?FamilyID=484269e2-3b89-47e3-8eb7-1f2be6d7123a&DisplayLang=en>

Then, open the ready-to-use libecwj2_win32_net_shared.vcproj Visual Studio Project available in C:\ExternalLibraries\libecwj2-3.3\Source\NCSBuildQmake.



You will be asked to create a new solution. Select a location where to create the solution and, when done, change the solution properties (right click on the solution -> Properties).



Select “*Configuration Properties*” and switch the *Configuration* value from “*Debug*” to “*Release*”.

Finally, select the libecwj2 project in your solution explorer and change its properties as follow:

Configuration Properties -> *C/C++* -> *General* -> *Additional Include Directories*:

add an entry referring the `include` subfolder of the Microsoft Windows® Server 2003 R2 Platform SDK (As an instance: “`C:\ProgramFiles\Microsoft Platform SDK for Windows Server 2003 R2\Include`”). Then, you are ready to build your solution.

3.7.1.4 – HDF4

As a first requirement, you need to download the binary distribution of HDF4 release from this site:

<http://hdf.ncsa.uiuc.edu/release4/obtain.html>

Scroll this page until you find the link to the binary distribution file for Windows and download it.

When your download is completed, unzip the binary somewhere on your hard disk, as an instance, on `C:\ExternalLibraries\HDF4`.

Then, enter in the `release` subfolder and create a `libpath` folder where you need to copy 4 *.lib files contained in `release\lib` and `release\dll` subfolders. They are: `hd421.lib`, `hd421m.lib`, `hm421.lib`, `hm421m.lib`

This could seem a strange workaround but it avoids errors when building GDAL against HDF4.

It is finally worth to point out that HDF4 leverages on some external libs: JPEG, ZLIB, SZIP. Be sure you have them. <http://hdf.ncsa.uiuc.edu/release4/obtain.html> also contains 3 links to download the required libraries: From the *External Software* section -> *External Libraries used by HDF*, for each library, you need to select the “*Pre-Compiled Binaries*” link and select the Windows version.

3.7.2 – GDAL Configuration

Firstly, you need to download GDAL 1.4.2 from OSGeo SVN.

You may use Tortoise SVN (available at: <http://tortoisesvn.net/downloads>) to download it.

Create a `GDAL` folder on your Hard-disk and open the contextual menu on it (It's the menu which appears when you click on some element with the right's button of your mouse) and select “*SVN Checkout...*”. Finally, specify <https://svn.osgeo.org/gdal/tags/1.4.2/gdal> as “URL of repository”.



After this, you need to apply the patch available at this location:

<https://imageio-ext.dev.java.net/svn/imageio-ext/trunk/patches/1.4.2GDAL.patch>

This patch contains several changes for:

- Kakadu support: Multithreading added; More Kakadu options supported. Makefile modified
- Java bindings: improved data access (read Dataset at once instead of read RasterBands at once; PixelSpace, LineSpace and BandSpace parameters now are allowed)

To apply the patch, supposing you already downloaded Tortoise SVN, you need to select the GDAL folder on your hard-disk, then, from the contextual menu, select *TortoiseSVN ->Apply patch...* At this point, you need to specify the previously downloaded 1.4.2GDAL.patch file and apply.

Alternatively, if you don't have TortoiseSVN, you may use the *patch* command distributed with MSYS³. In such a case, to apply the patch, enter in the GDAL main folder and run:

```
patch -p0 -f -i PATH_TO_DOWNLOADED_PATCH/1.4.2GDAL.patch
```

(where PATH_TO_DOWNLOADED_PATCH represents the location where you have previously downloaded the patch)

Finally, you need to modify your GDAL\NMAKE.opt as explained in the following sections.

3.7.2.1 – Kakadu configuration option

Find the KAKADU Setting properties in GDAL\NMAKE.opt by looking for the following line:

```
# Uncomment if you have Kakadu 4.0 or newer
```

Supposing your KAKADU library has been placed in C:\ExternalLibraries\kakadu, edit the next line, like this: KAKDIR = C:\ExternalLibraries\kakadu\v5_2_6-90032L

Be sure the proper version subfolder is set. (In this case: v5_2_6-90032L).

To enable kakadu support we need to change only another property. Go ahead in the NMAKE.OPT and look for the following line:

```
# Any extra libraries needed on this platform?
```

Then, edit the ADD_LIBS variable by adding the kakadu lib, like this:

```
ADD_LIBS = C:\ExternalLibraries\kakadu\lib\kdu_v52R.lib
```

3.7.2.2 – MrSID configuration option

Find the MrSID Setting properties in GDAL\NMAKE.opt by looking for the following line:

```
#Uncomment the following for MrSID support
```

Supposing your MrSID library has been placed in C:\ExternalLibraries\MrSid, edit the next lines, like this

³You can download MSYS from here: <http://prdownloads.sourceforge.net/mingw/MSYS-1.0.10.exe?download>

After the download, run the MSYS-1.0.10 executable which will install MSYS on your hard disk, as an instance on C:\MSYS\1.0. Finally, edit the PATH environment variable (as explained in note 1) by adding the bin subfolder of your MSYS installation (as an instance, C:\MSYS\1.0\bin)




```

MRSID_DIR = C:\ExternalLibraries\MrSid
MRSID_INCLUDE = -I$(MRSID_DIR)\include\base -I$(MRSID_DIR)\include\support \
-I$(MRSID_DIR)\include\metadata \
-I$(MRSID_DIR)\include\mrsid_readers \
-I$(MRSID_DIR)\include\j2k_readers
MRSID_LIB = $(MRSID_DIR)\lib\Release_md\lti_dsdk_dll.lib advapi32.lib
user32.lib

```

Lastly, if you also need to enable JPEG2000 support by means of MrSID library, you need to add the following line:

```

MRSID_FLAGS = -DMRSID_J2K

```

3.7.2.3 – ECW configuration option

Find the ECW Setting properties in `GDAL\NMAKE.opt` by looking for the following line:

```

# Uncomment the following and update to enable ECW support.

```

Supposing your ECW library has been placed in `C:\ExternalLibraries\libecwj2-3.3`, edit the next 2 lines, like this:

```

ECWDIR = C:\ExternalLibraries\libecwj2-3.3
ECWLIB = $(ECWDIR)\lib\libecwj2.lib

```

3.7.2.4 – HDF4 configuration option

Find the HDF4 Setting properties in `GDAL\NMAKE.opt` by looking for the following line:

```

# Uncomment the following and update to enable NCSA HDF Release 4 support.

```

Supposing your HDF4 library has been placed in `C:\ExternalLibraries\HDF4`, edit the next 2 lines, like this:

```

HDF4_DIR = c:\ExternalLibraries\HDF4\release
HDF4_LIB = /LIBPATH:$(HDF4_DIR)\libpath

```

3.7.3 – GDAL Building

Now, you are ready to build GDAL. Open Visual Studio Command Prompt, and enter in your `GDAL` home folder. At this point, you are ready to start the build process by running the following command:

```

nmake /f makefile.vc

```

When the build is terminated, you need to generate JAVA bindings.



3.7.4 – Generating JAVA Bindings

3.7.4.1 - Variable settings

Be sure the `SWIG` variable in your `GDAL\NMAKE.opt` is properly set. Check this by finding the following lines:

```
# Set the location of your SWIG installation
!IFDEF SWIG
SWIG = C:\ProgramFiles\swigwin-1.3.31\swig.exe
!ENDIF
```

Be sure `SWIG` variable refers to the proper `swig.exe` path.

Then, check your `GDAL\SWIG\JAVA\java.opt` is properly configured. (Basically, you need to check the `JAVA_HOME` and `ANT_HOME` variables are properly set)

3.7.4.2 - Running SWIG

Now, you are ready to generate java bindings. From the command line, enter in your `GDAL\SWIG` folder and run `nmake /f makefile.vc java`

This command will automatically generate wrappers and bindings.

3.7.5 – Final Settings

At this point, you should have:

- some external DLLs (for Kakadu, ECW, MrSID, HDF4)
- a GDAL DLL (`gdal114.dll`)
- 4 JNI DLL (`gdalconstjni.dll`, `gdaljni.dll`, `ogrjni.dll`, `osrjni.dll`)
- a jar file (`gdal.jar`)

You need to place all these DLLs in the folder where your application will look for libraries. Your `JAVA_HOME/BIN` folder could be a typical location where to place them.

Finally, be sure you properly set the `GDAL_DATA` environment variable. This needs to be set with your `GDAL\DATA` location in order to properly evaluate EPSG codes.

3.8 – ImageMagick & Jmagick

The ImageI/O-Ext project provides an additional plugin to handle JPEG format, leveraging on Jmagick. In order to build and use this plugin, you need to download and build the ImageMagick library from this site:

<ftp://ftp.imagemagick.org/pub/ImageMagick/windows/ImageMagick-windows.zip>

Prior to build ImageMagick you need to configure it:

Run the Visual Studio IDE and from the “Open->Project” menu, select the configure workspace available at the `ImageMagick-6.X.X\VisualMagick\configure` folder and press Open.

Choose “Build->Build Solution” to compile the configuration tool and, when finished, you will find a `configure.exe` tool on the `configure` folder.



Now, you are ready to configure the build of your ImageMagick libraries:

Run `configure.exe` and the wizard will be opened. Press Next and click on the multi-threaded DLL. Now press, on Next twice and finally Finish. The configuration utility just created a workspace required to build ImageMagick from source. Open the `VisualDynamicMT.sln` Visual Studio Solution from the `ImageMagick-6.X.X\VisualMagick` folder. Change the solution properties (right click on the solution -> Properties). Select “*Configuration Properties*” and switch the *Configuration* value from “*Debug*” to “*Release*”.

Finally, choose Build->Build Solution to compile and build the ImageMagick distribution. (Advanced Users may manually disable unrequired modules. Actually, the ImageI/O Ext plugin module leveraging on Jmagick, only provides support for JPEG files.

When finished, you need to place all the DLLs from the `ImageMagick-6.X.X\VisualMagick\bin` folder in the folder where your application will look for libraries. Your `JAVA_HOME/BIN` folder could be a typical location where to place them.

Future versions of this document will provide better instructions about how to customize ImageMagick build.

3.9 – ImageI/O-EXT Project

You need to download the **imageio-ext** project from Java.net SVN. To do this, you need to create a `imageio-ext` folder and use Tortoise SVN as explained in section 3.7.1.

The URL of repository for the *SVN Checkout* command is <https://imageio-ext.dev.java.net/svn/imageio-ext/trunk>

3.9.1 – DLL deployment instructions (Optional) - [windows] profile

In case you skipped the manual building process introduced in the previous sections, you should leverage on the DLL contained in the deploy module although this approach is not recommended (Testing some modules may fail since you need several licensed DLLs, which are not included in the deploy module).

To deploy available DLLs, specify the *windows* profile with the `-Pwindows` option when building the project (as explained in 3.9.3).

3.9.2 – JMagick libraries deployment instructions (Optional)- [jmagick] profile

In case you want to deploy and add Jmagick library support to the ImageI/O Ext project, specify the *jmagick* profile with the `-Pjmagick` option when building the project (as explained in 3.9.3).

3.9.3 – ImageI/O-Ext Project building

To build the ImageI/O-Ext project, enter in `imageio-ext\trunk\` and run:

`mvn install` (add `-Pwindows` or `-Pjmagick` or `-Pwindows,jmagick` depending on what is your need, with reference to chapters 3.9.1 and 3.9.2). This command will build and test all required modules and plugins and store the produced JARS in the local maven repository.

In case you need to do a fast build of the ImageI/O-Ext project, without tests, just add the `-Dmaven.test.skip` option to the previous `mvn` command.



Testing and debugging the ImageI/O-Ext project may be done with Eclipse. Maven allows to build ready-to-use Eclipse projects by setting the required dependencies of each project.

3.9.4 – ECLIPSE settings

First of all, you may download Eclipse from this site: <http://www.eclipse.org/downloads/>

From the “Eclipse IDE for Java Developers” section, click on the windows link located in the right side.

When you downloaded it and extracted on your hard disk, you may setup ImageI/O-Ext eclipse projects for future debugging and tests. Enter in your `imageio-ext\trunk\library` folder and run:

```
mvn eclipse:eclipse (this will build ready-to-use projects containing the main framework).
```

Finally, if you are interested in building eclipse projects for all the available ImageI/O-Ext plugins, you should enter in your `imageio-ext\trunk\plugin` folder and run again `mvn eclipse:eclipse`

Alternatively, if you are interested in a single plugin, you may enter in the proper subfolder, as an instance, `imageio-ext\trunk\plugin\gdalkakadujp2` and run the same command.

At this point, you should be ready to run eclipse and import the just produced projects from eclipse as follow. From the Eclipse *File* menu:

File->“Import”->“General”->“Existing Projects into Workspace”-> and select the root directory where you previously downloaded the whole ImageI/O-Ext project.

When ready, the “*Projects:*” window should contain all the projects previously built with “`mvn eclipse:eclipse`”. Select the ones you are interested in and go on.

These projects need several dependencies (as an instance, `gdalframework.jar`, `junit` and some others) which are contained in the maven repository.

Be sure you properly set the `M2_REPO` variable as explained here below:

Open the properties of one of your just imported projects and select “*Java Build Path*” entry in the left column. Then go to the “*Libraries*” Tab and check if your `M2_REPO` variable has been defined.

To define it, click on “*Add Variable*”->“*Configure Variables...*”->“*New...*” Set “`M2_REPO`” as Name and a proper location as Path... usually, the maven repo is located on `/root/m2/repository`.

Select a test class from `src/test/java` of a plugin project and select *Run As->Java Application*.

Note that to reduce building time with maven, all tests does not display image loaded. If you want to display the images in the available tests, just specify a proper JVM argument for the test run.

Select a test class and select *Run As -> Run...* . Then go in the *Arguments* TAB and add the following line in the “*VM arguments:*” box:

```
-Dorg.geotools.test.interactive=true
```

3.9.5 – Testing ImageI/O-Ext modules with Maven.

In case you simply need testing some ImageI/O-Ext modules without using eclipse, as an instance in order to check if everything is working fine, you can enter in the module you are interested in and run the maven test. As an instance:

```
C:\Projects\imageio-ext\trunk>cd plugin\gdalarcgrid
```

```
C:\Projects\imageio-ext\trunk\plugin\gdalarcgrid>mvn test
```



Lastly, if you want to perform interactive tests (which usually display data read on a windows), you should use the `interactive.tests` profile like this:

```
C:\Projects\imageio-ext\trunk\plugin\gdalarcgrid>mvn test  
-Pinteractive.tests
```

Anyway, displaying the image is a non blocking/waiting operation so you will see the image just for a brief instant (when displayed, it will be automatically closed. Future versions may include a property to customize “waiting time” before close).

3.9.5.1 – Testing JPEG2000 Kakadu (GDAL) writer capabilities

The JPEG2000 Kakadu (GDAL based) plugin contains a suite for testing writing capabilities. As default, the test performs a set of write operations with different write parameters leveraging on the available create options / Kakadu customizations. When the test is terminated, all the written files are automatically deleted. In case you would like to maintain the produced files, avoiding delete, you should use the profile `tests.holdwrittenfiles` when running test, using the following command:

```
C:\Projects\imageio-ext\trunk\plugin\gdalkakadujp2>mvn test  
-Ptests.holdwrittenfiles
```



4 – LINUX instructions

The following instructions have been tested on Linux Fedora Core 5 distribution.

Note: On some Linux distributions (as an instance, Ubuntu), you can install Java, Swig and Ant using the Package Manager.

4.1 – JAVA

First of all, you need your machine has JAVA 1.5.0_14 installed. (This version was available when writing this guide). You may download it from this site:

http://java.sun.com/javase/downloads/index_jdk5.jsp

Select the JDK 5.0 Update 14 and download the Linux Self-extracting file (A `jdk-1_5_0_14-linux-i586.bin` file). After you have downloaded it (as an instance on `/usr/local/java`), be sure that execute permissions are set on the downloaded file, by running this command:

```
chmod +x jdk-1_5_0_14-linux-i586.bin
```

Then, go in `/usr/local/java` and run: `./jdk-1_5_0_14-linux-i586.bin`

Usually, Fedora Core 5 distribution comes with a OLD java version (as an instance, 1.4.2). Now, you could add symbolic links on your `alternatives`.

Just run the following commands:

```
alternatives --install /usr/bin/java java /usr/.../jdk1.5.0_14/bin/java 2
```

next you can configure alternatives for java by using the following command:

```
alternatives --config java
```

```
alternatives --display java
```

Some Linux distributions come with Java 6 version. When building ImageIO-Ext with Java 6, an error related to `customstreams` module appears.

4.2 – ANT

Apache ANT is another needed tool. You can download it from: <http://ant.apache.org/>

When you downloaded it (as an instance, on `/usr/local/apache-ant-1.7.0`), you may create a symbolic link as follow: `ln -s /usr/local/apache-ant-1.7.0/bin/ant /usr/bin/ant`

4.3 – MAVEN

Maven is another important tool needed by the Image I/O ext project. You can download it from <http://maven.apache.org/download.html>.

When you downloaded it, extract the archive to the directory where you wish to install it, as an instance on `/usr/local/maven-2.0.7`

At this point, on your `/etc` folder, edit the "profile" file by adding the following lines just before the "export" section (`export PATH USER ...`):



```
PATH=/usr/local/maven-2.0.7/bin:$PATH
export JAVA_HOME=/usr/local/java/jdk1.5.0_14/
export JRE_HOME=/usr/local/java/jdk1.5.0_14/jre/
export MAVEN_HOME=/usr/local/maven-2.0.7/
export ANT_HOME=/usr/local/apache-ant-1.7.0/
export LD_LIBRARY_PATH=/usr/local/lib
```

4.4 – JAI

Go to <https://jai.dev.java.net/binary-builds.html> and select the daily builds link. Then, download the proper Linux version. After you downloaded it, extract the content of the lib folder on your `JAVA_HOME/lib` folder as well as on your `JAVA_HOME/JRE/lib`. (where `JAVA_HOME` defines your JDK, as an instance, `/usr/java/jdk1.5.0_14`).

4.5 – JAI-ImageIO Toolkit

Go to <https://jai-imageio.dev.java.net/binary-builds.html> and select the daily builds link. Then, download the proper Linux version. After you downloaded it, extract the content of the lib folder on your `JAVA_HOME/lib` folder and on your `JAVA_HOME/JRE/lib`. (where `JAVA_HOME` defines your JDK, as an instance, `/usr/java/jdk1.5.0_14`).

4.6 – SWIG

Be sure you have properly downloaded SWIG, the Simplified Wrapper and Interface Generator which allow to produce JAVA bindings for C/C++ code. You can obtain it by simply running:

```
yum update swig
```

4.6.1 – Manual SWIG installation

In case `yum` is not supported by your distribution, just download swig from:
<http://mesh.dl.sourceforge.net/sourceforge/swig/swig-1.3.32.tar.gz>.

Unzip this somewhere on your hard disk and then run:

```
./configure
```

```
make
```

```
sudo make install
```

 (As you may notice, this command requires administrator privileges)

4.7 – GDAL

This is one of the most important sections. GDAL is the Geospatial Data Abstraction Layer which provide data access to several data formats. Image I/O Ext deeply leverages on this complex library which need to be properly configured.



4.7.1 – GDAL requirements

Depending on the format you wish to support, you need to properly download and setup several libraries prior to build GDAL. The following instructions describe how to achieve this for these formats:

- Kakadu (v. 5.2.6)
- MrSID (v 6.0.7)
- ECW (v 3.3)

4.7.1.1 – Kakadu

Supposing you have your own Kakadu licensed source code, go in the main kakadu folder (as an instance on `usr/local/kakadu`).

Enter in `coresys/make` and modify the `Makefile-Linux-x86-gcc` file as follow:

Enable the static build by setting `KDU_GLIBS = -static -static-libgcc`

Then run make: `make -f Makefile-Linux-x86-gcc`

This will generate libs in `kakadu/lib/Linux-x86-gcc`.

From the `kakadu` folder, run: `sudo cp lib/Linux-x86-gcc/* /usr/local/lib`

After this, enter in `apps/make` and modify the `Makefile-Linux-x86-gcc` file as follow:

Enable the static build by setting `KDU_GLIBS = -static -static-libgcc`

Set `LIB_SRC` as follow: `LIB_SRC=$(LIB_DIR)/libkdu.a`

Run make: `make -f Makefile-Linux-x86-gcc`

Then, run `sudo ldconfig`

The following additional step is not required by GDAL but it is needed by an ImageIO-Ext plugin which directly leverages on the Kakadu Library.

Enter in `managed/make` and modify the `Makefile-Linux-x86-gcc` file. You will notice the presence of a `INCLUDES += -I../all_includes` row. In top of this, add the following additional setting:

`INCLUDES += -I$(JAVA_HOME)/include -I$(JAVA_HOME)/include/linux`

Run make: `make -f Makefile-Linux-x86-gcc`

Then, from the `kakadu` folder, run: `sudo cp /lib/Linux-x86-gcc/libkdu_jni.so /usr/local/lib`

Finally, run `sudo ldconfig`

4.7.1.2 – MrSID

As a first requirement, you need the LizardTech Decoding Software Development Kit (DSDK). You can download it free of charge from this site: <http://developer.lizardtech.com> (You need to be registered in order to download it). After logged in, select “Download” -> “Software Development Kits” -> “Download SDK’s”. Select the proper version of SDK to be downloaded (select the **GeoExpress SDK for Linux (x86) - gcc 3.4**)



4.7.1.3 – ECW

Download the Image Compression SDK (source code) from ER Mapper site at this address:

<http://www.ermapper.com> (You need to be registered in order to download it).

From the main site, select the menu “*products & downloads*” -> “*Image Compression SDK*” from the *Desktop* section. Download the *Image Compression SDK Source Code 3.3* file and extract this somewhere on your hard disk, as an instance on `/home/geosolutionsuser/libs/libecwj2`

From the command line, just enter this folder and simply run:

```
./configure
```

```
make
```

```
sudo make install
```

 (As you may notice, this command requires administrator privileges)

The last command will copy all the libs in the `usr/local/lib` folder. By this way, when configuring GDAL (as explained in the next chapter) it will automatically setup the build to support the ECW format.

4.7.2 – GDAL Configuration

Firstly, you need to download GDAL 1.4.2 from OSGeo SVN. Enter the folder where you want to download GDAL and run: `svn co http://svn.osgeo.org/gdal/tags/1.4.2/gdal gdal`

Then, you need to apply the patch available at this location:

<https://imageio-ext.dev.java.net/svn/imageio-ext/trunk/patches/1.4.2GDAL.patch>

This patch contains several changes for:

- Kakadu support: Multithreading added; More Kakadu options supported. Makefile modified
- Java bindings: improved data access (read Dataset at once instead of read RasterBands at once; PixelSpace, LineSpace and BandSpace parameters now are allowed)

To apply the patch, enter in the GDAL main folder and run:

```
patch -p0 -f -i PATH_TO_DOWNLOADED_PATCH/1.4.2GDAL.patch
```

(where `PATH_TO_DOWNLOADED_PATCH` represents the location where you downloaded the patch, as an instance, `/home/me/Desktop/`)

Be sure you properly set the `GDAL_DATA` environment variable. This need to be set with your `GDAL/DATA` location in order to properly evaluate EPSG codes. As an instance, supposing you installed GDAL on `/home/geosolutionsuser/gdal/1.4.2`, you can use the following command:

```
export GDAL_DATA=/home/geosolutionsuser/gdal/1.4.2/data/
```

Next step is configuring GDAL by means of the `./configure` command. Such a command allows to specify several options to enable formats, change build properties, customize libraries and much more. Depending on the required formats you wish to enable on GDAL, you need to add some options to this command as explained in the following sections.



4.7.2.1 – Kakadu configuration option

Add `--with-kakadu=KAKADU_FOLDER --without-libtool` option to the `./configure` command, where `KAKADU_FOLDER` represents the path where your Kakadu library is located. Building Kakadu using libtool cause several problems. Disabling libtool with the `--without-libtool` additional option will solve the problem (<http://trac.osgeo.org/gdal/ticket/1460>).

Check the `GDAL/frmts/jp2kak/GNUMakefile` file is properly set.

Probably, you should add `$(KAKDIR)/apps/make/kdu_stripe_decompressor.o` to the `APPOBJ` setting as well as `-I$(KAKDIR)/apps/support` to `KAKINC` setting.

4.7.2.2 – MrSID configuration option

Add `--with-mrsid=MRSID_FOLDER` option to the `./configure` command, where `MRSID_FOLDER` represents the path where you previously downloaded GeoDSK.

Note: During the future build process (4.7.3) a similar error could occur:

```
/...../include/base/lti_sceneBuffer.h:356:  
error: extra qualification 'LizardTech::LTISceneBuffer::' on member
```

You need to fix the issue in the header `MRSID_FOLDER/include/base/lti_sceneBuffer.h` by simply removing the extra qualification from the `inWindow` declaration. Line 356 should look

like this: `bool inWindow(lt_uint32 x, lt_uint32 y) const;`

Then repeat build process as suggested in 4.7.3.

4.7.3 – GDAL Building

Finally, you are ready to build GDAL. Supposing you properly configured it as explained in section 4.7.2, run the following commands:

```
make clean
```

```
make
```

```
sudo make install
```

 (As you may notice, this command requires administrator privileges)

When the build is terminated, run `sudo ldconfig`.

Next step is generating JAVA bindings.

4.7.4 – Generating JAVA Bindings

SWIG will generate java bindings for you.

As a first step, check your `GDAL/SWIG/JAVA/java.opt` is properly configured.

Basically, you need to check the `JAVA_HOME`, `JAVA_INCLUDE` and `ANT_HOME` variables are properly set. Be sure the following line exists: `JAVA_INCLUDE=-I$(JAVA_HOME)/include -I$(JAVA_HOME)/include/linux)`

A second step is required in order to customize the compiler options (This is needed to change default optimizations settings, which may cause JVM crashes). Just define a `CXXFLAGS` as shown below:



`export CXXFLAGS=-O1` (Note that the minus sign ("-") is followed by the "O" letter instead of the "zero" digit)

Then, enter in your main GDAL folder and run:

```
cd swig
cd java
make clean
make generate
make build
```

This command will automatically generate wrappers and bindings. Then, copy the generated libs in `/usr/local/lib` using the command:

```
sudo cp *.so /usr/local/lib
```

 (As you may notice, this command requires administrator privileges)

Finally, run `sudo ldconfig`.

4.8 – ImageI/O-EXT Project

You need to download the **imageio-ext** project from Java.net SVN. Enter the folder where you want to download ImageI/O-EXT and run:

```
svn co https://imageio-ext.dev.java.net/svn/imageio-ext/trunk imageio-ext --
username MYUSERNAME
```

(Note: MYUSERNAME need to be replaced with your own username)

4.8.1 – Libraries deployment instructions (Optional) - [deploylibs] profile

In case you skipped the manual building process introduced in the previous sections, you should leverage on the libraries contained in the deploy module although this approach is not recommended.

To deploy available libraries, specify the *deploylibs* profile with the `-Pdeploylibs` option when building the project (as explained in 4.8.2).

NOTE that when using this profile, you will be asked for superuser privileges and the installation process will wait you for the password.

4.8.2 – ImageI/O-Ext Project building

To build the ImageI/O-Ext project, enter in `imageio-ext\trunk\` and run:

```
mvn install -Plinux
```

 (or `-Plinux,deploylibs` depending on what is your need, with reference to chapter 4.8.1). This command will build and test all required modules and plugins and store the produced JARS in the local maven repository.

In case you need to do a fast build of the ImageI/O-Ext project, without tests, just add the `-Dmaven.test.skip` option to the previous `mvn` command.

Testing and debugging the ImageI/O-Ext project may be done with Eclipse. Maven allows to build ready-to-use Eclipse projects by setting the required dependencies of each project.



4.8.3 – ECLIPSE settings

First of all, you may download Eclipse from this site: <http://www.eclipse.org/downloads/>

From the “Eclipse IDE for Java Developers” section, click on the Linux link located in the right side.

When you downloaded it and extracted on your hard disk, you may setup Imagel/O-Ext eclipse projects for future debugging and tests.

Enter in your `imageio-ext/trunk/library` folder and run: `mvn eclipse:eclipse` (this will build ready-to-use projects containing the main framework).

Finally, if you are interested in building eclipse projects for all the available Imagel/O-Ext plugins, you should enter in your `imageio-ext/trunk/plugin` folder and run again `mvn eclipse:eclipse`

Alternatively, if you are interested in a single plugin, you may enter in the proper subfolder, as an instance, `imageio-ext/trunk/plugin/gdalkakadu2` and run the same command.

At this point, you should be ready to run eclipse and import the just produced projects from eclipse as follow. From the main *File* menu:

File->“*Import*”->“*General*”->“*Existing Projects into Workspace*”-> and select the root directory where you previously downloaded the whole Imagel/O-Ext project.

When ready, the “*Projects:*” window should contain all the projects previously built with “`mvn eclipse:eclipse`”. Select the ones you are interested in and go on.

These projects need several dependencies (as an instance, `gdalframework.jar`, `junit` and some others) which are contained in the maven repository.

Be sure you properly set the `M2_REPO` variable as explained here below:

Open the properties of one of your just imported projects and select “*Java Build Path*” entry in the left column. Then go to the “*Libraries*” Tab and check if your `M2_REPO` variable has been defined. To define it, click on “*Add Variable*”->“*Configure Variables...*”->“*New...*” Set “`M2_REPO`” as Name and a proper location as Path... usually, the maven repo is located on `/home/geosolutionsuser/.m2/repository`.

You should be almost ready to run/debug some test classes.

Select a test class from `src/test/java` of a plugin project and select *Run As*->*Open Run Dialog*. Then select the “*Environment*” tab and check whether the `LD_LIBRARY_PATH` has been properly specified. If such a variable is not yet set, just add it using the “*Select...*” button. Be sure it also contains the `/usr/local/lib/` path. If missing, simply add it using the “*Edit...*” button, and append the `:/usr/local/lib/` string to the value of such a variable.

Now, you should be ready to tests Imagel/O-Ext plugins.

Note that to reduce building time with maven, all tests does not display image loaded. If you want to display the images in the available tests, just specify a proper JVM argument for the test run.

Select a test class and select *Run As* -> *Run...* . Then go in the *Arguments* TAB and add the following line in the “*VM arguments:*” box:

```
-Dorg.geotools.test.interactive=true
```



4.8.4 – Testing ImageI/O-Ext modules with Maven.

In case you simply need testing some ImageI/O-Ext modules without using eclipse, as an instance in order to check if everything is working fine, you can enter in the module you are interested in and run the maven test. As an instance:

```
imageio-ext/trunk/plugin>cd plugin/gdalarcgrid  
imageio-ext/trunk/plugin/gdalarcgrid>mvn test
```

Lastly, if you want to perform interactive tests (which usually display data read on a windows), you should use the `interactive.tests` profile like this:

```
imageio-ext/trunk/plugin/gdalarcgrid>mvn test -Pinteractive.tests
```

Anyway, displaying the image is a non blocking/waiting operation so you will see the image just for a brief instant (when displayed, it will be automatically closed. Future versions may include a property to customize “waiting time” before close).

4.8.4.1 – Testing JPEG2000 Kakadu (GDAL) writer capabilities

The JPEG2000 Kakadu (GDAL based) plugin contains a suite for testing writing capabilities. As default, the test performs a set of of write operations with different write parameters leveraging on the available create options / Kakadu customizations. When the test is terminated, all the written files are automatically deleted. In case you would like to maintain the produced files, avoiding delete, you should use the profile `tests.holdwrittenfiles` when running test, using the following command:

```
imageio-ext/trunk/plugin/gdalkakadujp2>mvn test -Ptests.holdwrittenfiles
```

