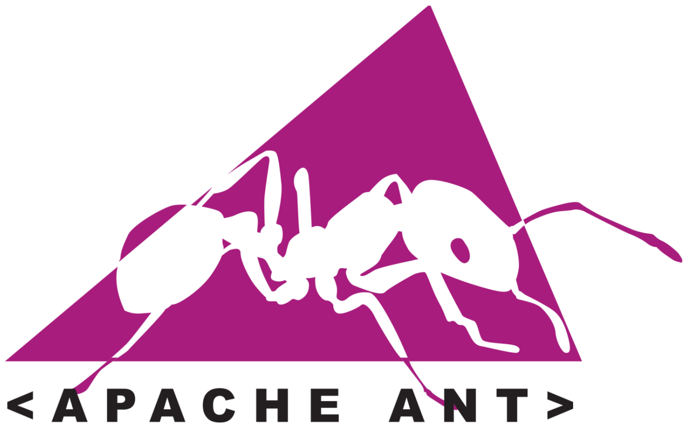
ECSE 321 - Tutorial 9

Jars, Ant, and Javadocs



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A Motivating Problem

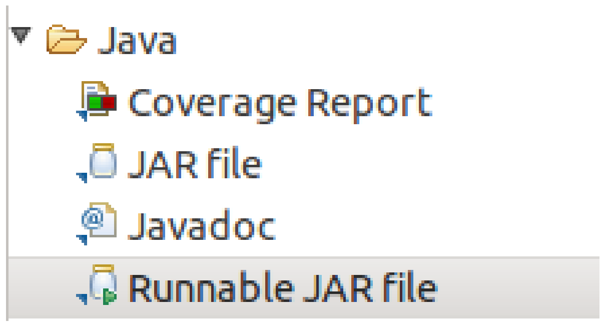
- Suppose you want to show a friend your game - how do you send your Java project to them? Do you zip it?
- What if they don't know how to use Eclipe?
- What if they don't know how to unzip?
- What if they don't know what Java is?
- Ideally, we want to package our project into one file that your friend can just double click to run!

Enter Jar Files

- A Jar file lets you bundle up your entire Java project in one executable file!
- This is kind of like an .exe file on Windows!
- Internally, it's basically like a zip file... except that you can run it!

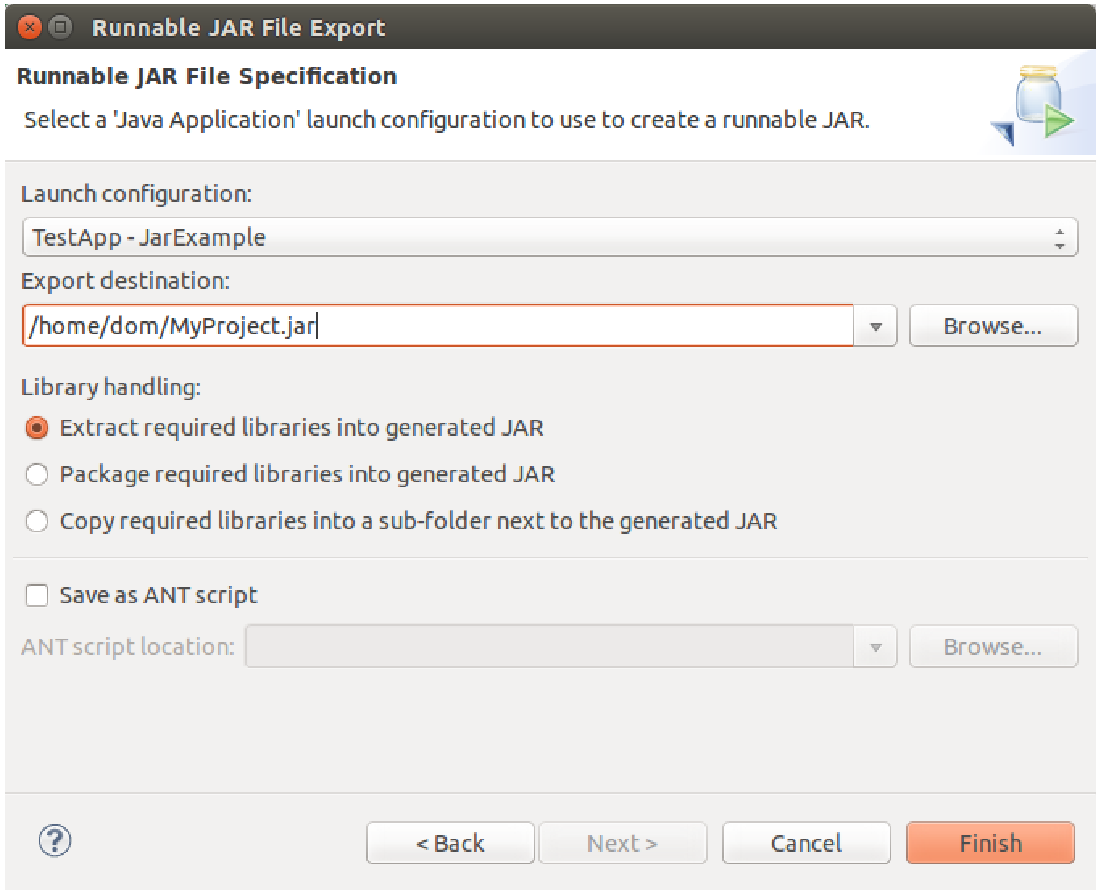
Easy as 1, ...

Step 1. From Eclipse: go to the **File** menu and hit **Export**. Select **Runnable Jar File**



…, 2, …

- Select the Run configuration for your project (should be the name of the class with your main)
- Select the destination where the Jar file will go.


Runnable JAR File Export

Runnable JAR File Specification

Select a 'Java Application' launch configuration to use to create a runnable JAR.

Launch configuration: TestApp - JarExample

Export destination: /home/dom/MyProject.jar

Library handling:

- [✓ Extract required libraries into generated JAR]
- Package required libraries into generated JAR
- Copy required libraries into a sub-folder next to the generated JAR

☐ Save as ANT script

ANT script location:

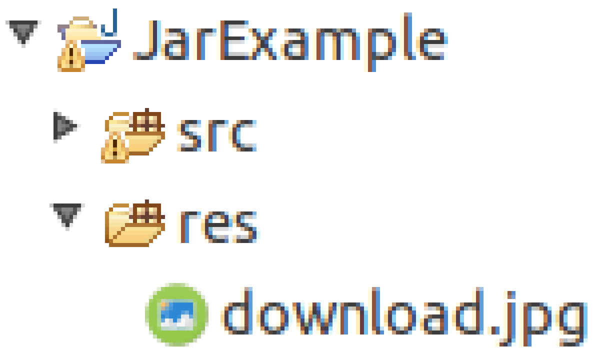
..., 3!

Hit the **Finish** button!

You might get a message about repacking referenced libraries... don't worry about that for now!

Unfortunately...

- There is one extra step! :(
- When a Jar file is built, it may do some re-organizing.
- If you have project resources (eg. game images), you have to do some things differently...
- First, create a **source folder** called **res** in Eclipse at the same level as **src** and put your resources there:



Accessing our Resources

- Now, whenever you want to refer to a resource, instead of just passing the file name you need to build a URL object like this:

```
MyClassName.class.getResource("/download.jpg")
```

- Note that we have to give a class as the first value!
- Also note that we start our path by a slash! This means it is at the root of the classpath. You need to put **/** and not **/res**.

Note about libraries

- Ideally your libraries should be in a folder called **lib**.
- Most libraries come in a **Jar** file as well - remember that a **Jar** is basically like a zip file!
- Try to leave "*Extract required libraries into generated Jar*" as checked - this will make sure you don't have any class path issues when running a Jar file.

Stop - Demo Time!

<APACHE ANT>

http://ant.apache.org/

What is Ant?

- Ant is a command line tool which lets you do all sorts of magical things with your project!
- Kind of like **Makefiles**
- We can create a bunch of tasks associated with our project, such as **building (creating a Jar)**, **cleaning**, **uploading to a remote server**, **pushing to git**, all sorts of things!

Installing Ant

You can download Ant from here:

http://ant.apache.org/bindownload.cgi

For Linux users:

```
sudo apt-get install ant
```

Ant Basics

- To use Ant, your project should have a **build.xml** file which will describe all the available tasks.
- To run a specific task, you do:

```
ant taskName
```

- If you don't specify a task name, it will use the default task specified by the project.

Hello, world!

Here we will create a build.xml file with one task (**hello-world**) which is the default task. When invoke, it simply prints out "Hello, world!"

```
<project name="MyProject" default="hello-world" basedir=".">
        <target name="hello-world">
                <echo>Hello, world!</echo>
        </target>
</project>
```

```
$ ant hello-world

Buildfile: /home/dom/Coding/Workspace/AntJarExample/build.xml

hello-world:
     [echo] Hello, world!

BUILD SUCCESSFUL
Total time: 0 seconds
```

Ant Targets

- A **target** in Ant is essentially a **task**!
- It has a name! It can also have dependencies, which are tasks that will be run before this one is run.
  - For example, if you have a build task that has clean and init as a dependency, running build will cause clean and init to run first!
- A target has a list of steps! A step can be removing a file, executing a command, printing to the screen... all sorts of things!
  - For a list of built-in tasks: http://ant.apache.org/manual/tasklist.html

Ant Variables

- Ant lets you create variables which you can then use in your tasks!
- This can be useful for the name of folders! If you put them in a variable, then you can change **bin** to **build** or **src** to **source** and you only need to change the variable!

```
<property name="src" location="src"/>
<property name="build" location="bin"/>
<property name="dist"  location="dist"/>
```

Example Project

- We're going to be making a build file for a project: https://github.com/dominiccharleyroy/antjarexample
- We want the following tasks:
    - One for cleaning up!
    - One for compiling our Java files to .class files
    - One for building a Jar file

Our project structure

- Our project will have the following folders:
  - src/ for holding source code.
  - res/ for resources
  - lib/ for external libraries
  - bin/ for compiled Java files (.class files)
  - dist/ for our final Jar file

Our Clean task

Our clean task should simply delete the bin and dist folders.

```xml
<project name="MyProject" default="compile" basedir=".">
        <property name="src" location="src"/>
        <property name="lib" location="lib"/>
        <property name="res" location="res"/>
        <property name="build" location="bin"/>
        <property name="dist"  location="dist"/>

        <target name="clean">
                <!--
                        Delete our directories.
                -->
                <delete dir="${build}"/>
                <delete dir="${dist}"/>
        </target>
        ...
</project>
```

Our Compile Task

This compiles all of our files in the source folder and puts them as .class files in the bin folder. Note that it cleans first!

```xml
<target name="compile" depends="clean">
        <!-- Create the build directory. -->
        <mkdir dir="${build}"/>
        <!--
                Compile all of the source files.
                Make sure to include libraries.
        -->
        <javac srcdir="${src}" destdir="${build}">
                <classpath>
                        <fileset dir="${lib}">
                                <include name="**/*.jar"/>
                        </fileset>
                </classpath>
        </javac>
        <!-- Copy our resources. -->
        <copy todir="${build}">
            <fileset dir="${res}"/>
        </copy>
</target>
```

Our Jar Task

This creates the Jar file and puts it in the dist folder!

Note: This can be automatically generated from Eclipse in the Export to Runnable Jar screen.

```xml
<target name="jar" depends="compile">
        <!-- Create our dist folder. -->
        <mkdir dir="${dist}"/>
        <!-- Create the jar file as build.jar -->
        <jar destfile="${dist}/build.jar" filesetmanifest="mergewithoutmain">
                <!-- Specify the class which has the main method. -->
                <manifest>
                        <attribute name="Main-Class" value="TestApp"/>
                        <attribute name="Class-Path" value="."/>
                </manifest>
                <!-- Add in our compiled files. -->
                <fileset dir="${build}"/>
                <!-- Add in our libraries. -->
                <zipgroupfileset dir="${lib}" includes="**/*.jar"/>
        </jar>
</target>
```

Example Run

```
$ ant jar

Buildfile: /home/dom/Coding/Workspace/AntJarExample/build.xml

clean:
   [delete] Deleting directory /home/dom/Coding/Workspace/AntJarExample/bin
   [delete] Deleting directory /home/dom/Coding/Workspace/AntJarExample/dist

compile:
    [mkdir] Created dir: /home/dom/Coding/Workspace/AntJarExample/bin
    [javac] Compiling 2 source files to /home/dom/Coding/Workspace/AntJarExample/bin
     [copy] Copying 1 file to /home/dom/Coding/Workspace/AntJarExample/bin

jar:
    [mkdir] Created dir: /home/dom/Coding/Workspace/AntJarExample/dist
      [jar] Building jar: /home/dom/Coding/Workspace/AntJarExample/dist/build.jar

BUILD SUCCESSFUL
Total time: 1 second
```

Eclipse and Ant

- You can run Ant targets from within Eclipse!
- Right click your build.xml and select **Run As > Ant Build** to run the default task.
- Right click your build.xml and select **Run As > Ant Build...** to select a different task to run.

Javadoc

- Javadoc is a documentation feature of Java!
- You can run certain tools to generate a nice, human-readable form of the Javadocs of a project.
- Example: https://docs.oracle.com/javase/7/docs/api/overview-summary.html

Generating Javadoc with Ant

We can create an Ant target to generate the HTML version of our Javadoc! This will put our HTML files in the **doc** folder.

Just make sure to add the right line to clean.

```
<property name="doc"  location="doc"/>
...
<target name="doc" depends="clean">
        <!-- Create the doc directory. -->
        <mkdir dir="${doc}"/>
        <!-- Generate the Javadoc. -->
        <javadoc sourcepath="${src}" destdir="${doc}"/>
</target>
```

Want More?

- Apache Ant Manual: http://ant.apache.org/manual/
- Rami's ECSE 321 Ant tutorial: https://github.com/sayar/talks (under ECSE321/Tutorial 9)
- Ant and Eclipse: http://help.eclipse.org/luna/index.jsp?topic=%2Forg.eclipse.platform.doc.user%2FgettingStarted%2Fqs-93_project_builder.htm