Task Dependencies: ant

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Contents

ant

ant is a build manager based upon a task dependency graph expressed in an XML file

- **ant** devised by James Davidson of Sun, contributed to Apache project (along with what would eventually become TomCat), released in 2000
- Quickly became a standard tool for Java projects
  - slower to move into other arenas

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What's Wrong with make?

ant is actually an acronym for Another Neat Tool.
But why do we need "another" tool for build management?

- **make** works by issuing command to **/bin/sh**
  - That's not portable.
- The commands that people write into their makefile rules are generally not portable either:
  - Commands themselves are system-dependent (e.g., **mkdir**, **cp**, **chmod**
  - Paths are system-dependent (`/` versus `\`, legtal characters, quoting rules)
  - Path lists are system-dependent (`:` versus `;`)

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Other Criticisms

- Some feel that **make** is too low-level with tis focus on individual files
  - Some will feel that **ant** is too high-level
  - But this is the apparent rationale for moving the focus from file dependencies to task dependencies.
- The `makefile` syntax is arcane and hard to work with.
  - And XML syntax isn't?

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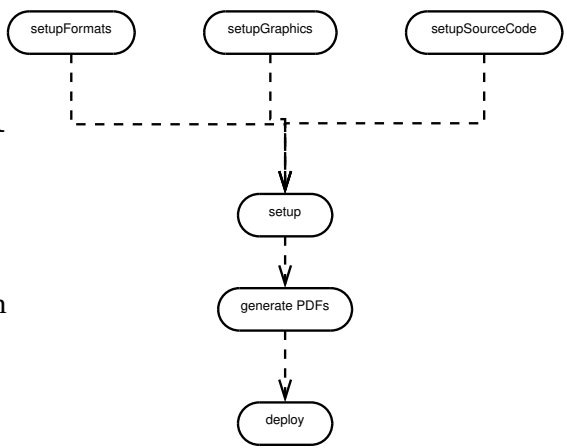
1 The ant Command

ant



- **ant** looks for its instructions in a file named, by default, `build.xml`
- The **ant** command can name any target to be built, e.g.,

```
ant setup
```

- If no target is given, **ant** builds a target explicitly listed in `build.xml` as a default for the project.

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ant Options

Some useful options:

-k, -keep-going "Keep going." Don't stop the build at the first failue, but continue building any required targets that do not depend on the one whose construction has failed.

-f *filename* Use *filename* instead of the default `build.xml`. Also `-file` or `-buildfile`

-D*property*=*value* Sets a property (similar to **make**'s variables)

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2 Build Files

Build Files

The commandant build file is an XML file.

- The build file describes a project.
  - The project has a name and a default target.

```
<project name="382Website" default="deploy">
    <description>
       Extract Metadata Extractor - top level
    </description>
  ⋮
</project>
```

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2.1 Targets

Targets

At its heart, a build file is a collection of *targets*.

- A target is an XML element and, as attributes, has a name and, optionally,
  - a list of dependencies
  - a condition
  - a human-readable description
- The target can contain multiple *tasks*, which contain the actual "commands" to get things done.

ant targets correspond, roughly, to **make**'s "artificial targets".

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Example of Targets

```
<project name="JavaBuild" default="deploy"> ❶
  <description>
    Example of a simple project build
  </description>

  <target name="compile" description="Compile src/.../*.java into bin/"> ❷
    <mkdir dir="bin" />                    ❸
    <javac srcdir="src" destdir="bin"
       debug="true" includeantruntime="false"/>
    <echo>compiled </echo>
  </target>
```

```
  <target name="unittest" depends="compile" unless="test.skip"> ❹
    <mkdir dir="test-reports" />
    <junit printsummary="on" haltonfailure="true"
       fork="true" forkmode="perTest">
      <formatter type="plain" />
      <batchtest todir="test-reports">
    <fileset dir="bin">
      <include name="**/Test*.class" />
      <exclude name="**/Test*$*.class" />
    </fileset>
      </batchtest>
    </junit>
  </target>

  <target name="deploy" depends="unittest" description="Create project's Jar file">
    <jar destfile="myProject.jar">
      <fileset dir="bin"/>
    </jar>
  </target>
</project>
```

❶ The project has a name and default target

❷ A basic target. It is named "compile" and has a description (which may be picked up by some IDEs)

❸ This target has 3 tasks. It creates a directory, compiles Java source code, and prints a message when completed.

- The fact that the tag names resemble familiar commands is intended as self-documentation, but is not otherwise significant.
- The tag names actually map to Java class names that implement the task.

❹ This target illustrates both a dependency and a condition.

The tasks within this target would not be executed if I invoked **ant** like this:

```
ant -Dtest.skip=1
```

However, the `unittest` task would still be considered to have succeeded, in the sense that tasks that depend on it would be allowed to run.

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Task versus File Dependencies

ant targets correspond, roughly, to **make**'s "artificial targets".

So this build file

```
<project name="JavaBuild" default="deploy"> ❶
  <description>
    Example of a simple project build
  </description>

  <target name="compile" description="Compile src/.../*.java into bin/"> ❷
    <mkdir dir="bin" />                    ❸
    <javac srcdir="src" destdir="bin"
       debug="true" includeantruntime="false"/>
```


```
    <echo>compiled </echo>
  </target>

  <target name="unittest" depends="compile" unless="test.skip"> ❹
    <mkdir dir="test-reports" />
    <junit printsummary="on" haltonfailure="true"
       fork="true" forkmode="perTest">
      <formatter type="plain" />
      <batchtest todir="test-reports">
    <fileset dir="bin">
      <include name="**/Test*.class" />
      <exclude name="**/Test*$*.class" />
    </fileset>
      </batchtest>
    </junit>
  </target>

  <target name="deploy" depends="unittest" description="Create project's Jar file">
    <jar destfile="myProject.jar">
      <fileset dir="bin"/>
    </jar>
  </target>
</project>
```

is roughly equivalent to this makefile

```
JAVAFILESsrc=$(shell find src/ -name '*.java')
JAVAFILES=$(JAVAFILESsrc:src/%=%)
```


```
CLASSFILES=$(JAVAFILES:%.java=%.class)
TESTFILES=$(shell find src/ -name 'Test*.java')
TESTS=$(TESTFILES:src/%.java=%)

deploy: unittest
    cd bin; jar cvf myProject.jar `find . -name '*.class'`

unittest: build
    cd bin; for test in $(TESTS); do
       java $$test;
    done
build:
    cd src; javac -d ../bin -g $(JAVAFILES)
```

though a "real" makefile author would probably write this:

```
JAVAFILESsrc=$(shell find src/ -name '*.java')
JAVAFILES=$(JAVAFILESsrc:src/%=%)
CLASSFILES=$(JAVAFILES:%.java=%.class)
TESTFILES=$(shell find src/ -name 'Test*.java')
TESTS=$(TESTFILES:src/%.java=%)

deploy: myProject.jar
unittest: testReport.txt
build: $(CLASSFILES)

myProject.jar: testReport.txt $(CLASSFILES)
    cd bin; jar cvf myProject.jar `find . -name '*.class'`
```


```
testReport.txt: $(CLASSFILES)
    -rm testReport.txt
    cd bin; for test in $(TESTS); do
       java $$test >> testReport.txt;
    done


bin/%.class: src/%.java
    cd src; javac -d ../bin -g $*.java
```

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Make Efficiency

If we do

```
make
make
```

The second command does not actually perform any steps.

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Ant Efficiency

What happens if we do

```
ant
ant -Dskip.test=1
```

- Each of the tasks *is* executed, but

  - The `javac` task knows not to re-compile Java files with up-to-date class files
  - The `javac` task knows not to update Jar files that are newer than all of the files being added.

- So some level of incremental behavior gets built into many of the individual tasks.
- If we remove the `-Dskip.test=1`, however, the tests will be re-run.

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2.2 Properties

Properties

Properties are named string values.

- Can be set from the command line or via a `<property` and a few other tasks
- Accessed as `${`*`propertyName`*`}`
- Properties are immutable: once set, attempts to re-assign their values are ignored
- By convention, properties names are grouped into faux hierarchies with '.'
  - e.g., `compile.src`, `compile.dest`, `compile.options`

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The `<property` Task

Two basic modes:

- `<property name="compile.options" value="-g -O1"/>`

  Sets this property to "-g -O1"

- `<property name="compile.src" location="src/main/java"/>`

  Sets this property to the *absolute path* to the directory/file named.

- The / and \ characters are changed as necessary to conform to the OS on which **ant** is being run

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Additional `<property` Variants

- `<property file="project.default.properties"/>`

  Loads property values from a file, written as a series of *property*=*value* lines

```
courseName=CS795
baseurl=https://secweb.cs.odu.edu/~zeil/cs795SD/s13
homeurl=https://secweb.cs.odu.edu/~zeil/cs795SD/s13/Directory/topics.html
email=zeil@cs.odu.edu
```

- `<property environment="env"/>`

  Copies the OS environment variables into the build state, prefaced by the indicated prefix

  - e.g., `${env.PATH}`

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2.3 File Sets and Lists

File Sets and Lists

- A file set is a collection of existing files

  - can be specified using wild cards

- A file list is a collection of files that may or may not exist
  - Must be specified explicitly without wild cards

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File Sets

```
<fileset file="src/main.cpp"/>
<fileset dir="src"
    includes="main.cpp utility.h utility.cpp"/>
<fileset dir="src" includes="*.cpp,*.h"/>
```

- More commonly seen as a nested form

```
<fileset id="unitTests" dir="bin">
   <include name="**/Test*.class"/>
   <exclude name="**/*$*.class"/>
</fileset>
```

- The `id` in the prior example allows later references:

```
<fileset refid="unitTests"/>
```

.....

File Lists

```
<filelist dir="src"
    files="main.cpp utilities.h utilities.cpp"/>
```

- Can also use `id` or `refid` attributes

.....

Mappers

- Allow for a transformation of file names
- Some commands use a file set to describe inputs, then a mapper to describe outputs

  ```
  <listset dir="src" includes="*.cpp"/>
  <globmapper from="*.cpp" to="*.o"/>
  ```

  would map each file in `src/*.cpp` to a corresponding `.o` file

  ```
  <listset dir="bin" includes="**/Test*.java"/>
  <packagemapper from="*.class" to="*"/>
  ```

  would map a compiled unit test file `project/package/TestADT.class` to `project.package.TestADT`

- There are several other mappers as well

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Selectors

Selectors provide more options for selecting file than simple include/exclude based on the names.

```
<fileset id="unitTestSrc" dir="src">
   <include name="**/Test*.java"/>
   <contains text="@Test" casesensitive="no"/>
</fileset>
```

(Our previous examples assumed that unit tests woule be identified by file name. Here we look instead for the JUnit4 @Test annotation.)

- Other selectors replicate several of the tests from the classic Unix **find** command

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2.4 Path Sets

Path Sets

Used to specify a sequence of paths, usually to be searched.

```
<classpath>
    <pathelement path="${env.CLASSPATH}"/>
    <fileset dir="target/classes">
       <include name="**/*.class"/>
    </fileset>
    <filelist refid="third-party_jars"/>
</classpath>
```

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Referencing Path Sets

- For reason unclear to me, you cannot name classpaths and re-use them directly, but must do it this way

```
<path name="test.compile.classpath">
    <pathelement path="${env.CLASSPATH}"/>
    <fileset dir="target/classes">
       <include name="**/*.class"/>
    </fileset>
    <filelist refid="third-party_jars"/>
</path>
   ⋮
<classpath refid="test.compile.classpath"/>
```

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2.5 Filters

Filters

Filters are used to modify the outputs of some commands by performing various substitutions:

```
<copy file="../../templates/@{format}.tex"
      tofile="${doc}-@{format}.ltx">
  <filterset>
    <filter token="doc" value="${doc}"/>
    <filter token="relPath" value="${relPath}"/>
    <filter token="format" value="@{format}"/>
  </filterset>
</copy>
```

A filter set replaces tokens like @doc@ by a string, in this case the value of the property `${doc}`

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Filter Chains

Filter chains offer a variety of more powerful options, e.g.,

```
<loadfile property="doctitle" srcfile="${doc}.info.tex">
  <filterchain>
    <linecontains>
      <contains value="\title{"/>
    </linecontains>
    <tokenfilter>
      <replaceregex pattern=" *\\title[{]([^}]*)[}]"
                    replace="\1"/>
    </tokenfilter>
  </filterchain>
</loadfile>
```

- `loadfile` loads an entire file into a property
- The filter extracts the contents of a LaTeX `\title{...}` command

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2.6 Tasks

Tasks

The Ant Manual has a good breakdown on these.

- Consistent with their XML structure, tasks can be parameterized via attributes or nested XML attributes
  - Sometimes you can do the same thing either way.
- Look at:

- File tasks: copy, delete, mkdir, move, fixcrlf, sync
- Compile tasks: javac, depend
- Archive, documentation, testing tasks
- Execution tasks: java, exec, apply

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Extending Ant

- Ant has a built-in macro capability
- More powerful extension is accomplished by adding Java classes, mapped onto task names:

```
<project name="code2html" default="build">

  <taskdef classpath="JFlex.jar"
           classname="JFlex.anttask.JFlexTask"
           name="jflex" />
     ⋮

  <target name="generateSource">
    <mkdir dir="src/main/java"/>
    <jflex file="src/main/jflex/code2html.flex"
           destdir="src/main/java"/>
    <jflex file="src/main/jflex/code2tex.flex"
               destdir="src/main/java"/>
       ⋮
```

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Finding Extensions

- Many Java-oriented tools (e.g. JFlex) come with an ant task as part of the package.
- Other are contributed by users of the tool, (e.g. LaTeX)
- Some general-purpose Ant libraries.

  e.g., antcontrib adds

  - C/C++ compilation
  - If and For-loop
  - outofdate (a make-like file dependency wrapper)
  - enhanced property tasks (e.g., URL encoding)

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3 Case Studies

3.1 Code Annotation

Code Annotation Tool

The steps involved in building this tool are:

1. Run the program **jflex** on each file in `src/main/jflex`, generating a pair of .java files that get placed in `src/main/ja`
2. Compile the Java files in `src/main/java`, placing the results in `target/classes`
3. Compile the Java files in `src/test/java` (using the `target/classes` compilation results, placing the results in `target/test-classes`.

4. Run the JUnit tests in `target/test-classes`.
5. If all tests pass, package the compiled classes in `target/classes` into a .jar file.

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The Code Annotation Tool Build

```
<project name="code2html" default="build">

  <record name="ant.log" action="start" append="false" />    ❶

  <taskdef classpath="JFlex.jar" classname="JFlex.anttask.JFlexTask"
       name="jflex" />                                       ❷

  <echo>loading build-${os.name}.paths</echo>
  <include file="build-${os.name}.paths"/>                   ❸


  <target name="generateSource">                             ❹
    <mkdir dir="src/main/java"/>
    <jflex file="src/main/jflex/code2html.flex"
       destdir="src/main/java"/>
    <jflex file="src/main/jflex/code2tex.flex"
       destdir="src/main/java"/>
    <jflex file="src/main/jflex/list2html.flex"
       destdir="src/main/java"/>
     <jflex file="src/main/jflex/list2tex.flex"
```


```
      destdir="src/main/java"/>
  </target>


  <target name="compile" depends="generateSource">        ❺
    <mkdir dir="target/classes"/>
    <javac srcdir="src/main/java" destdir="target/classes"
       source="1.6" includeantruntime="false"/>
  </target>

  <target name="compile-tests" depends="compile">         ❻
    <mkdir dir="target/test-classes"/>
    <javac srcdir="src/test/java" destdir="target/test-classes"
       source="1.6" includeantruntime="false">
      <classpath refid="testCompilationPath"/>
    </javac>
  </target>

  <target name="test" depends="compile-tests">            ❼
    <mkdir dir="target/test-results/details"/>
    <junit printsummary="yes"
       haltonfailure="yes"
       >
      <formatter type="xml"/>
      <batchtest todir="target/test-results/details">
         <fileset dir="target/test-classes">
            <include name="**/*Test*.class"/>
```


```
        </fileset>
      </batchtest>
      <classpath refid="testExecutionPath"/>
    </junit>
    <junitreport todir="target/test-results">
      <fileset dir="target/test-results/details">
        <include name="TEST-*.xml"/>
      </fileset>
    </junitreport>
  </target>

  <target name="build"  depends="test">                    ❽
    <jar destfile="codeAnnotation.jar" basedir="target/classes">
        <manifest>
     <attribute name="Main-Class"
                value="edu.odu.cs.code2html.Code2HTML"/>
           </manifest>
    </jar>
  </target>

  <target name="clean">                                    ❾
    <delete dir="target"/>
  </target>

</project>
```

This is a fairly “stock” build for a Java project.

Nonetheless, there are multiple steps that would not be handled by typical IDE build managers.

❶ Not all tasks need to be within targets.

Properties are usually not, but this is an example of a more "active" task - it copies the **ant** output into a log file.

❷ Establishes the `<jflex` tag, provided in `JFlex.jar`

❸ Includes an XML file of additional **ant** commands.

– The name of the file loaded includes the operating system name `${os.name}`, so this allows for customization.

```
<project>
    <path id="testCompilationPath">
      <pathelement location="/usr/share/java/junit4.jar"/>
      <pathelement location="/usr/share/java/hamcrest-library.jar"/>
      <pathelement path="target/classes"/>
    </path>

    <path id="testExecutionPath">
      <pathelement location="/usr/share/java/junit4.jar"/>
      <pathelement location="/usr/share/java/hamcrest-library.jar"/>
      <pathelement path="target/classes"/>
      <pathelement path="target/test-classes"/>
    </path>
</project>
```

```
<project>
    <path id="testCompilationPath">
```

```
        <pathelement location="./junit4.jar"/>
        <pathelement location="hamcrest-library.jar"/>
        <pathelement path="target/classes"/>
      </path>

      <path id="testExecutionPath">
        <pathelement location="./junit4.jar"/>
        <pathelement location="hamcrest-library.jar"/>
        <pathelement path="target/classes"/>
        <pathelement path="target/test-classes"/>
      </path>
  </project>
```

- **ant** has various tasks for including other files into a build
  - `loadfile`: loads properties in plain-text form
  - `include`: shown here, loads XML **ant** instructions
  - `import`: Similar to `include`, but `import` allows the imported targets to be overridden by the importer. `include` does not
    The manual page for `import` has a good example showing the difference.

❹ In this target we use the `jflex` tag which was loaded as an extension earlier.

This creates several Java files in `src/main/java`.

❺ All Java source in `src/main/java` is compiled, placing the resulting `.class` files in `target/classes`

- Note the classpath, which was included from our OS-dependent path files.

❻ All Java source in `src/test/java` is compiled, placing the resulting `.class` files in `target/test-classes`

  - The destination directory is distinct to make it easier to later package up the "real" deliverable classes, omitting the test drivers.
  - The classpath here is different, because it must include both the code we have already compiled and the JUnit package.

❼ Run the tests and generate a basic summary report.

❽ Package up the application into a Jar file, selecting one of the 4 executables as the default to be run when the jar file is lauchned by double-clicking or via `java -jar`

❾ A typical clean-up task,

  - Note that this target does not depend on the others. It is intended to be invoked separately.
  - The task is made simpler be keeping the compilation binaries in a separate directory.
  - In larger projects, I might have done the same with the JFlex-generated sources, so that they would be cleaned as well.

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3.2 Projects with Multiple Sub-Projects

Managing Subprojects with ant

Typical key ideas:

- Gather common structures into a build file that can be included or imported by each subproject.
- Create a top-level build file that
  - Performs project-wide initialization

- Distributes common targets to individual subproject builds

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A Top-Level Build

```
<project name="course" default="build">

  <record name="ant.log" action="start" append="false" />

  <!-- Invoke this build file as
      ant
        - to build the desired documents
      ant clean
        - to clean out all generated files

   -->

  <property file="course.properties"/>

  <macrodef name="iterate">                    ❶
    <attribute name="target"/>
    <sequential>
      <subant target="@{target}">
    <fileset dir=".">
      <include name="*/**/build.xml"/>
      <exclude name="templates/**"/>
    </fileset>
```



```
    </subant>
  </sequential>
</macrodef>

<dependset>                                ❷
  <srcfileset file="course.properties"/>
  <targetfileset file="course.info.tex"/>
</dependset>
<available property="course.info.tex.exists" ❸
        file="course.info.tex"/>


<target name="courseSetup" unless="course.info.tex.exists">     ❹
  <copy file="templates/course.info.tex" toFile="course.info.tex">
    <filterset>
  <filtersfile file="course.properties"/>
    </filterset>
  </copy>
  <replace file="course.info.tex" token="~" value="%7E"/>
  <echo file="course.info.tex" append="true">
    % This file is generated automatically from course.properties
  </echo>
  <echo file="course.info.tex" append="true">
    % Do not edit. Any changes are likely to be overwritten.
  </echo>
</target>
```


```
  <target name="emailSetup">
    <copy todir=".">
      <fileset dir='.' file="templates/sendEmail.html"/>
      <filterset>
    <filtersfile file="course.properties"/>
      </filterset>
    </copy>
  </target>

  <target name="setup" depends="courseSetup,emailSetup"      ❺
        description="Prepare all source files prior to running LaTeX"
        >
    <iterate target="setup"/>
  </target>

  <target name="build"  depends="courseSetup,emailSetup"
      description="Generate all documents">            ❻
    <iterate target="build"/>
  </target>

  <target name="zip" depends="build"                    ❼
      description="Generate all documents and prepare a zip file that can be uploaded to and unpa
      >
    <tstamp>
      <format property="today" pattern="yyyy-MM-dd_hh-mm"/>
    </tstamp>
    <zip destfile="${courseName}_${today}.zip" level="9">
```


```
      <fileset dir=".">
    <exclude name="**/*~"/>
    <exclude name="**/*.aux"/>
    <exclude name="**/*.fdb_latexmk"/>
    <exclude name="**/*.fls"/>
    <exclude name="**/*.log"/>
    <exclude name="**/*.out"/>
    <exclude name="**/*.toc"/>
    <exclude name="**/*.nav"/>
    <exclude name="**/*.snm"/>
    <exclude name="**/*.vrb"/>
    <exclude name="**/*.tex"/>
    <exclude name="**/*.ltx"/>
      </fileset>
    </zip>
  </target>

  <target name="deploy" depends="build"                    ❽
      description="Generate all documents and sync with the deployment directory (usually a websi
      >
    <sync todir="${deploymentDestination}"
      includeEmptyDirs="true" granularity="2000">
      <fileset dir=".">
    <exclude name="**/*~"/>
    <exclude name="**/*.aux"/>
    <exclude name="**/*.fdb_latexmk"/>
    <exclude name="**/*.fls"/>
```


```
    <exclude name="**/*.log"/>
    <exclude name="**/*.out"/>
    <exclude name="**/*.toc"/>
    <exclude name="**/*.nav"/>
    <exclude name="**/*.snm"/>
    <exclude name="**/*.vrb"/>
    <exclude name="**/*.tex"/>
    <exclude name="**/*.ltx"/>
      </fileset>
      <preserveintarget>
    <include name="**/.ht*"/>
      </preserveintarget>
    </sync>
  </target>


  <target name="clean">
    <iterate target="clean"/>
  </target>

  <target name="cleaner">
    <iterate target="cleaner"/>
  </target>

  <target name="cleanest">
    <iterate target="cleanest"/>
  </target>
```


```
</project>
```

❶ A macro declaration

- This macro takes a parameter, “target”
- It uses the task `subant` to invoke **ant** recursively on that target (`@target`) for each `build.xml` file that it finds in a subdirectory (at any depth)
  - except for subdirectories of `templates`

❷ This task is used for simulate **make**-like file dependencies. It deletes the target files if any of them are older than any of the source files.

- Still a bit more coarse-grained than **make**

❸ Sets a property to true/false depending on whether a file exists.

- The file is the same one used as the target of the prior `dependset`

❹ Part of the project-wide setup, skipped if the earlier `dependset` decided that the target file was already up-to-date.

❺ The main target for project-wide setup.

❻ The “build” target is issued to individual sub-projects using the earlier macro.

- This is the default target.
- Once we are satisfied with a build, we can issue a new **ant** command to perform either of the next two options.

❼ After all the builds are done, we could build a zip file of the results.

  – The date and time of the build is included in the zip file name.

❽ Or, instead of the zip file, we might sync the results with another directory (a website).

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3.3 Extend or Exec?

Extend or Exec?

As we move further from common Java project structures, the problem arises of how to issue commands for which we have no readily available **ant** task.

- Write our own task as a java class
  - A lot of work, particularly for a one-off
- If the desired command is actually a Java program, use the `java` task to launch it.
  - Can be reasonably portable
  - But some **ant** purists still find this objectionable
- Use the `exec` or `apply` tasks to simply run a command or non-Java program
  - Portability becomes much more of an issue

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Mitigating Factors

Although the community has contributed numerous extension tasks,

- Some have steep learning curves and/or tricky setup
  - e.g., `cc` task from ant-contrib
- Others may be incomplete or buggy

This can drive a project to use `exec`/`apply` even if **tasks** purportedly exist

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Generating Course Website PDFs

Each document is a subproject with a build file like this:

```
<project name="docs" default="build">

  <import file="../../commonBuild.xml"/>

  <target name="makeSources" depends="properties">
    <docformat format="slides"/>
    <docformat format="web"/>
    <docformat format="printable"/>
    <docformat format="10-4x3"/>
    <docformat format="10-16x10"/>
    <docformat format="7-4x3"/>
    <docformat format="7-16x10"/>
  </target>
```



```
</project>
```

The “good stuff” is in the included `commonBuild.xml`

```
<project>

  <condition property="windowsos">
    <os family="windows" />
  </condition>

  <target name="logging" unless="windowsos">
    <record name="ant.log" action="start" append="false" />
  </target>

  <property environment="env"/>

  <basename property="doc" file="${basedir}"/>
  <property name="baseParent" location=".."/>
  <basename property="relPath" file="${baseParent}"/>

  <property file="../../course.properties"/>

  <macrodef name="docformat">
    <attribute name="format"/>
    <sequential>
  <copy file="../../templates/@{format}.tex"
        tofile="${doc}-@{format}.ltx">
```



```
      <filterset>
        <filter token="doc" value="${doc}"/>
        <filter token="relPath" value="${relPath}"/>
        <filter token="format" value="@{format}"/>
      </filterset>
    </copy>
    <replaceregexp file="index.html"
           match ="[.]vis@{format} [{]display:none" replace=".vis@{format} {table-row"/>
    <copy file="${doc}-@{format}.ltx" tofile="${doc}-@{format}.main.tex"/>
      </sequential>
    </macrodef>

    <available property="dblatex-is-installed"
          file="dblatex" filepath="${env.PATH}"/>

    <target name="checkDB" depends="logging" if="dblatex-is-installed">
      <dependset>
    <srcfileset file="${doc}.dbk"/>
    <targetfileset file="${doc}.content.tex"/>
      </dependset>
    </target>

    <target name="checkForContent" depends="checkDB">
      <available property="content.exists" file="${doc}.content.tex"/>
    </target>

    <target name="convertDB" depends="checkForContent" unless="content.exists">
```


```
    <apply executable="dblatex" parallel="false">
  <arg value="--style=simple"/>
  <arg value="--type=tex"/>
  <arg value="--xsl-user=../../templates/dblatex-sjz.xsl"/>
  <fileset file="${doc}.dbk"/>
    </apply>
    <replace file="${doc}.dbk.tex" token="language=cpp" value="language=C++"/>
    <replace file="${doc}.dbk.tex" token="cyrcharcyrie{}" value="$epsilon$"/>
    <apply executable="csplit" parallel="false" addsourcefile="false">
  <arg value="${doc}.dbk.tex"/>
  <arg value="/title/"/>
  <arg value="/^%/"/>
  <arg value="/mainmatter/+1"/>
  <arg value="/end{document}/"/>
  <fileset file="${doc}.dbk.tex"/>
    </apply>
    <move file="xx01" tofile="${doc}.info.tex"/>
    <move file="xx03" tofile="${doc}.content.tex"/>
    <delete>
  <fileset dir="." includes="xx0*"/>
  <fileset file="${doc}.dbk.tex"/>
    </delete>
  </target>



  <target name="makeGraphics" depends="logging,epsGraphics,gifGraphics"/>
```


```
<available property="epstopdf-is-installed"
       file="epstopdf" filepath="${env.PATH}"/>

<target name="epsGraphics" depends="logging,diaGraphics,figGraphics"
    if="epstopdf-is-installed">
  <apply executable="epstopdf" parallel="false">
<fileset dir="." includes="*.eps"/>
<globmapper from="*.eps" to="*.pdf"/>
  </apply>
  <dependset>
<srcfileset dir="." includes="*.eps"/>
<targetfileset dir="." includes="${doc}-*.pdf"/>
  </dependset>
</target>

<available property="dia-is-installed"
       file="dia" filepath="${env.PATH}"/>

<target name="diaGraphics" depends="logging" if="dia-is-installed">
  <apply executable="dia" parallel="false">
<arg value="-t"/>
<arg value="eps-builtin"/>
<fileset dir="." includes="*.dia"/>
<globmapper from="*.dia" to="*.eps"/>
  </apply>
</target>
```


```
    <available property="fig2dev-is-installed"
           file="fig2dev" filepath="${env.PATH}"/>

    <target name="figGraphics" depends="logging" if="fig2dev-is-installed">
      <apply executable="fig2dev" parallel="false">
    <arg value="-L"/>
    <arg value="eps"/>
    <srcfile/>
    <targetfile/>
    <fileset dir="." includes="*.fig"/>
    <globmapper from="*.fig" to="*.eps"/>
      </apply>
    </target>

    <available property="convert-is-installed"
           file="convert" filepath="${env.PATH}"/>

    <uptodate property="gifConversion.notRequired">
      <srcfiles dir= ".">
    <include name="*.gif"/>
      </srcfiles>
      <globmapper from="*.gif" to="*.png"/>
    </uptodate>

    <target name="gifGraphics" depends="logging"
        if="convert-is-installed" unless="gifConversion.notRequired">
```


```
  <apply executable="convert" parallel="false" relative="true">
<srcfile/>
<targetfile/>
<fileset dir="${basedir}" includes="*.gif"/>
<globmapper from="*.gif" to="*.png"/>
  </apply>
</target>

<available property="ext-file-exists"
       file="${doc}.ext.tex" filepath="."/>

<uptodate property="makeSourceCodeHTML.notRequired">
  <srcfiles dir= ".">
<include name="*.h"/>
<include name="*.cpp"/>
<include name="*.java"/>
<include name="*.listing"/>
  </srcfiles>
  <globmapper from="*" to="*.html"/>
</uptodate>
<uptodate property="makeSourceCodeTex.notRequired">
  <srcfiles dir= ".">
<include name="*.h"/>
<include name="*.cpp"/>
<include name="*.java"/>
<include name="*.listing"/>
  </srcfiles>
```


```
    <globmapper from="*" to="*.tex"/>
  </uptodate>

  <target name="makeSourceCodeTex" depends="logging"
      unless="makeSourceCodeTex.notRequired">
    <apply executable="java">
  <arg value="-cp"/>
  <arg value="../../templates/codeAnnotation/codeAnnotation.jar"/>
  <arg value="edu.odu.cs.codeAnnotation.Code2TeX"/>
  <fileset dir=".">
    <include name="**/*.h"/>
    <include name="**/*.cpp"/>
    <include name="**/*.java"/>
  </fileset>
  <globmapper from="*" to="*.tex"/>
    </apply>
    <apply executable="java">
  <arg value="-cp"/>
  <arg value="../../templates/codeAnnotation/codeAnnotation.jar"/>
  <arg value="edu.odu.cs.codeAnnotation.Listing2TeX"/>
  <fileset dir=".">
    <include name="**/*.listing"/>
  </fileset>
  <globmapper from="*" to="*.tex"/>
    </apply>
  </target>
```


```
<target name="makeSourceCodeHTML" depends="logging"
    unless="makeSourceCodeHTML.notRequired">
  <apply executable="java">
<arg value="-cp"/>
<arg value="../../templates/codeAnnotation/codeAnnotation.jar"/>
<arg value="edu.odu.cs.codeAnnotation.Code2HTML"/>
<arg value="-footer"/>
<arg value="&lt;footer/&gt;"/>
<fileset dir=".">
  <include name="**/*.h"/>
  <include name="**/*.cpp"/>
  <include name="**/*.java"/>
</fileset>
<globmapper from="*" to="*.html.xml"/>
  </apply>
  <apply executable="java">
<arg value="-cp"/>
<arg value="../../templates/codeAnnotation/codeAnnotation.jar"/>
<arg value="edu.odu.cs.codeAnnotation.Listing2HTML"/>
<fileset dir=".">
  <include name="**/*.listing"/>
</fileset>
<globmapper from="*" to="*.html.xml"/>
  </apply>
</target>

<target name="makeSourceCode" depends="makeSourceCodeHTML, makeSourceCodeTex"/>
```


```
    <target name="makeExt" unless="ext-file-exists">
      <echo file="${doc}.ext.tex">% External documents referenced from here</echo>
    </target>

    <target name="properties" depends="logging,convertDB">
      <loadfile property="doctitle" srcfile="${doc}.info.tex">
    <filterchain>
      <linecontains>
        <contains value="title{"/>
      </linecontains>
      <tokenfilter>
        <replaceregex pattern=" *title[{]([^}]*)[}]"
       replace="1"/>
      </tokenfilter>
    </filterchain>
      </loadfile>
      <echo file="title.xml">&lt;title doc="${doc}"&gt;${doctitle}&lt;/title&gt;</echo>
      <copy file="../../templates/index.html" tofile="index.html" overwrite="true">
    <filterset>
      <filter token="doc" value="${doc}"/>
      <filter token="title" value="${doctitle}"/>
    </filterset>
      </copy>
    </target>
```


```
    <target name="makeHTML" depends="makeSources">
      <dependset>
    <srcfileset dir="." includes="*.html.xml"/>
    <targetfileset dir="." includes="*.html"/>
      </dependset>
      <xslt style="../../templates/modifyHTML.xsl" destdir=".">
    <fileset dir=".">
      <include name="*.html.xml"/>
    </fileset>
    <globmapper from="*.html.xml" to="*.html.tmp"/>
      </xslt>
      <copy todir=".">
    <fileset dir='.' includes="*.html.tmp"/>
    <globmapper from="*.html.tmp" to="*.html"/>
    <filterset>
      <filtersfile file="../../course.properties"/>
    </filterset>
      </copy>
      <delete>
    <fileset dir='.' includes="*.html.tmp"/>
      </delete>
    </target>


    <target name="setup" depends="convertDB,makeHTML,makeGraphics,makeSourceCode,makeExt"
        description="Prepare all source files prior to running LaTeX"
```


```
      >
    <replaceregexp file="index.html" match="@[^@]+@" replace="none" flags="g"/>
  </target>

  <dependset>
    <srcfileset dir=".">
  <include name="*.tex"/>
  <include name="*.ltx"/>
    </srcfileset>
    <targetfileset dir="." includes="${doc}-*.pdf"/>
  </dependset>

  <uptodate property="pdfGen.notRequired">
    <srcfiles dir= ".">
    <include name="*.ltx"/>
    </srcfiles>
    <globmapper from="*.ltx" to="*.pdf"/>
  </uptodate>

  <target name="genPDFs" depends="setup" unless="pdfGen.notRequired">
    <apply executable="latexmk" parallel="false">
  <arg value="-pdf"/>
  <env key="TEXMFHOME" value="../../templates//"/>
  <fileset dir="." includes="*.ltx"/>
  <globmapper from="*.ltx" to="*.pdf"/>
    </apply>
  </target>
```


```
    <target name="slides" depends="setup"
        description="Force a (single) latex run on the slides format - used for debugging slide c
        >
      <exec executable="pdflatex">
    <arg value="${doc}-slides.ltx"/>
    <env key="TEXMFHOME" value="../../templates//"/>
      </exec>
    </target>

    <target name="printable" depends="setup"
        description="Force a (single) latex run on the printable format - used for debugging non-
        >
      <exec executable="pdflatex">
    <arg value="${doc}-printable.ltx"/>
    <env key="TEXMFHOME" value="../../templates//"/>
      </exec>
    </target>

    <target name="web" depends="setup"
        description="Force a (single) latex run on the web format - used for debugging non-slide
        >
      <exec executable="pdflatex">
    <arg value="${doc}-web.ltx"/>
    <env key="TEXMFHOME" value="../../templates//"/>
      </exec>
```


```
    </target>

    <target name="bookweb" depends="setup"
        description="Force a (single) latex run on the Book web format - used for debugging non-s
        >
      <exec executable="pdflatex">
    <arg value="${doc}-bookweb.ltx"/>
    <env key="TEXMFHOME" value="../../templates//"/>
      </exec>
    </target>

    <target name="build" depends="genPDFs"
        description="Generate all documents">
    </target>

    <target name="deploy" depends="build"
        description="Generate all documents and sync with the deployment directory (usually a web
        >
      <sync todir="${deploymentDestination}/${relPath}/${doc}"
      includeEmptyDirs="true" granularity="2000">
    <fileset dir=".">
      <exclude name="**/*~"/>
      <exclude name="**/*.aux"/>
      <exclude name="**/*.fdb_latexmk"/>
      <exclude name="**/*.fls"/>
      <exclude name="**/*.log"/>
      <exclude name="**/*.out"/>
```


```
      <exclude name="**/*.toc"/>
      <exclude name="**/*.nav"/>
      <exclude name="**/*.snm"/>
      <exclude name="**/*.vrb"/>
      <exclude name="**/*.tex"/>
      <exclude name="**/*.ltx"/>
    </fileset>
    <preserveintarget>
      <include name="**/.ht*"/>
    </preserveintarget>
      </sync>
    </target>

    <target name="clean"
        description="Remove temporary files created when running LaTeX"
        >
      <delete>
    <fileset dir=".">
      <include name="*.fdb_latexmk"/>
      <include name="*.fls"/>
      <include name="*.nav"/>
      <include name="*.snm"/>
      <include name="*.vrb"/>
      <include name="*.log"/>
      <include name="*.out"/>
      <include name="*.h.html.xml"/>
      <include name="*.cpp.html.xml"/>
```


```
      <include name="*.java.html.xml"/>
    </fileset>
      </delete>
    </target>

    <target name="cleaner" depends="clean"
        description="Remove all files that can be easily regenerated, including the PDF documents
        >
      <delete>
    <fileset dir=".">
      <include name="index.html"/>
      <include name="${doc}-*.pdf"/>
      <include name="*.h.tex"/>
      <include name="*.cpp.tex"/>
      <include name="*.java.tex"/>
      <include name="*.h.html"/>
      <include name="*.cpp.html"/>
      <include name="*.java.html"/>
    </fileset>
      </delete>
    </target>

    <target name="cleanest" depends="cleaner"
        description="Remove all files that can be automatically regenerated"
        >
      <delete>
    <fileset dir=".">
```


```
      <include name="${doc}-*.ltx"/>
      <include name="${doc}-*.main.tex"/>
      <include name="${doc}-*.aux"/>
      <include name="${doc}-*.toc"/>
    </fileset>
      </delete>
    </target>


</project>
```

- Note use of `exec` to invoke the LaTeX document processor.

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4 Eclipse/Ant Integration

Limitations of Eclipse Builder

- Cannot run code-proprocessing (e.g., JFlex)
- An Eclipse project is oriented towards producing a single output product (program, library, . . .)
  - With C++ projects, a problem if you have a "real" product (e.g., a library) and a set of test drivers, each of which yields a distinct program executable.
  - Java projects have fewer problems (because executables don't need separate processing), but what it you are planning to generate both

    * a binary distribution jar, and
    * a source distribution jar

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Project Dependencies

Eclipse supports the idea of projects that depend on other projects, so you could do

- project1 produces the binary distribution jar
- project2 depends on project1 and produces a source distribution jar
  - These projects must reside together in a known relative path from one another
  - project2 is not automatically rebuild if project1 has changed
- Does not scale well.
  - For C++ are you going to have a distinct project for each test driver?

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Eclipse/Ant Integration

Eclipse is generally **ant**-friendly.

- Drop a `build.xml` file into a project and Eclipse will recognize it.
  - Right-clicking on it will bring up options to run it, or to configure how to run it
    * including the selection of the target
    * some preference given to targets with descriptions

- Once **ant** has been run, the “Run Last Tool” button defaults to re-running it.
- But the default build is still Eclipse’s default build manager
  - For projects with elaborate classpaths, requires keeping both the Eclipse project description and the build file up-to-date and consistent.
  - Pre-compilation steps (e.g., tools that generate source code) are not re-run automatically when needed.

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Eclipse Builders

Eclipse supports mutliple, plug-able *builders*.

- Open Project Properties and go to “Builders”
  - In a typical java project, you have just the “Java Builder”
  - Click new to see options.
    In this case, select “Ant Builder”.
  - Fill in the main screen. Leave “Arguments” blank.
  - Go to the Targets tab. Select appropriate targets for
    Clean: Menu selection `Project->clean`
    Manual build: What you want done after explicitly requesting a build
    Auto build: What you want done after a file has been saved/changed
- Return to the Builders list and uncheck the “Java Builder”

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