Ant: The Definitive Guide, 2nd Edition

By Steve Holzner

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Overview

As the most widely used tool for cross-platform development, Ant has undergone a number of important changes in its functionality and use since its launch. Ant: The Definitive Guide, 2nd Edition has been reworked to reflect these changes for Java developers everywhere. Topics covered include everything from downloading and installing, to using Ant to build Web applications, to using Ant to test code.

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Preface

Welcome to Ant, today's premiere build tool. Ant is an extraordinary tool, and it fills a long-standing need among developers. No longer do you have to try to remember the 50 steps to build your projec and make sure you do them in the right order or try to get finicky makefiles just right. Now you've got a true build tool that's genuinely easy to work withand outstandingly powerful. If you've never used Ant, you're in for a treat.

We're going to push the envelope in this book, working from the basics through the advanced, doing nearly everything that Ant can do. This book was designed to open up Ant and make it more accessible than any other book on the subject. It's a programmer-to-programmer book, written to make you an Ant pro without wasting time.

If you're a programmer, this book is written to give you exactly what you want to see, which is the good stuff and only the good stuff. There's as much Ant crammed into this book as you need to master the topic, and mastering Ant is the goal.

What's Inside

From cover to cover, this book is pure Ant, covering hundreds of topics and techniques. We start from the most basic Java© development up to extending Ant yourself; it's all here. Here are a few of the topics in this book:

- Getting and installing Ant
- Creating build files
- Running a build
- Handling build failures
- Specifying build targets
- Using property files
- Handling datatypes and properties
- Handling filesets
- Using selectors, filtersets, and filter chains
- Working with mappers
- Creating conditional targets
- Packaging applications
- Moving, copying, and deleting files
- Building documentation
- Creating JAR files
- Deploying applications
- Using FTP
- Handling remote deployment
- Getting and installing JUnit
- Using JUnit assertions
- Creating a test case

- Running a test case
- Using CVS and Ant
- Accessing CVS
- Initializing CVS
- Running external programs and continuous integration
- Running code in a new JVM
- Calling other programs
- Setting environment variables
- Scheduling Ant builds automatically
- Scheduling builds in Unix and Windows
- Using scripting
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- Using XDoclet for EJB development
- Connecting Ant to Eclipse
- Configuring Ant in Eclipse
- Writing Ant tasks
- Handling errors
- Writing custom filters and selectors
- Writing custom Ant loggers and listeners

Here's an overview, chapter by chapter:

Chapter 1

This chapter is all about the basics, including all the details on how to create Ant build files and how to run them.

Chapter 2, *Using Properties and Types*

This chapter is about two central Ant topics: properties and types. Properties let you configure Ant tasks, and types hold data used by tasks.

Chapter 3, *Building Java Code*

This chapter focuses on the Java build process, from compiling Java code with the `javac` task through compressing and packaging the results with tasks such as `jar`.

Chapter 4, *Deploying Builds*

This chapter covers tasks to package applications for deployments such as `tar`, `gzip`, and `zip`; tasks to prepare directories for deployment such as `delete` and `mkdir`; and tasks to deploy applications such as `copy` and `move` for local and network deployment, as well as `ftp`, `telent`, `sshexec`, and `mail` for remote deployment.

Chapter 5, *Testing Builds With JUnit*

It doesn't make much sense to deploy code that has been broken by a new build. This chapter using the JUnit framework with Ant, during which you can run tests on your code and deploy it if it satisfies those tests.

Chapter 6, *Getting Source Code from CVS Repositories*

There's a lot of support built in for Concurrent Version System (CVS) in Ant, and this chapter is all about making code sharing in teams with CVS happen.

Chapter 7, *Executing External Programs*

Part of the build process involves testing what you've built, and an obvious way of doing that is to run the results of a build. Doing so from Ant involves using the major tasks in this chapter: `java`, `exec`, and `apply`.

Chapter 8, *Developing for the Web*

This chapter covers the tasks specifically designed for packaging web applications, such as `war`, `cab`, `ear`, and `jspc`, and for deploying them, such as `get`, `serverdeploy`, and `scp`. I'll also cover the custom Ant tasks targeted to specific servers such as `deploy`, `reload`, and `undeploy`.

Chapter 9, *XML and XDoclet*

You can validate XML documents using XML DTDs and schema using the `xmlvalidate` task. You can read properties from an XML document using `xmlproperty`. You can use the `xslt/style` task to transform XML documents using XSLT. In this chapter, I discuss XDoclet, an open source code generation engine designed to run in Ant. XDoclet can generate code, deployment descriptors such as *web.xml*, and other artifacts for web and EJB applications.

Chapter 10, *Optional Tasks*

Ant comes with a number of optional tasks, and this chapter covers the highlights, including tasks that create sounds to indicate where you are in a build, tasks that display splash screens tasks that work with regular expressions to match text, and more.

Chapter 11, *Integrating Ant with Eclipse*

Eclipse is the premiere integrated development environment (IDE) for Java programmers. Eclipse is great at visual development, whereas Ant is great for builds. Eclipse comes with Ant built in, and there's an extensive Ant interface in Eclipse. The Ant/Eclipse connection is extremely useful to Java developers, and it's covered in this chapter.

Chapter 12, *Extending Ant*

This chapter covers how to create new Ant tasks, handle task attributes, access property values, work with nested text and elements, make builds fail, work with filesets, use custom tasks as wrappers for external programs, and more.

Conventions Used in This Book

There are some conventions I'll use that you should know about. When there's a new piece of code under discussion, it will appear highlighted; when there's more code to come, you'll see three dots. Here's what that looks like:

```
import org.apache.tools.ant.Task;
import org.apache.tools.ant.BuildException;

public class Project extends Task
{
    private String language;

    public void execute( ) throws BuildException
    {
        System.out.println("The language is " + language);
    }

    public void setLanguage(String language)
    {
        this.language = language;
        .
        .
        .
    }
}
```

Note that I'll use the standard convention for selecting menu items in this book when menu items come into play (as when we use Ant in the Eclipse IDE). For instance, to create a new project in Eclipse, you use the File New Project menu item.

The following typographical conventions are used in this book:

Plain text

Indicates menu titles, menu options, menu buttons, and keyboard accelerators.

Italic

Indicates new terms, URLs, email addresses, filenames, file extensions, pathnames, directories and Unix utilities.

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`Constant width`

Indicates commands, options, switches, variables, types, classes, namespaces, methods, modules, properties, parameters, values, objects, events, event handlers, or XML tags.

`Constant width italic`

Shows text that should be replaced with user-supplied values.

`Constant width bold`

This icon signifies a tip, suggestion, or general note.

This icon signifies a caution or warning.

What You'll Need

All the software you'll need in this book can be downloaded from the Internet for free. You'll need Antthis book was written using Ant 1.6.1and I'll discuss where to get Ant in Chapter 1. Other softwar packages are used at various points in the book, such as the AntHill build server or the Eclipse IDE (Chapter 11 is on using Ant in Eclipse), and I'll show where to download all the requisite software as it's needed. It's all free.

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Chapter 1. Getting Started

Build tools are one of the most boring items developers must have available in their development cycle. They aren't sexy, they aren't going to impress your friends, and you'll hardly notice a build tool at all until it's time to redeploy that 1,000-class Java application you've been working on. Then, all the interesting code, killer IDEs, and amazing design patterns aren't worth nearly as much as typing `ant` and calmly watching your boring build tool handle complicated dependencies, deployment onto multiple servers via FTP and SSH, and log errors. It is here that build tools like Ant truly shine.

At its most basic, all a good build tool does is take source code, compile it, and create a working application. When you're writing a single-class application, this isn't a big deal; in fact, it can be annoying to manage a build system instead of typing `javac`. But it's a different story when you start working with multiple source files, with multiple dependencies, need to check code out of a central repository automatically, test the code, and deploy it to some remote destination. You can end up with dozens of tasks to complete each time you want to build your application, which is the last thing you want to spend time on when you're already brain-dead from an all-night debugging session. When new members join your team, you'll have to walk through this whole process again, showing them the ropes and hoping they don't break anything in the process. It's for all of these reasons that developersand especially Java programmersturn to Ant.

Though there are still powerful alternatives to Ant like `make`, Jam, Cons, `gnumake`, and `nmake`, nothing is as integrated into the Java programming language. Ant is pure Java; you'll find line after line of Java code and *.java* files if you obtain a source release of the tool. Further, some of the most popular projects in the Java universe are built using Ant; everything from Tomcat to JBoss to Turbine can go from source to binary by typing `ant`.

1.1. Ant's Origins

Ant was originally the brainchild of James Duncan Davidson, and the word Ant stands for "Another Neat Tool," a fact that relatively few developers realize. Ant 1.0 first appeared in March 2000. James' original inspiration was to create a build tool that used a simple XML-based format for build files, as opposed to the shell commands and involved formatting that `Makefile`s used. Ant caught on rapidly, and newer versions followedAnt 1.1 (July 2000), 1.2 (October 2000), 1.3 (March 2001), 1.4 (September 2001), and 1.5 (July 2003). The version this book usesversion 1.6.1appeared in February of 2004. Although James Davidson has moved on to work with other build tools, Ant continues to evolve on an almost daily basis.

Ant is an open source, Apache community project, and its home page is at http://ant.apache.org. Because it's an open source project, it's always developing. There are multiple authors, called *committers*, which can write to Ant's source code repositories. However, officially sanctioned Ant versions don't appear too rapidly, and when they do, they're usually backward compatible enough to make sure your build files aren't broken.

> One notable exception to this practice is Ant 2.0, which may be out sometime in the next year or so. When it does come out, the Apache Ant team plans on releasing an automated migration tool that will translate 1.x build files to Ant 2.0.

1.2. Getting Ant

Ant comes in two editions: binary and source. The binary release is ready to use: just download, uncompress, and go. The source release allows you to see what makes Ant run and to make modifications of your own if you choose. To download either, go to http://ant.apache.org/ and click a link under the Download title (either Binary Distributions or Source Distributions).

Downloading a binary edition is easiest: Just click the Binary Distributions link and download the *.tar.gz* or *.zip* compressed file.

> If you want bleeding-edge Ant, you can get the nightly builds from http://cvs.apache.org/builds/ant/nightly/.

1.2.1. Installing Ant

To install the binary distribution of Ant, expand it. Here's the resulting directory layout (only the *bin* and *lib* directories are needed to run Ant):

```
ant
 |___ bin  Ant launch scripts
 |
 |___ lib  Ant jars
 |
 |___ docs Ant documentation
 |
 |___ etc  XSL for formatting Ant XML output
```

You need to perform the following steps to complete the setup process:

1. Add the Ant *bin* directory to your path.
2. Set the `ANT_HOME` environment variable to the directory where you installed Ant.

   > On some operating systems, the Ant scripts can guess `ANT_HOME` specifically in Unix and Windows NT/2000but it's better not to rely on them doing so accurately.

3. Set the `JAVA_HOME` environment variable to the directory where your JDK is installed.

If you've expanded Ant in *c:\ant* on Windows, you'll end up with a new directory, *c:\ant\apache-ant-1.6.1*. If you've installed the JDK in *c:\jdk1.4* (and the Java *bin* directory is *C:\jdk1.4\bin*), set the environment variables like this:

```
set  ANT_HOME=C:\ant\apache-ant-1.6.1
set JAVA_HOME=C:\jdk1.4
set PATH=%PATH%;%ANT_HOME%\bin
```

In Unix (`bash`), assume Ant is installed in */usr/local/ant*. Here's how you'd set up the environment:

```
export ANT_HOME=/usr/local/ant
export  JAVA_HOME=/usr/local/jdk1.4
export PATH=${PATH}:${ANT_HOME}/bin
```

In Unix (`csh`), you'd do something like this:

```
setenv ANT_HOME /usr/local/ant
setenv  JAVA_HOME  /usr/local/jdk1.4
set path=( $path $ANT_HOME/bin )
```

There are great instructions on how to set environment variables on many different systems in the installation documentation for the Java JDK.

To compile Java code, you'll need a working JDK on your machine. If you only have a Java Runtime Environment (JRE), Ant won't be able to do many things you need it to do. Also note that the Microsoft JVM/JDK is not supported.

In Windows 95, Windows 98, and Windows ME, the batch file used to launch Ant will not work if `ANT_HOME` holds a long filename (a filename which is not in the 8.3 format). It's best to install Ant in a short 8.3 path, such as *c:\Ant*. If you're using one of these operating systems, you'll need to configure more environment space. Update the following line in your *config.sys* file:

```
shell=c:\command.com c:\ /p /e:32768
```

1.2.2. Testing Ant

With Ant in your path, you should be able to run it at the command line. To test this, type `ant -version`, which should display the current Ant version:

```
%ant -version
Apache Ant version 1.6.1 compiled on February 12 2004
```

If Ant's not working, you'll see something along these lines:

```
-bash-2.05b$ ant
-bash: ant: command not found
```

Here's the Windows version of the same error:

```
C:\>ant
'ant' is not recognized as an internal or external command,
operable program or batch file.
```

In that case, go back over the installation instructions, and look at the Ant documentation for troubleshooting issues.

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1.3. Ant at Work

Rather than go on and on about what Ant can do for you, an example can illustrate how easy Ant makes the build process. Assume that you have a Java file called *Project.java*, as shown in Example 1-1.

Example 1-1. A simple Java class

```
public class Project
{
    public static void main(String args[])
    {
        System.out.println("No worries.");
    }
}
```

Assume you want to compile this code and store the results, *Project.class*, in a JAR file, *Project.jar*. With Ant and a build file, this is a piece of cake. By default, Ant looks for a build file named *build.xml*. That file is a valid XML document; Example 1-2 shows the build file for this example.

Example 1-2. A simple Ant build file

```
<?xml version="1.0" ?>
<project default="main">

    <target name="main" depends="compile, compress">
        <echo>
            Building the .jar file.
        </echo>
    </target>

    <target name="compile">
        <javac srcdir="."/>
    </target>

  <target name="compress">
        <jar jarfile="Project.jar" basedir="." includes="*.class" />
  </target>

</project>
```

To run this Ant build file, make sure it's in the same directory as *Project.java*, and enter `ant` at the command-line prompt. Ant has been tested on many platforms, including Linux; Unix versions from Solaris to HP-UX; Windows 9x, NT, 2000, and XP; OS/2 Warp, Novell Netware 6, and MacOS X.

When you run Ant on this first build file, here's what you'd see in Unix (using the `bash` shell):

```
-bash-2.05b$ ant
Buildfile: build.xml

compile:
    [javac] Compiling 1 source file

compress:
      [jar] Building jar: /home/httpd/vhosts/builder/Project.jar

main:
     [echo]
     [echo]             Building the .jar file.
     [echo]

BUILD SUCCESSFUL
Total time: 2 seconds
```

You'll get the same results in any supported operating system. For example, here's what you'd see in Windowsverything except the build time is identical:

```
C:\ant\ch01>ant
Buildfile: build.xml

compile:
    [javac] Compiling 1 source file

compress:
      [jar] Building jar: C:\ant\ch01\Project.jar

main:
     [echo]
     [echo]             Building the .jar file.
     [echo]

BUILD SUCCESSFUL
Total time: 4 seconds
```

For the most part, Ant builds are independent of operating system, and for that reason, `%` is used as a generic command prompt in this book. If anything is operating-system-dependent, it will be listed explicitly.

When Ant finishes executing the build file, you'll have *build.xml*, *Project.java*, the compiled *Project.class*, and *Project.jar*, all in the same directory. *Project.jar* will contain a manifest file and *Project.class*. Fortunately, Ant handles 10, 20, or 100 source files in this same way, making your life easy at build time.

Team LiB

1.4. Anatomy of a Build File

Ant projects all revolve around one or more build files. By default, Ant looks for a build file named *build.xml*. Because Ant files are XML documents, they start with an XML declaration, as all valid XML documents must:

```
<?xml version="1.0" ?>
        .
        .
        .
```

> For the complete XML 1.0 syntax, look at http://www.w3.org/TR/REC-xml/. XML 1.1 is out now as well, but Ant build files are based on XML 1.0, and the difference between these versions is small anyway, centering mostly on the manner in which certain Unicode characters are supported.

1.4.1. Projects

Every Ant build file contains exactly one *project*. You set up an Ant project in a build file with the `project` element, which is the *document elementi.e.,* the element that contains all other elements:

```
<?xml version="1.0" ?>
<project>
        .
        .
        .
</project>
```

As Ant build files are just XML, you'll need to know which attributes are allowed on the top-level `project` element.

> You'll also want to know about the elements that can be nested within `project`. Those are dealt with throughout the rest of this chapter and in Chapter 2.

The three allowed attributes for the `project` element are shown in Table 1-1.

Table 1-1. The project element's supported attributes

Attribute	Description	Required
name	Defines the project name	No
default	The target to invoke if no target is explicitly specified	Yes
basedir	The base directory from which all relative paths are resolved	No

Note that the default attribute is required. This attribute points to the Ant target that you want run by default; in other words, this controls what happens when you type ant at the command prompt, without any other special instructions. In the following case, the default target is main:

```
<?xml version="1.0" ?>
<project default="main">
        .
        .
        .
</project>
```

1.4.2. Targets

An Ant *target* is a group of tasks that you want Ant to perform. These tasks are grouped together into one easily remembered unit, which is the target For example, you might have a target deploy which opens an FTP connection to a remote server, uploads various files, and closes the connection. Though multiple tasks may be involved (opening the connection, performing an upload, closing the connection, and perhaps checking for error messages), it's easiest to think of this as one unit of work. Considering this as a single target makes it reusable and easily accessed from various portions of your build file.

Another example might be a target named init that initializes a build by deleting output directories and recreating them so they'll be empty, as well as copying over license files that should be a part of every build. You might use a target named compile to compile dozens of source files across various directories and store the results in various output directories. In all these cases, the target handles piecing together various individual tasks.

Ant build files are made up of targets like these. For example, to create the main target, you use the target element, along with the name attribute:

```
<?xml version="1.0" ?>
<project default="main">

    <target name="main">
        .
        .
        .
    </target>

</project>
```

You can see the possible attributes for the target element in Table 1-2.

Table 1-2. The target element's attributes

Attribute	Description	Required
name	Defines the target name	Yes
depends	Comma-separated list of targets to execute before this target	No
if	Name of a property needed to run this task	No
unless	Name of a property that can *not* be set before running this task	No
description	Description of this target's purpose	No

1.4.3. Tasks

You populate an Ant target with *tasks*; a task is an XML element that Ant can execute to make something happen. For example, the echo task echoes text messages to the console:

```
<?xml version="1.0" ?>
<project default="main">

    <target name="main">
        <echo>
            Building the .jar file.
        </echo>
    </target>

</project>
```

To create an Ant target, you place Ant tasks like echo inside a target element; in this case, the main target only has one task, but you can include hundreds.

1.4.3.1 Built-in tasks

As you'd expect, Ant comes with a large number of built-in tasks, and you can see them all in Table 1-3 (many of these tasks may contain subelements).

In cases where a task is listed and followed by another task name in brackets (as in `apply [execon]`), the first task is the current name you should use; the second task is an older name that performs similar functionality but is now deprecated. Always use the task *not* in brackets to ensure your code is current.

Table 1-3. Core Ant tasks

Task name	Description
`ant`	Executes Ant
`antcall`	Executes a target from the current build file
`antstructure`	From a given build file, creates a DTD reflecting all of the tasks Ant currently knows about
`apply [execon]`	Invokes a native executable
`available`	Sets a Boolean value in a property according to the availability of desired resource
`basename`	Sets a property to the last element of a specified path in an effort to determine a file's name without directory structure
`buildnumber`	Manages build numbers
`bunzip2`	Expands GZip or BZip2 archives
`bzip2`	Packs GZip or BZip2 archives
`checksum`	Creates checksums for one or more files
`chmod`	Modifies file permissions on Unix
`concat`	Concatenates multiple files
`condition`	Checks the result of a condition and sets the result to in a property
`copy [copydir, copyfile]`	Copies files
`cvs`	Interacts with a CVS repository
`cvschangelog`	Converts a series of CVS change logs into an XML report
`cvspass`	Adds entries to a *.cvspass* file
`cvstagdiff`	Creates an XML report highlighting the differences between tags
`cvsversion`	Finds the CVS software version
`defaultexcludes`	Modifies the list of default exclude patterns, affecting which files are automatically excluded from processing by file-related tasks
`delete [deltree]`	Delete files and folders

Task name	Description
dependset	Deletes target files that are older than new source files
dirname	Assigns a file's directory path to a property
ear	Extends the jar task to support handling files for an Enterprise Application archive (EAR)
echo	Echoes text to System.out or to a file
exec	Invokes a native executable
fail	Halts and exits a build by throwing a BuildException
filter	Sets a token filter that can be used by filter-related tasks such as copy
fixcrlf	Adds or remove tabs, carriage returns, linefeeds, and EOF characters from a set of files
genkey	Adds a new key to a given *keystore*
get	Retrieves files using FTP, HTTP, and more from a URL
gunzip	Unpacks a GZip file
gzip	Packs a GZip file
import	Allows the use of other Ant files
input	Displays a message and reads a line of input from the console, allowing for user input during the build process
jar	Creates a JAR archive similar to Java's jar command
java	Executes the Java interpreter to run a class or application
javac	Compiles the specified source file(s)
javadoc [javadoc2]	Invokes the javadoc tool to create documentation
loadfile	Sets a property file to the entire contents of a text file
loadproperties	Loans an entire property file into Ant properties
macrodef	Defines a new task as a macro built-up upon other tasks
mail	Sends SMTP mail messages
manifest	Creates an archive's manifest file
mkdir	Makes a new directory
move [rename]	Moves a file to another directory
parallel	Contains other Ant tasks that can be run simultaneously by multiple Java threads
patch	Uses the patch command (assuming it is on the path) to apply *diff* files to a source file (or files)
pathconvert	Converts paths between platforms

Task name	Description
presetdef	Defines a new task based on an existing task with certain options preset as defaults
property	Sets one or more properties to new values
record	Runs a listener that records the logging output of the build process to a file
replace	Replaces a string with another in all files in a directory
rmic	Invokes the rmic compiler
sequential	A container task that can contain other Ant tasks and run them in sequence
signjar	Uses the JarSigner to securely sign ZIP and JAR archives
sleep	Suspends execution for a specified period of time
sql	Runs SQL statements against a database
subant	Runs Ant within all subdirectories of the project directory
sync	Synchronizes two directory trees
tar	Makes a new TAR archive
taskdef	Creates a new task definition and adds it to the current project
tempfile	Sets a temporary filename to an Ant property
tstamp	Sets time-based properties to the current time
typedef	Creates a new task or data type for use in the current project
unjar	Unpacks a JAR file
untar	Unpacks a TAR file
unwar	Unpacks a WAR file
unzip	Unpacks a ZIP file
uptodate	Sets a property value to true if a given target file is newer than a set of source files
waitfor	Halts a build and continues when specified conditions are met
war	Creates WAR archive files (an extension of the jar task)
whichresource	Locates a class or resource, either on the current class path or the system class path
xmlproperty	Loads Ant properties from an XML property file
xslt [style]	Transforms a set of documents via XSLT
zip	Creates and packs a new ZIP archive

1.4.3.2 Optional tasks

Besides these built-in tasks, called the*core tasks*, Ant supports many optional tasks, which you can see in Table 1-4. These tasks may require the support of additional JAR files, which you load into the Ant *lib* directory. For example, `ftp` uploads files to remote servers; you need to place the JAR files *jakarta-oro.jar* and *commons-net.jar* in your Ant *lib* directory to use the task. Another optional task is `csc`, which compiles Microsoft C# code:

```
<csc optimize="true" debug="false"
    warnLevel="4"
    unsafe="false" targetType="exe" incremental="false"
    mainClass = "Main" destFile="app.exe" >
    <src dir="src" includes="*.cs" />
    <reference file="${testCSC.dll}" />
    <define name="RELEASE" />
</csc>
```

> To determine which additional JAR files an optional task needs, see http://ant.apache.org/docs/manual/index.html#librarydependencies, which lists the needed libraries for each optional taskand where to get them.

Table 1-4. Optional Ant tasks

Task name	Description
`antlr`	Runs the ANTLR Translator Generator Language Tool.
`attrib`	Changes the permissions and/or attributes of a file.
`cab`	Creates CAB files (Microsoft archives).
`chgrp`	Changes file groups on Unix.
`chown`	Changes file ownership.
`depend`	Determines which class files are out-of-date compared to their source.
`echoproperties`	Lists the project's properties.
`ftp`	Supports a basic FTP client.
`icontract`	Generates a property file for iContract, an application for controlling assertions.
`image`	Performs bulk image manipulation.
`jarlib-available`	Checks for the presence of an extension.
`jarlib-display`	Displays the "Optional Package" and "Package Specification" information for JAR files.
`jarlib-manifest`	Generates a manifest with required dependencies.

Task name	Description
jarlib-resolve	Searches for the location of a JAR file, setting the location to an ANT property.
javacc	Invokes the JavaCC compiler.
javah	Generates C header and source files for the Java Native Interface (JNI).
JPCoverage	Runs the JProbe coverage analyzer.
JcovMerge	Merges JProbe coverage snapshots.
JcovReport	Takes a JProbe coverage snapshot and creates a report.
jdepend	Uses the JDepend parser to generate code quality metrics.
jjdoc	Invokes the JJDoc documentation generator (used with JavaCC).
jjtree	Inserts parse tree building actions into source code using the JJTree preprocessor for the JavaCC compiler.
jlink	Deprecated. Merges archive contents. Use the zip and jar tasks with the zipfileset and zipgroupfileset attributes instead.
jprobe	Runs various tools from the JProbe suite.
jspc	Deprecated. Compiles JSP pages to Java source code. Use Tomcat's jspc task instead.
junit	Runs unit tests using JUnit.
junitreport	Merges separate XML files generated by the JUnit task into a single XML file.
maudit	Highlights stylistic and potential execution problems using the Metamata Metrics/WebGain Quality Analyzer.
mimemail	Deprecated. You can still send mail using the mail task.
mmetrics	Generates metrics using the WebGain's Metameta Metrics Quality Analyzer.
mparse	Takes a grammar file, and compiles it with MetaMata's MParse compiler.
native2ascii	Takes a native encoded file and converts it to ASCII.
netrexxc	Compiles all NetRexx source files.
propertyfile	Creates or modifies property files.
pvcs	Gets latest source code from a PVCS repository.
renameextensions	Deprecated. You can achieve the same results by using the move task and using a glob mapper.
replaceregexp	Replaces matched text with new text.
rexec	Controls a rexec session from Ant.
rpm	Builds Linux RPM installation files.
scp	Moves files to and from a remote SSH server.
script	Executes an Apache BSF script.

Task name	Description
Scripdef	Defines Ant tasks from scripts.
serverdeploy	Runs a hot-deployment tool for a J2EE server.
setproxy	Configures web proxy properties.
sound	After a build, plays a sound file letting you know whether the build succeeded or failed.
splash	Displays a splash screen.
sshexec	Executes a command on a remote server using SSH.
stylebook	Uses Apache Stylebook to generate book documentation.
symlink	Makes, deletes, or edits Unix symbolic links.
telnet	Controls a Telnet session from ANT.
test	Executes a JUnit test.
translate	Translates keywords in files using values in resource bundles.
vajload	Loads files for Visual Age for Java source control.
vajexport	Exports packages for Visual Age for Java source control.
vajimport	Imports files for Visual age for Java source control.
wljspc	Compiles JSP pages using Weblogic's JSP compiler.
xmlvalidate	Validates XML files and reports any errors.

In addition to these tasks, specific Ant tasks for .NET are shown inTable 1-5.

Table 1-5. .NET Ant tasks

Task name	Description
Csc	Invokes the C# compiler.
vbc	Invokes the VB.NET compiler.
jsharpc	Invokes the J# compiler.
ildasm	Disassembles from .NET intermediate language back to source code.
ilasm	Assembles code into .NET intermediate language.
WsdlToDotNet	Given a WSDL file, this task will generate C# or VB code.
ImportTypelib	COM library importer.

Specific tasks for the Clearcase version control system are listed in Table 1-6.

Table 1-6. Clearcase Ant tasks

Task name	Description
`CCCheckin`	Checks in files.
`CCCheckout`	Checks out files.
`CCUnCheckout`	Un-checks out files.
`CCUpdate`	Executes `cleartool update`.
`CCMklbType`	Executes `cleartool mklbtyle`.
`CCMklabel`	Executes `cleartool mklabel`.
`CCRmtype`	Executes `cleartool rmtype`.
`CCLock`	Executes `cleartool lock`.
`CCUnluck`	Executes `cleartool unlock`.
`CCMkbl`	Executes `cleartool mkbl`.
`CCMkattr`	Executes `cleartool mkattr`.
`CCMkdir`	Executes `cleartool mkdir`.
`CCMkelem`	Executes `cleartool mkelem`.

Many EJB specific tasks are shown in Table 1-7.

Table 1-7. EJB-related Ant tasks

Task name	Description
blgenclient	Generates a client JAR for Borland application servers.
ddcreator	Creates EJB deployment descriptors, given a group of WebLogic deployment descriptors.
ejbc	Invokes WebLogic's ejbc tool.
Iplanet-ejbc	Invokes iPlanet's ejbc tool.
ejbjar	Invokes the ejbjar tool (used for many application servers).
wlrun	Starts a WebLogic server.
Wlstop	Stops a WebLogic server.

The Perforce source control tasks are shown in Table 1-8.

Table 1-8. Perforce Ant tasks

Task name	Description
P4Sync	Synchronizes files with the Perforce server.
P4Change	Gets a list of current changes from the Perforce server.
P4Edit	Checks out files for editing.
P4Submit	Checks in files.
P4Have	Lists all client-viewable files.
P4Label	Makes a label based on the files in the current workspace.
P4Labelsync	Syncs with a label.
P4Counter	Gets or sets a counter value. (Counters can be used to keep track of build events, such as the number of builds that have been executed.)
P4Reopen	Reopens a checked-out file.
P4Revert	Reverts file(s) that have been changed to their original content.
P4Add	Adds file(s) to the list to be submitted to the server.

Task name	Description
`P4Delete`	Deletes file(s).
`P4Integrate`	Integrates file(s). You must specify the source file(s) and the target file(s).
`P4resolve`	Resolves file(s) in case others have made changes to the file(s) when you were working on it.
`P4Fstat`	Views differences with the server.

Many tasks for Microsoft Visual Source Safe are detailed in Table 1-9.

Table 1-9. Visual Source Safe tasks

Task name	Description
`vssget`	Gets a copy of a particular VSS file.
`Vsslabel`	Makes a new label for the current version of a file.
`Vsshistory`	Displays a file's history in the project.
`Vsscheckin`	Checks in files to VSS.
`Vsscheckout`	Checks out files from VSS.
`Vssadd`	Adds a new file to VSS.
`Vsscp`	Changes the project considered the current project by VSS.
`Vsscreate`	Makes a new project.

Continuing with source control repository tasks, Table 1-10 shows tasks for working with Starteam source control.

Table 1-10. Starteam Ant tasks

Task name	Description
`STCheckout`	Checks out files from StarTeam projects
`STCheckin`	Checks in files to StarTeam projects
`STLabel`	Creates a new label for this project
`STList`	Displays a list of files in the project

Table 1-11 shows tasks for the Continuous source control server.

Table 1-11. Continuous/Synergy Ant tasks

Task name	Description
`CCMCheckin`	Checks in files to the source manager
`CCMCheckout`	Checks out files from the source manager
`CCMCheckinTask`	Checks in all files in the current task
`CCMReconfigure`	Reconfigures an existing command
`CCMCreateTask`	Creates a task

Finally, Table 1-12 lists optional tasks for supporting SourceGear's SourceOffSite Visual Source Safe plug-in.

Table 1-12. SourceOffSite Ant tasks

Task name	Description
`Sosget`	Gets a read-only copy of a file
`Soslabel`	Creates a label for the current project
`Soscheckin`	Checks in files to the source manager
`Soscheckout`	Checks out files from the source manager

In addition to the built-in and the optional tasks, Ant supports third-party and custom tasks (yes, that's a large number of tasks you can use!). As you'd expect, third-party tasks add functionality to Ant; as an example, take a look at the third-party tasks available for free at http://ant-contrib.sf.net/, which includes a set of tasks for use with Ant and C++. Creating Ant tasks is easier than you might think, and you're going to create your own in Chapter 11.

1.4.4. Dependent Tasks

Typically, you create an Ant build file with a default target named something like `main`; this target then acts as a master target, handling program flow for the entire build process. It tells Ant to run other targets and specifies their ordering. This is accomplished through the `target` element's `depends` attribute.

For example, you might want to add a target named `compile` to compile your code and add another target called `compress` to put the compiled code into a JAR file:

```
<?xml version="1.0" ?>
<project default="main">

    <target name="main">
        <echo>
            Building the .jar file.
        </echo>
    </target>

    <target name="compile">
        <javac srcdir="."/>
    </target>

    <target name="compress">
        <jar jarfile="Project.jar" basedir="." includes="*.class" />
    </target>

</project>
```

Ensure that the `compile` and `compress` targets runin that orderby assigning the string "compile, compress" to the default target's `depends` attribute:

```
<?xml version="1.0" ?>
<project default="main">

    <target name="main" depends="compile, compress">
        <echo>
            Building the .jar file.
        </echo>
    </target>

    <target name="compile">
        <javac srcdir="."/>
    </target>

    <target name="compress">
        <jar jarfile="Project.jar" basedir="." includes="*.class" />
    </target>

</project>
```

When you run Ant, it'll look for *build.xml* and execute the default target, which the `project` element indicates is `main`. The `main` target's `depends` attribute tells Ant to run the `compile` target and then run the `compress` target *before* running the body of the `main` target.

> Though you use this attribute to indicate the order targets should run in, targets can still fail, which means you're not guaranteed that they will all behave as expected. Generally, a failed target will stop the Ant build process, but that's not always the case.

Bear in mind that dependencies can be nested inadvertently. For example, take a look at this build file fragment:

```
<target name="find"/>
<target name="inspect" depends="find"/>
<target name="test" depends="inspect"/>
<target name="purchase" depends="test, inspect, find"/>
```

If target `purchase` was the default target, you might think that targets `test`, `inspect`, `find`, and `purchase` were executed in that order. However, target `test` depends on target `inspect`, which depends on `find`, and so on. An Ant target gets executed *once* even when multiple targets depend on it. Because the dependencies of a task are executed before the task, the actual order of execution here is `find`, `inspect`, `test`, and then `purchase`.

1.4.5. Properties

In addition to targets and tasks, the third pillar of an Ant build file is its *properties*. Properties are name-value pairs that act much like constants in Java code. You set the value of a property with the `property` element and can refer to that property by name throughout your build file. You can insert the value of a property in task attributes by dereferencing the property name with `${`*`property-name`*`}`.

For example, if you had a property named `bin` corresponding to the output directory of your build and wanted to refer to that directory, you could refer to it as `${bin}` when you assign it to task attributes in your build file. If you wanted to refer to the *archives* subdirectory in that output directory, you could refer to it as `${bin}/archives`. The advantages to this approach should be obvious to anyone who's had to change a directory name in 300 different places throughout an application.

> A forward slash will work as a directory delimiter even on Windows systems; Ant is smart enough to know what you mean.

1.4.5.1 Property attributes

Properties are used the same way as constants are in Java: they let you collect definitions in one centralized place rather than having them dispersed throughout a build file. When you want to change property values, you can make changes in one location and know that they will propagate throughout the build file. You can see the attributes of the `property` element in Table 1-13.

Table 1-13. The property element's attributes

Attribute	Description	Required
classpath	The classpath to use when looking for a resource.	No
classpathref	The classpath to use when looking for a resource, which can then be given as a reference to a path element later in the build file.	No
environment	The prefix to use when retrieving environment variables. For example, if you specify environment="env", you will be able to access operating-system-specific environment variables as property names like ${env.PATH}.	A resource, file, url, or environment attribute is required when not using the name attribute.
file	The name of a property file to load values from.	A resource, file, url, or environment attribute is required when not using the name attribute.
location	Sets the property to the absolute filename of the given file. If an absolute path is supplied, it's left unchanged (with / and \ characters converted for the current platforms). Otherwise, the supplied filename is taken as a path relative to the project's base directory and then expanded.	A value, location, or refid element is required when using the name attribute.
name	The name of the property to set.	No
prefix	The prefix to add to properties loaded from a file or a resource. A . is appended to the prefix if none is specified.	No
refid	A reference to a (previously) defined object.	A value, location, or refid element is required when using the name attribute.
resource	The resource name of the property file, used for searching the classpath.	A resource, file, url, or environment attribute is required when not using the name attribute.
url	The URL from which to read properties.	A resource, file, url, or environment attribute is required when not using the name attribute.
value	The value of this property.	A value, location, or refid element is required when using the name attribute.

As an example, you can store a message that displays "Building the .jar file." in a property named message:

```
<?xml version="1.0" ?>
<project default="main">

    <property name="message" value="Building the .jar file." />
        .
        .
        .
</project>
```

> You declare properties *outside* your targets. As of Ant 1.6, *all* tasks can be declared outside of targets (earlier versions only allowed `property`, `typedef` and `taskdef` to be used outside of a `target` element). When you define tasks external to a specific target, those tasks are evaluated *before* any targets are executed.

You can echo the message to the console like this:

```
<?xml version="1.0" ?>
<project default="main">

    <property name="message" value="Building the .jar file." />
        .
        .
        .
    <target name="main" depends="compile, compress">
        <echo>
            ${message}
        </echo>
    </target>

</project>
```

Properties are frequently used to hold pathnames, and the `property` element's `location` attribute is useful in this context. Suppose you're storing your source code in a subdirectory of the current directory named *source* and want to deploy the *.jar* file created by this build file to a directory named *bin*. You can create properties corresponding to these directories:

```
<?xml version="1.0" ?>
<project default="main">

    <property name="message" value="Building the .jar file." />
    <property name="src" location="source" />
    <property name="output" location="bin" />

    <target name="main" depends="init, compile, compress">
        <echo>
            ${message}
```

```
        </echo>
    </target>
        .
        .
        .
</project>
```

The default target in this build file, `main`, depends on an `init` target where the `mkdir` task (detailed in Chapter 3) is used to create the `output` directory:

```
<?xml version="1.0" ?>
<project default="main">

    <property name="message" value="Building the .jar file." />
    <property name="src" location="source" />
    <property name="output" location="bin" />

    <target name="main" depends="init, compile, compress">
        <echo>
            ${message}
        </echo>
    </target>

    <target name="init">
        <mkdir dir="${output}" />
    </target>
        .
        .
        .
</project>
```

Now you can compile the Java source code from the `${src}` directory, placing the created *.class* file in the `${output}` directory, and create the *Project.jar* file in the `${output}` directory, all using properties:

```
<?xml version="1.0" ?>
<project default="main">

    <property name="message" value="Building the .jar file." />
    <property name="src" location="source" />
    <property name="output" location="bin" />

    <target name="main" depends="init, compile, compress">
        <echo>
            ${message}
        </echo>
    </target>

    <target name="init">
        <mkdir dir="${output}" />
    </target>
```

<target name="compile"> **<javac srcdir="${src}" destdir="${output}" /> </target> <target name="compress"> <jar destfile="${output}/Project.jar" basedir="${output}**" **includes="*.class" /> </target>** </project>

The relative paths used will be expanded in a platform-specific way, something like this in Unix:

```
-bash-2.05b$ ant -f properties.xml
Buildfile: properties.xml

init:
    [mkdir] Created dir: /home/steve/bin

compile:
    [javac] Compiling 1 source file to /home/steve/bin

compress:
      [jar] Building jar: /home/steve/bin/Project.jar

main:
     [echo]
     [echo]             Building the .jar file.
     [echo]

BUILD SUCCESSFUL
Total time: 2 seconds
```

Here's the Windows version:

```
C:\ant\ch01>ant -f properties.xml
Buildfile: properties.xml

init:
    [mkdir] Created dir: C:\ant\ch01\bin

compile:
    [javac] Compiling 1 source file to C:\ant\ch01\bin

compress:
      [jar] Building jar: C:\ant\ch01\bin\Project.jar

main:
     [echo]
     [echo]             Building the .jar file.
     [echo]

BUILD SUCCESSFUL
Total time: 4 seconds
```

1.4.5.2 Built-in properties

Ant gives you access to the same system properties you'd have access to in Java code, as if they were Ant properties. For example, if you want to determine the name of the operating system, you can refer to `${os.name}` in your build file.

> For a list of system properties, see the Java documentation of the `System.getProperties( )` method.

Ant has some additional Ant-specific properties:

`ant.file`

Contains the absolute path of the build file

`ant.java.version`

Contains the JVM version Ant is using (can hold only `1.1`, `1.2`, `1.3`, `1.4` and [as of Ant 1.6] `1.5`)

`ant.project.name`

Holds the name of the project that is executing (set with the `name` attribute of `project`)

`ant.version`

Contains the version of Ant running

`basedir`

Holds the absolute path of the project's base directory (set with the `basedir` attribute of `project`)

1.5. Running Ant

Running Ant from the command-line is simple:

```
%ant [options] [target [target2 [target3] ...]]
```

1.5.1. Command-Line Options

options are one or more of the command-line options that begin with a hyphen, listed in Table 1-14; *target*, *target2*, etc., are the specific targets you want to run in the event you don't want to defer to the `project` element's default target.

> Entering **`ant -help`** on the command line generates a list of command-line options.

Table 1-14. Ant command-line options

Name	Description
`-buildfile` *`file`*, or `-f` *`file`*, or `-file` *`file`*	Runs the build file specified by *`file`*.
`-D`*`property`*`=`*`value`*	Sets a property called *`property`* with a value of *`value`*, and passes it to Ant.
`-debug, -d`	Prints debugging information.
`-diagnostics`	Prints diagnostics about Ant.
`-emacs, -e`	Creates plain, emacs-friendly logging information.
`-find` *`file`*, or `-s` *`file`*	Searches for the build file (named *`file`*) along the directory structure towards the root.
`-help, -h`	Prints help information.

Name	Description
`-inputhandler` *`class`*	Specifies the class that will handle user text input.
`-keep-going, -k`	Continues to execute targets even if prior targets fail. Only targets that do not depend on failed targets are attempted.
`-l` *`file`*, or `-l` *`file`*	Uses *`file`* to log to.
`-lib` *`path`*	Specifies the classpath on which to search for JARs and library classes.
`-listener` *`classname`*	Adds an instance of *`classname`* as a listener, which is alerted when build events occur (e.g., starting and stopping of the build process).
`-logger` *`classname`*	Specifies the class to handle logging of Ant's output.
`-noinput`	Turns off interactive input.
`-projecthelp, -p`	Prints the project's help information (if there is any).
`-propertyfile` *`file`*	Loads properties from the specified file.
`-quiet, -q`	Reduces Ant messages to the minimum possible.
`-verbose, -v`	Specifies verbose output.
`-version`	Prints the version of Ant being used.

Ant Is Just Java

Ultimately, Ant is just Java code, and can be run with `java` like any other Java class:

```
java -Dant.home=/home/steven/ant org.apache.tools.ant.Main
     [options] [target [target2 [target3] ...]]
```

You can use the Ant Launcher, which first appeared in Ant 1.6:

```
java -Dant.home=/home/steven/ant org.apache.tools.ant.launch.Launcher
     [options] [target [target2 [target3] ...]]
```

1.5.2. Executing Ant

If you want to use a build file named *build.xml* and want to run the default target, enter `ant` in the directory containing the build file:

```
%ant
```

For example, if you ran the build file from Example 1-2, that command gives this result:

```
-bash-2.05b$ ant
Buildfile: build.xml

compile:
    [javac] Compiling 1 source file

compress:
      [jar] Building jar: /home/httpd/vhosts/builder/Project.jar

main:
     [echo]
     [echo]             Building the .jar file.
     [echo]

BUILD SUCCESSFUL
Total time: 2 seconds
```

Each build file requires a default target, but you can specify the target(s) you want Ant to run via the command line. For example, add a target named `clean` to the build file (using Example 1-2 as a starting point):

```
<project default="main">
```

```
    <target name="main" depends="compile, compress">
        <echo>
            Building the .jar file.
        </echo>
    </target>

    <target name="compile">
        <javac srcdir="."/>
    </target>

  <target name="compress">
        <jar jarfile="Project.jar" basedir="." includes="*.class" />
  </target>

    <target name="clean">
        <delete file="*.class"/>
        <delete file="*.jar"/>
    </target>
</project>
```

You can then specify the `clean` target from the command line:

```
%ant clean
```

If you want to run multiple targets, you can list them (in the order they should be run):

```
%ant clean compile compress
```

> If you don't want to allow a target to be run from the command line, you can start the target name with a hyphen (e.g., `-clean`). This will make Ant think the target is a command-line option, and since `-clean` isn't a valid command-line option, Ant will refuse to run that target directly.

By default, the build file that Ant looks for is *build.xml*, but you can name the file as you want.

> The downloadable example code for Ant has multiple build filenames to make the separation of examples clearer.

For example, if you have a build file named *project.xml* that you want to use, you can specify that Ant should use that build file with `-f` (or `-file` or `-buildfile`):

```
%ant -f project.xml
```

If you use the `-find file` option, Ant will search for a build file first in the current directory, then in the parent directory, and so on, until a build file with the supplied name is found or the root of the filesystem is reached.

1.5.3. Customizable Environment Variables

Ant scripts, which start Ant, use some customizable environment variables:

`JAVACMD`

Holds the full path of the Java executable. Use this to launch a different JVM than `JAVA_HOME`*/bin/java(.exe)*.

`ANT_OPTS`

Command-line arguments that should be passed to the JVM unchanged.

`ANT_ARGS`

Ant command-line arguments. These may be used, for example, to point to a different logger, a new listener, or to include the `-find` flag in all invocations of Ant.

The Ant wrapper script for Unix will read the file *~/.antrc* before it starts running. On Windows, the Ant wrapper batchfile *ant.bat* invokes `%HOME%`*\antrc_pre.bat* at the start of the Ant process and `%HOME%`*\antrc_post.bat* at the end of that process. You can use these files to set or unset environment variables that should only be used during the execution of Ant.

1.5.4. Failed Builds

Every Ant developer has builds that fail for one reason or another. Ant does its best to pinpoint the problem. For example, say you misspelled the name of the `javac` task:

```
<?xml version="1.0" ?>
<project default="main">
    <target name="main" depends="compile, compress">
        <echo>
            Building the .jar file.
        </echo>
    </target>
```

```
    <target name="compile">
        <jjavac srcdir="."/>
    </target>
        .
        .
        .
```

Ant will diagnose this problem when it runs and give you some feedback:

```
%ant
build.xml:10: Could not create task or type of type: jjavac.

Ant could not find the task or a class this task relies upon.

This is common and has a number of causes; the usual
solutions are to read the manual pages then download and
install needed JAR files, or fix the build file:
 - You have misspelt 'jjavac'.
   Fix: check your spelling.
 - The task needs an external JAR file to execute
   and this is not found at the right place in the classpath.
   Fix: check the documentation for dependencies.
   Fix: declare the task.
 - The task is an Ant optional task and optional.jar is absent
   Fix: look for optional.jar in ANT_HOME/lib, download if needed
 - The task was not built into optional.jar as dependent
   libraries were not found at build time.
   Fix: look in the JAR to verify, then rebuild with the needed
   libraries, or download a release version from apache.org
 - The build file was written for a later version of Ant
   Fix: upgrade to at least the latest release version of Ant
 - The task is not an Ant core or optional task
   and needs to be declared using <taskdef>.

Remember that for JAR files to be visible to Ant tasks implemented
in ANT_HOME/lib, the files must be in the same directory or on the
classpath

Please neither file bug reports on this problem, nor email the
Ant mailing lists, until all of these causes have been explored,
as this is not an Ant bug.

Total time: 0 seconds
```

Sometimes errors won't stop a build, and you may want to change that behavior so the build will terminate when there's been any kind of problem. Most tasks have a`failonerror` attribute, which is set to false by default. Setting this attribute's value to true makes the build fail if the task encounters an error, allowing you to stop a build if a specific task generates errors.

Keep in mind that this won't affect your build in the case where you've previously executed the build and your output files are up to date. By default, Ant tasks check to see if the output files they're supposed to create are current (i.e., the output file is more recent than the files used to create it); if they are, Ant tasks won't recreate them because Ant considers the target executed. For example, here's what you'd see when you run the example build file a second timeAnt displays the names of the various targets but, because they're up to date, it doesn't execute them:

```
%ant
Buildfile: build.xml

compile:

compress:

main:
     [echo]
     [echo]             Building the .jar file.
     [echo]

BUILD SUCCESSFUL
Total time: 3 seconds
```

Ant doesn't come with a built-in debugger, which can make it tough to troubleshoot build files. However, one of the items under development in the Java Eclipse IDE is an Ant build file debugger. Chapter 11 has more on integrating Ant into Eclipse.

1.5.5. Verbose Output

You can control the amount of output Ant gives you when it runs with the `-verbose`, `-quiet`, and `-debug` command-line options. If you ask Ant to be quiet, it won't display anything except for build failure or success, total build time, and any text you specifically output via the `echo` task. Here's an example of a quiet build:

```
%ant -quiet
     [echo]
     [echo]             Building the .jar file.
     [echo]

BUILD SUCCESSFUL
Total time: 2 seconds
```

On the other side of the coin, the `-verbose` option gives you a lot more information than normal, including whether Ant is skipping up-to-date output files, what OS or JDK you're using, and a lot more. Here's what you might see from a verbose build on Unix:

```
-bash-2.05b$ ant -verbose
```

```
Apache Ant version 1.6.1 compiled on February 12 2004
Buildfile: build.xml
Detected Java version: 1.4 in: /opt/j2sdk1.4.2_02/jre
Detected OS: Linux
parsing buildfile /home/build.xml
Project base dir set to: /home
Build sequence for target `main' is [compile, compress, main]
Complete build sequence is [compile, compress, main, clean, ]

compile:
    [javac] Project.class skipped - don't know how to handle it
    [javac] Project.jar skipped - don't know how to handle it
    [javac] Project.java omitted as Project.class is up to date.
    [javac] build.xml skipped - don't know how to handle it

compress:
      [jar] Project.class omitted as Project.class is up to date.

main:
     [echo]
     [echo]             Building the .jar file.
     [echo]

BUILD SUCCESSFUL
Total time: 1 second
```

This output shows that Ant is skipping up-to-date output targets. Here's similar output in Windows:

```
%ant -verbose
Apache Ant version 1.6.1 compiled on February 12 2004
Buildfile: build.xml
Detected Java version: 1.4 in: C:\jdk1.4
Detected OS: Windows 2000
parsing buildfile C:\ant\ch01\build.xml with URI = file:///C:/ant/ch01/build.xml

Project base dir set to: C:\ant\ch01
Build sequence for target `main' is [compile, compress, main]
Complete build sequence is [compile, compress, main, clean, ]

compile:
    [javac] Project.class skipped - don't know how to handle it
    [javac] Project.jar skipped - don't know how to handle it
    [javac] Project.java omitted as Project.class is up to date.
    [javac] build.xml skipped - don't know how to handle it

compress:
      [jar] Project.class omitted as Project.class is up to date.

main:
     [echo]
     [echo]             Building the .jar file.
```

```
     [echo]

BUILD SUCCESSFUL
Total time: 2 seconds
```

The `-debug` options prints out even more informationoften pages of itwhich isn't reproduced here. Included in a debugging build is information about classes as they're loaded, classes that Ant looked for but couldn't find, the locations where Ant is picking up library files, and almost everything else you could think of.

Another useful command-line option for displaying information is the `-projecthelp` option, which prints out a list of the build file's targets. Targets that include a description attribute are listed as Main targets; those without a description are listed as "Subtargets", and then the "Default" target is listed.

Here's the example build file, with the addition of a `description` attribute for each `target` element:

```
<?xml version="1.0" ?>
<project default="main">
    <target name="main" depends="compile, compress" description="Main target">
        <echo>
            Building the .jar file.
        </echo>
    </target>

    <target name="compile" description="Compilation target">
        <javac srcdir="."/>
    </target>

  <target name="compress" description="Compression target">
        <jar jarfile="Project.jar" basedir="." includes="*.class" />
  </target>
</project>
```

Here's what you'd see when running Ant with the `-projecthelp` option:

```
%ant -projecthelp
Buildfile: build.xml

Main targets:

 compile   Compilation target
 compress  Compression target
 main      Main target
Default target: main
```

1.5.6. Logging and Libraries

You can log the output of running Ant using the `-logfile` option. For example, here's how you'd sent output to a file named *file.log*:

```
%ant -logfile file.log
```

You can log part of a build file's results with the `record` task; for example, if you were using the `javac` task to compile code and wanted to log the output of this task to a file named *log.txt*, you could start and stop that logging this way:

```
<record name="log.txt" action="start"/>
    <javac ... />
<record name="log.txt" action="stop"/>
```

Another handy option is the `-lib` option, which adds additional directories to be searched for *.jar* or *.class* files. Here's an example, which adds */home/ant/morejars* to the library search path:

```
%ant -lib /home/ant/morejars
```

The `-lib` option is useful when you're working on a system where you don't have access to the Ant *lib* directory as is often the case when dealing with Internet Service Providers (ISPs). Using this option, you can make sure Ant has access to JAR files needed for Ant's optional tasks without having to load them into directories you don't have permission to access.

> Before Ant 1.6, all JARS in the `ANT_HOME`*/lib* would be added to the `CLASSPATH` used to run Ant. Since Ant 1.6, two directories are scanned `ANT_HOME`*/lib* and *.ant/lib* in the Java user home directory. You can place additional library files in this directory if you don't have access to `ANT_HOME`*/lib*. The location of the Java user home directory depends on your JVM settings. In Unix, it's usually your home directory (so you'd store additional Ant libraries in, for example, */home/`username`/.ant/lib*). In Windows, it's usually *C:\Documents and Settings\\`username`* (so you'd store additional Ant libraries in *C:\Documents and Settings\\`username`\.ant\lib*). To determine where your Java user home is, use this element in a build file:
>
> ```
> <echo>${user.home}</echo>
> ```

Team LiB

Chapter 2. Using Properties and Types

In Chapter 1, you learned about properties and tasks in Ant. However, long tables with short descriptions do not an Ant expert make. In this chapter, you begin to get the details on using Ant's extensive feature set, which relies on two conerstones: properties and types. You received an introduction to them in the previous chapter, but here's where to get a real working knowledge.

In the examples from last chapter, building was a linear process: you compiled some files, you JARred them up, and then you were done. In the real world, things are almost never so straightforward. You need to be able to check for specific files and perform different tasks depending on the existence of those files. You need to respond to error conditions, and let the user know what has happened when errors do occur. You often need to deal with groups of files, copy them over en masse, and more. These kinds of tasks involve using properties and types.

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2.1. Using Properties to Control Tasks

Ant provides extensive support for controlling the build process; though Ant is not a programming language, it has a number of control structures, and those control structures rely on properties. As `if` and `TRy`/`catch` allow you to handle several logic paths in Java, Ant's control tasks allow you the same flexibility within the context of a build process.

2.1.1. Setting Conditions

The foundation to any type of control processing is some form of the `if` statement. This typically involves two steps:

1. Check or determine if a certain condition is true.
2. If the condition is true, perform one action; if it is false, perform another.

In Java, this all happens in a single line of code; in Ant, the condition must be set in one step, and the evaluation of that condition occurs in another step. First, you need to set a condition based on some criteria; not surprisingly, `condition` is the name of the task Ant provides. `condition` allows you to specify one or more true/false tests (sometimes called *criteria*). If all the criteria evaluate to true, a property, supplied to the `condition` task, is set to `TRue`; if one or more of the criteria evaluate to false, the property is assigned a `false` value. You can check that property's value later in the build file.

In this example, the build file checks to see if two files exist using the `available` task (covered later in the chapter) and sets the property `all.set` (to `true`) if the files are found:

```
<condition property="all.set">
  <and>
     <available file="file1.java"/>
     <available file="file2.java"/>
  </and>
</condition>
```

Here's another example where the build file checks to see if it's running on Mac OS but not Mac OS X which Ant treats as part of the Unix family:

```
<condition property="MacOs.Not.MacOsX">
  <and>
    <os family="mac"/>
    <not>
      <os family="unix"/>
    </not>
```

```
    </and>
  </condition>
```

Here's how you can set a property; in this case, called do.abort--if the do.delete property value equals "yes":

```
<condition property="do.abort">
  <equals arg1="yes" arg2="${do.delete}"/>
</condition>
```

You can see the attributes of the condition task in Table 2-1.

Table 2-1. The condition task's attributes

Attribute	Description	Required	Default
property	The property you want to set.	Yes	
value	The value you want to set the property to.	No	true

This task depends on nested elements for evaluation; you can see the possibilities in Table 2-2.

Table 2-2. Elements that can be nested within the condition task

Nested element	Functionality
and	True if all of its contained conditions are true.
available	Identical to the available task, which checks for the availabilty of files.
checksum	Identical to the Ant checksum task, which generates a checksum for files. If you compare two files that you think are the same, but their checksums are different, the files are different as well.
contains	Checks if one string (string) contains another (substring). Optionally, you can make the test case sensitive with the casesensitive attribute. The default is to make comparisons case insensitive.
equals	Checks whether two strings are identical. The strings are given using the (required) attributes arg1 and arg2. The optional attributes are casesensitive and TRim.
filesmatch	Checks to see whether two files have identical contents. The required attributes are file1 and file2.

Nested element	Functionality
http	Checks for a valid response from a web server at the specified URL. The required attribute is url, and the optional attribute is errorsBeginAt (the lowest HTTP response code that is an error).
isfalse	Behaves the same as istrue but returns the logically opposite value.
isreference	Checks if a particular reference has been defined. The required attribute is refid; the optional attribute is type, which holds the name of the datatype or task you expect this reference to be.
isset	Checks if a given property has been set. The required attribute is property.
istrue	Checks if a string equals any of the strings Ant considers true, that is, true, yes, or on. There is one required attribute: value (holds the value to test).
not	Logically negates the results of a condition.
or	True if at least one of the contained conditions is true.
os	True if the operating system matches the attributes you specify. The attributes (all optional) of this element are family ("windows", "dos", "unix", "mac", win9x, sunOS, etc.), name, arch (meaning architecture), and version.
socket	Checks for the existence of a TCP/IP listener. The required attributes are server (an IP address or DNS name) and port.
uptodate	Identical to the uptodate task. True if the target file is at least as up-to-date as its source code. The required attributes are property (the property to set), srcfile (source file to check), and targetfile (the file you want to check for up-to-dateness).

Here's an example that sets the property omit.debug.info to true if the property build.type contains *either* of the words "release" or "gold" *and* if the property explicitly.include.debug.info is false:

```
<condition property="omit.debug.info">
    <and>
        <or>
            <contains string="${build.type}" substring="release"/>
            <contains string="${build.type}" substring="gold"/>
        </or>
        <isfalse value="${explicitly.include.debug.info}"/>
    </and>
</condition>
```

Here's another example, which sets the property use.property.file true if the files build.properties *and* version.properties are available, *or* if the file *core.jar* is not current:

```
<condition property="use.property.file">
    <or>
        <and>
```

```
            <available file="build.properties"/>
            <available file="version.properties"/>
        </and>
        <not>
            <uptodate srcfile="core.java" targetfile="core.jar"/>
        </not>
    </or>
</condition>
```

2.1.2. Performing Conditional Actions

Actions can be conditionally executed based on two factors: if a certain condition has been met (using the `if` attribute) and if a certain condition has not been met (using the `unless` attribute). You can determine if a task runs using `if` and `unless` to check the values of properties. Three elements support `if` and `unless` attributes: `target`, `patternset` (which can group file-matching patterns like "*.java", "*.class", and so on. See "Working with Patterns" in this chapter); `fail` `target` is the simplest, as shown here:

```
<target name="buildModule" if="code.complied.OK"/>
        .
        .
        .
</target>
```

The `buildModule` target is executed only if the `code.complied.OK` property is true.

Example 2-1 demonstrates the `unless` attribute. In this case, the build file won't compile the source files if the file *enduser.agreement* exists, which sets a property named `final.version`.

Example 2-1. Using the unless attribute (ch02/if/build.xml)

```
<?xml version="1.0" ?>
<project default="main">

    <property name="message" value="Building the .jar file." />
    <property name="src" location="source" />
    <property name="output" location="bin" />
    <available file="${output}/enduser.agreement" property="final.version"/>

    <target name="main" depends="init, compile, compress">
        <echo>
            ${message}
        </echo>
    </target>

    <target name="init">
        <mkdir dir="${output}" />
    </target>
```

```
    <target name="compile" unless="final.version">
        <javac srcdir="${src}" destdir="${output}" />
    </target>

  <target name="compress">
        <jar destfile="${output}/Project.jar" basedir="${output}"
            includes="*.class" />
  </target>
</project>
```

2.1.3. Stopping Builds

You can make a build fail at runtime using property values and the `fail` task.

> The `fail` task has been made more useful since Ant 1.5 with the addition of support for the `if` and `unless` attributes.

For example, this build will fail with a message unless the specified classes are found in the classpath

```
<target name=
    <condition property="classes.available">
        <and>
            <available classname="org.steven.SAXparser" />
            <available classname="org.steven.DOMparser" />
        </and>
    </condition>
    <fail message="Could not find all classes." unless="classes.available" />
        .
        .
        .
</target>
```

You can see the available attributes of `fail` in Table 2-3.

Table 2-3. The fail task's attributes

Attribute	Description	Required	Default
`message`	A message indicating why the build exited	No	
`if`	Fails if the property of the given name is true in the current project	No	

Attribute	Description	Required	Default
unless	Fails if a property of the given name is false in the current project	No	

2.1.4. Property-Setting Tasks

A few tasks allow you to indirectly set properties; that is, you specify a task (like available) and assign the result of that task's processing to a property. These function are like the condition task, though the syntax is different.

2.1.4.1 Availability of resources

The available task sets a property to true if a resource is available at runtime. The resource can be a file, a directory, a class in the classpath, or a JVM system resource. If the resource is available, the property value is set to true; otherwise, the property is not set.

For example, the following build fragment will set the property Math.present to true if org.steve.Math is in Ant's classpath:

```
<available classname="org.steve.Math" property="Math.present"/>
```

Here's another example, which sets file.present to true if the file build.properties exists in the current directory:

```
<available file="build.properties" property="file.present"/>
```

You can see the attributes of this task in Table 2-4. You can set the property value to something other than the default by using the value attribute.

> This task is handy for setting properties that avoid or allow target execution depending on system parameters or the presence of various files. For example, you may want to load in properties from a property file (see Section 2.2 in this chapter) rather than use default values if that property file exists.

Table 2-4. The available task's attributes

Attribute	Description	Required	Default

Attribute	Description	Required	Default
classname	Class to search for.	One of classname, file, or resource	
classpath	Classpath to use when searching for classname or resource.	No	
classpathref	A reference to the classpath to use for searches.	No	
file	The file to search for.	One of classname, file, or resource	
filepath	The path to use when searching for a file.	No	
ignoresystemclasses	Set to true to ignore Ant's runtime classes in searches, using only the specified classpath instead. Affects the classname attribute.	No	false
property	The name of the property to set with the results of the search.	Yes	
resource	The resource to look for.	One of classname, file, or resource	
type	The type of file to look for. Set this to a directory (type="dir") or a file (type="file").	No	
value	Specifies the value you want to set the property to for a successful match.	No	TRue

2.1.4.2 Checking file modification dates

The uptodate task sets a property to true under certain conditions. In this case, the property is set to true if a target file, or set of target files, is more current than a source file or set of source files. You can specify the file you want to check with the targetfile attribute and the source file that is used to create it with the srcfile attribute. If you want to check a set of source files, use nested srcfiles elements. If the target (or targets) is current, based on the source file or files, the property whose name you specify will be set to true.

In this example, the property Do.Not.Build will be set to true if the target file, *classes.jar*, is current when compared to its source *.java* files:

```
<uptodate property="Do.Not.Build" targetfile="classes.jar" >
    <srcfiles dir= "${src}" includes="*.java"/>
</uptodate>
```

You can use the ** wildcard to stand for the current directory and any subdirectory of that directory, which makes it easy to work with a directory hierarchy in depth. For example, if you want to check the `${src}` directory for *.java* files, as in the previous example, and any subdirectory of `${src}`, you could set `includes` to `**/*.java`. Doing so would match the *.java* files in the `${src}` directory and in any subdirectories of `${src}`. Here's how that might look:

```
<uptodate property="Do.Not.Build" targetfile="classes.jar" >
    <srcfiles dir= "${src}" includes="**/*.java"/>
</uptodate>
```

Here's an example checking against a single source file, using the `srcfile` attribute:

```
<uptodate property="Do.Not.Build" targetfile="classes.jar" >
    <srcfile includes="/usr/local/bin/classes.java"/>
</uptodate>
```

You can see attributes for the `uptodate` task in Table 2-5.

Table 2-5. The uptodate task's attributes

Attribute	Description	Required	Default
`property`	The name of the property to set with the results of this task	Yes.	
`value`	The value you want to set the property to if the target is current	No.	`true`
`srcfile`	The file you want to check against the target file(s)	Yes, unless a nested `srcfiles` element is present	
`targetfile`	The file you want to check for current status	Yes, unless a nested `mapper` element is present	

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2.2. Using Property Files

In larger build files, you might be working with dozens of properties, and storing them in property files i common. Setting tens, or hundreds, of properties all within a build file is a bad habit to get into and almost impossible to maintain.

Using property files means that you can quickly tailor a build file to different sets of circumstances by swapping property files. And you can store property values; though we've been using mostly true/false properties to make conditional processing easier, they can hold all kinds of textual data, such as copyright notices and legal information, in a central repository everyone can share.

> You can specify a property file to use on the command line with the `-propertyfile` option.

Take a look at Example 2-2, which uses a property file to hold a property named `message`. This example points to the property file with the `property` task's `file` attribute, which can hold the fully qualified name of the file. You can use the `property` task's `url` attribute to point to a property file.

Example 2-2. Using a property file (ch02/properties/build.xml)

```
<?xml version="1.0" ?>
<project default="main">

    <property file="build.properties" />
    <property name="src" location="source" />
    <property name="output" location="bin" />

    <target name="main" depends="init, compile, compress">
        <echo>
            ${message}
        </echo>
    </target>

    <target name="init">
        <mkdir dir="${output}" />
    </target>

    <target name="compile">
        <javac srcdir="${src}" destdir="${output}" />
    </target>

  <target name="compress">
        <jar destfile="${output}/Project.jar" basedir="${output}" includes="*.class" />
```

```
  </target>
</project>
```

Here are the entire contents of another sample file, *build.properties* , which uses a *`name = value`* format for each property:

```
message=Building the .jar file.
```

Using the build file from Example 2-2 , here's the output from running Ant; note the value of the `message` property was picked up correctly from *build.properties* :

```
%ant
Buildfile: build.xml

init:
    [mkdir] Created dir: /home/steve/ch02/properties/bin

compile:
    [javac] Compiling 1 source file to /home/steve/ch02/properties/bin

compress:
      [jar] Building jar: /home/steve/ch02/properties/bin/Project.jar

main:
     [echo]
     [echo]             Building the .jar file.
     [echo]

BUILD SUCCESSFUL
Total time: 3 seconds
```

Properties in external files are stored as text strings, suitable for properties of the kind you'd set with the `property` task's `value` attribute.

> Ant has an optional task, `propertyfile` , that lets you edit property files. This can be useful when you need to make unattended modifications to configuration files when deploying to servers.

2.2.1. Loading Text

You can use the `loadfile` task to load a text file into a single property. Here's an example that loads the property `message` with the text in the file *message.txt* :

```
<loadfile property="message"
    srcFile="message.txt"/>
```

You can see the attributes of this task in Table 2-6.

Table 2-6. The loadfile task's attributes

Attribute	Description	Required	Default
srcFile	Indicates the source file	Yes	
property	Indicates the property you want to store the text in	Yes	
encoding	Indicates the encoding you want to use when reading text from the file	No	
failonerror	Set to true if you want to halt the build if this task failed	No	TRue

2.2.2. Overriding Properties

Take a look at Example 2-3, defining a property named message twice ("Building the .jar file.") and then redefining it ("Compiling and compressing.").

Example 2-3. Overriding a property (ch02/overriding/build.xml)

```
<?xml version="1.0" ?>
<project default="main">

    <property name="message" value="Building the .jar file." />
    <property name="src" location="source" />
    <property name="output" location="bin" />
    <property name="message" value="Compiling and compressing." />

    <target name="main" depends="init, compile, compress">
        <echo>
            ${message}
        </echo>
    </target>

    <target name="init">
        <mkdir dir="${output}" />
    </target>

    <target name="compile">
        <javac srcdir="${src}" destdir="${output}" />
    </target>

  <target name="compress">
        <jar destfile="${output}/Project.jar" basedir="${output}" includes="*.class" />
  </target>
</project>
```

This attempts to override the property with a new definition. Once you define a property in a build file, i behaves much like a constantie., you can't redefine it inside the build file. So, when you run Ant using this build file, you'll see the first version of the property:

```
init:
    [mkdir] Created dir: /home/steve/ch02/properties/bin

compile:
    [javac] Compiling 1 source file to /home/steve/ch02/properties/bin

compress:
      [jar] Building jar: /home/steve/ch02/properties/bin/Project.jar

main:
     [echo]
     [echo]            Building the .jar file.
     [echo]

BUILD SUCCESSFUL
Total time: 3 seconds
```

When Ant sees a property defined, whether in a build or a property file, it considers that property defined. You can't change it.

Except in one way. (Of course! Who wants a language without exceptions?)

If you want to override a property in a build file, you can set properties on the command line. That can be done with the `-Dproperty=value` option, where property is the `name` of the property and `value` is the value for that property. If you specify a property set in the build file, the value specified on the command line will override the value specified in the build file.

Here's how to do that:

```
%ant -Dmessage="Compiling and compressing"
Buildfile: build.xml

init:
    [mkdir] Created dir: /home/steve/ch02/properties/bin

compile:
    [javac] Compiling 1 source file to /home/steve/ch02/properties/bin

compress:
      [jar] Building jar: /home/steve/ch02/properties/bin/Project.jar

main:
     [echo]
     [echo]            Compiling and compressing
     [echo]
```

```
BUILD SUCCESSFUL
Total time: 3 seconds
```

The value on the command line overrides both of the values within the build file.

2.2.3. Setting Properties Using Environment Variables

You can access environment variables with the `property` element's `environment` attribute, which sets the prefix to use for environment variables ("env" is customary in Ant files); after you set that prefix, you can reference environment variables by name using that prefix. Here's an example build file that displays the value of `ANT_HOME`:

```
<project default="main">

    <property file="build.properties" />
    <property name="src" location="source" />
    <property name="output" location="bin" />
    <property environment="env" />

    <target name="main" depends="init, compile, compress">
        <echo>
            ${env.ANT_HOME}
        </echo>
    </target>
        .
        .
        .
```

Here's the result of running Ant using this build file:

```
%ant
Buildfile: build.xml

init:

compile:

compress:

main:
     [echo]
     [echo]             C:\ant\apache-ant-1.6.1
     [echo]

BUILD SUCCESSFUL
Total time: 2 seconds
```

It's easy to pass environment variables from the command line as well; use `-D` *VAR* `=%` *ENV_VAR* `%` (Windows) or `-D` *VAR* `=$` *ENV_VAR* (Unix). You can then access these variables inside your build file as `${` *VAR* `}` .

You've got a good handle on properties at this point, and they're a major building block of Ant build files. The next step up is to work with the built-in Ant *types* .

Team LiB

2.3. Handling Data Using Types

Ant supports a number of types, and the rest of this chapter is devoted to understanding them and how to work with them. These types work much like data types in programming languages, and as you're going to see, types and properties are intertwined. The data structures you create using types can be assigned to properties, and the data you use to set up those data structures is often stored in properties. Now that you've got properties under your belt, it's time to move on to types.

Much of what a build tool like Ant does is work with files in directory structures, so you might expect that many of the Ant types have to do with handling files and directories. You can see the available Ant core (that is, built-in) types in Table 2-7.

Table 2-7. Core Ant types

Type	Description
Assertions	Enables, or disables, Java 1.4 assertions
Description	Holds a description of the project that can be viewed if you use the `Ant -projecthelp` command
DirSet	Contains a group of directories
FileList	Contains a named list of files
FileSet	Contains a groups of files
File mappers	Maps original filenames to a new set of names
FilterChains	Contains a group of ordered `FilterReader`s
FilterSet	Contains a group of filters
PatternSet	Contains a group of filename-matching patterns
Path-like structures	Includes a wide variety of support for specifying file paths
Permissions	Contains the security permissions given to the code as executed in the JVM where Ant is currently running
PropertySet	Groups a set of properties together
Selectors	Groups files in a `fileset` selected using criteria other than filename, as provided by the `include` and `exclude` tags
XMLCatalog	Contains a catalog of public XML resources, such as DTDs or entities
ZipFileSet	Contains a special form of a `fileset`, using ZIP files

Many Ant tasks in the upcoming chapters depend on the types you see inTable 2-7, so it's worth going through them in detail, especially the ones that handle files. Understanding Ant types is centra to using Ant; if you don't understand paths andFileSets, for example, you'll be severely hampered by what you can do with Ant.

2.3.1. Path-Like Structures

In Ant, paths are often handled by the path type, called a*path-like structure*. As you can imagine, you have to work with paths frequently. For example, a task likejavac supports the path attributes srcdir, classpath, sourcepath, bootclasspath, and exTDirs, all of which are handled as path-like structures. That means you can set them as attributes:

```
<javac destdir="${build}"
       classpath="classes.jar"
       srcdir="${src}"/>
       debug="on">
</javac>
```

You can set paths as nested elements, not just as attributes, and you do that with thesrc, classpath, sourcepath, bootclasspath and exTDirs elements. For the javac task, the srcdir attribute becomes the src element. Nested elements are a good idea when you have multiple paths you want to work with that would otherwise be assigned to the same attribute. Here's an example:

```
<javac destdir="${build}"
       classpath="classes.jar"
       debug="on">
  <src path="${src}"/>
  <src path="${src2}"/>
</javac>
```

In addition, when you want to specify path-like values, a nested element can be used with internal pathelement elements, which specify paths, like this:

```
<javac destdir="${build}"
       classpath="classes.jar"
       debug="on">
  <src path="${src}"/>
  <src>
    <pathelement path="${src2}"/>
    <pathelement path="${src3}"/>
  </src>
</javac>
```

In pathelement, the location attribute specifies a single file or directory relative to the project's base directory (or an absolute filename), while thepath attribute holds colon-separated or semicolon-separated lists of locations (such as "classes.jar;classes2.jar").

> You can separate directories with a `/` or a `\` on any platform.

If you want to build your own paths and reference them later, you can use the `path` element with enclosed `pathelement` elements. For example, to create a new path and give it the ID `build.classpath`, you can use this `path` element and then refer to the new path with the `refid` attribute that path-like structure elements support:

```
<path id="build.classpath">
      <pathelement path="${classes}"/>
      <pathelement path="${classes2}"/>
</path>

<target name="compile">
    <javac destdir="${build}"
         classpath="classes.jar"
         debug="on">
    <src path="${src}"/>
    <classpath refid="build.classpath"/>
  </javac>
</target>
```

> If a task supports path-like structures, you can specify paths using the attributes of the task, nested elements with names that correspond to those attributes, or with a reference to a path you've explicitly created with `path`.

2.3.2. Working with Groups of Files

`FileSet`s are types that represent groups of files, and they're common in Ant because handling a group of files is a common thing to do. The `fileset` element can contain nested `include`, `includesfile`, `exclude` and `excludesfile` elements; here's an example using `fileset`, as well as `include` and `exclude`:

```
<fileset dir="${source}">
    <include name="**/*.java"/>
    <exclude name="**/*test*"/>
</fileset>
```

Here's an example that lets you include certain files using the `filename` selector (more on selectors later in this chapter):

```
<fileset dir="${source}">
```

```
    <filename name="**/*.java"/>
    <filename name="test.cpp"/>
</fileset>
```

Many Ant tasks support file sets, such as the copy task (see Chapter 4); here's an example, which copies all but *.java* files from the src directory to the dest directory:

```
<copy todir="../dest">
    <fileset dir="src">
        <exclude name="**/*.java"/>
    </fileset>
</copy>
```

You can see the attributes of the fileset type in Table 2-8.

> FileSets can appear inside tasks that support file sets or at the same level as target (as when you want to assign a file set to a property).

Table 2-8. The fileset type's attributes

Attribute	Description	Required	Default
casesensitive	Specifies whether the include and exclude patterns be treated in a case-sensitive way.	No.	true
defaultexcludes	Specifies whether default excludes will be used or not (yes or no). Default excludes *are* used when omitted.	No.	TRue
dir	Specifies the root of the directory tree used to create this FileSet..	dir or file must be specified.	
excludes	Specifies a list (comma- or space-separated) of patterns of files that you want to exclude.	No.	
excludesfile	Specifies a file; each line of this file is used as an exclude pattern.	No.	
file	A shortcut for creating a single file fileset.		
followsymlinks	Specifies whether you want symbolic links to be followed. Defaults to true.	No.	
includes	Specifies a list of patterns for files that you want included. Comma- or space-separated.	No.	
includesfile	Specifies the name of a file; each line in the file will be used as an include pattern.	No.	

As mentioned, the `fileset` element can contain `include`, `includesfile`, `exclude` and `excludesfile` elements, and you can see the allowed attributes of these elements in Table 2-9. The `fileset` element can contain `patternset` and selector elements, which you'll see later in this chapter.

Table 2-9. The include, includesfile, exclude and excludesfile type's attributes

Attribute	Description	Required	Default
`If`	If the corresponding property is true, use this pattern.	No	
`Name`	Pattern to include/exclude (for `include` and `exclude` types) or the name of the file holding the patterns to include/exclude (for `includesfile` and `excludesfile` types).	Yes	
`unless`	If the corresponding property is *not* set, use this pattern.	No	

Some tasks form *implicit* file sets, such as the `javac` task. This means that a task supports all attributes of `fileset` (see Table 2-8). You don't have to use a nested `fileset` element at all if you don't want to because the built-in attributes of the task give you all the support you need. Each time we come across such a task, I'll be sure to mention this.

> The FileSet `dir` attribute becomes `srcdir` in the `javac` task because a `dir` attribute would be ambiguous in the `javac` task: Is it the source or destination directory?

2.3.2.1 Default excludes

Some files are excluded by default from file sets since they correspond to system or temporary files of various kinds. Here are the patterns excluded by default (recall that ** means the current directory, or any subdirectory of the current directory):

- `**/*~`
- `**/#*#`
- `**/.#*`
- `**/%*%`
- `**/._*`
- `**/CVS`

- `**/CVS/**`
- `**/.cvsignore`
- `**/SCCS`
- `**/SCCS/**`
- `**/vssver.scc`
- `**/.svn`
- `**/.svn/**`
- `**/.DS_Store`

> If you do not want these default excludes applied, you can disable them with `defaultexcludes="no"` in types such as `FileSet`s. You can modify the list of default excludes by using the `defaultexcludes` task.

2.3.3. Working with Groups of Directories

Directory sets (DirSets) are types corresponding to groups of directories. This type is great for grouping directories together and handling them at one time with various tasks. DirSets can appear inside various tasks or at the same level as `target`; like file sets, directory sets can contain nested `include`, `includesfile`, `exclude`, `excludesfile`, and `patternset` elements. Here's an example:

```
<dirset dir="${build.dir}">
    <include name="apps/**/classes"/>
    <exclude name="apps/**/*Test*"/>
</dirset>
```

You can find the attributes of this type in Table 2-10.

Table 2-10. The dirset type's attributes

Attribute	Description	Required	Default
`casesensitive`	Specifies whether you want to use case sensitivity.	No	`true`
`dir`	Contains the root of the directory tree you want to use.	Yes	
`excludes`	A list of the patterns matching directories you want exluded. Comma- or space-separated list.	No	
`excludesfile`	Specifies a name of a file; each line of the file is interpreted as an `exclude` pattern.	No	

Attribute	Description	Required	Default
`followsymlinks`	Set to true if you want symbolic links to be followed.	No	`true`
`includes`	A list of the patterns matching directories you want included. Comma- or space-separated list.	No	
`includesfile`	Specifies a name of a file; each line of the file is interpreted as an `include` pattern.	No	

2.3.4. Creating Lists of Files

FileLists are types corresponding to explicitly named lists of files. While FileSets act as filters, returning only those files that exist in the filesystem and match specified patterns, FileLists are usefu for specifying files individually. Here's an example:

```
<filelist
    id="docfiles"
    dir="${doc}"
    files="type.html,using.html"/>
```

You can see the filelist attributes in Table 2-11.

FileLists are not supported by as many tasks as FileSets are. You might try using a FileSet with nested `filename` elements to add individual files to the FileSet.

Table 2-11. The filelist type's attributes

Attribute	Description	Required
`dir`	The base directory you want to use for this file list	Yes
`files`	A comma-separated list of filenames to include in the file list	Yes

2.3.5. Working with Patterns

A powerful way of working with multiple files is to use patterns, such as the pattern "*.java", which will match all files with the extension *.java*, "*.class", which matches files with the extension *.class*, and so on. If you want to work with multiple patterns simultaneously in Ant, patterns can be groupec into sets and later referenced by their `id` attribute. These sets are defined with the `patternset` type, which can appear nested into a FileSet or an implicit FileSet.

Here's an example, where I'm creating a file set, using a pattern set, that will match all of a project's documentation files, excluding beta documentation:

```
<fileset dir="${src}" casesensitive="yes">
    <patternset>
        <include name="docs/**/*.html"/>
        <include name="prof/**/*.html" if="professional"/>
        <exclude name="**/*beta*"/>
    </patternset>
</fileset>
```

You can see the attributes of this type in Table 2-12.

Table 2-12. The patternset type's attributes

Attribute	Description
`excludes`	A list of the patterns matching files you want exluded. Comma- or space-separated list.
`excludesfile`	Specifies a name of a file; each line of the file is interpreted as an `exclude` pattern.
`includes`	A list of the patterns matching files you want included. Comma- or space-separated list.
`includesfile`	Specifies a name of a file; each line of the file is interpreted as an `include` pattern.

PatternSets can include nested `include`, `includesfile`, `exclude`, and `excludesfile` elements, and you can nest PatternSets within one another.

2.3.6. Selectors

Besides all the types we've seen, selectors are powerful types and go far beyond selecting files based on filenames. They let you select files that make up a file set based on many criteria, such as what text a file contains, the date a file was modified, the size of a file, and more. Selectors have become one of the coolest things in Ant, and you can see Ant's core selectors, which come built into Ant, in Table 2-13.

Table 2-13. The core selectors

Selector	Means
`contains`	Selects files that contain particular text
`containsregexp`	Selects files whose contents contain text that matches a given regular expression

Selector	Means
date	Selects files that were modified before a particular date and time, or that date and time
depend	Selects files that were modified more recently than files you compare them to
depth	Selects files based on how far down they appear in a directory tree
different	Selects files that are different from a set of target files you specify
filename	Selects files using a pattern to match filenames
modified	Selects files if an algorithm gives a different result from that stored
present	Selects files based on their presence, or absence, at some other location
size	Selects files larger or smaller than a particular size
type	Selects files based on their type: regular files or directories

You can nest selectors inside file sets to select the files you want. For example, here's how to create a file set of HTML documentation files that contain the text "selector" using the contains selector:

```
<fileset dir="${docs}" includes="**/*.html">
    <contains text="selector" casesensitive="no"/>
</fileset>
```

The date selector lets you choose file sets based on date, as here, where I'm selecting all documentation files before 1/1/2005:

```
<fileset dir="${docs}" includes="**/*.html">
     <date datetime="01/01/2005 12:00 AM" when="before"/>
</fileset>
```

You can use the filename selector much like the include and exclude tags inside a fileset. Here's an example:

```
<fileset dir="${source}" includes="**/*">
    <filename name="**/*.cpp"/>
</fileset>
```

The containsregexp selector limits the files in a fileset to only those whose contents contain a match to the regular expression specified by the expression attribute:

```
<fileset dir="${source}" includes="*.java">
    <containsregexp expression="$println(.);"/>
</fileset>
```

The type tag selects files of a certain type: directory or regular. Here's an example:

```
<fileset dir="${src}">
    <type type="dir"/>
</fileset>
```

FileSets are no longer about filenames. Now you've got access to more data, including what's inside files.

> Selectors can be defined outside of any target by using the `selector` tag and using them as references.

2.3.7. File Filters

Filters let you filter the data in files, modifying that data if you want to. FilterSets are groups of filters, and you can use filters to replace tokens in files with new content. For example, say that your files contain a token, like `@DATE@`; you can use filters and a filter set to copy those files with the `copy` task, while replacing that token with the current date. You can find the attributes of the `filter set` type in Table 2-14; to use FilterSets, you can use the filter task, which is coming up next (with examples).

> When a `filter set` is used in an operation, the files are processed in text mode and the filters applied line by line. This means that the copy operations will typically corrupt binary files.

Table 2-14. The filter set type's attributes

Attribute	Description	Required	Default
`begintoken`	The string, usually a character, that specifies the beginning of a token (e.g., @ in `@AUTHOR#`)	No	`@`
`endtoken`	The string, usually a character, that specifies the end of a token (e.g., # in `@AUTHOR#`)	No	`@`
`id`	The ID you want to use for this filter set	No	
`refid`	The ID of a filter set you want to use while creating this filter set	No	

You specify the filters inside a `filter set` with the `filter` task, coming up next.

2.3.7.1 Using the filter task

The filter task supports the actual filters in a filter set. Here's a filter set example where the build file instructs Ant to copy *build.java* from the ${archives} directory to the ${source} directory, and replace the token @DATE@ in the files with today's date:

```
<copy file="${archives}/build.java" toFile="${source}/build.java">
    <filter set>
        <filter token="DATE" value="${TODAY}"/>
    </filter set>
</copy>
```

Here's the same example where the token to replace is %DATE;:

```
<copy file="${archives}/build.java" toFile="${source}/build.java">
    <filter set begintoken="%" endtoken=";">
        <filter token="DATE" value="${TODAY}"/>
    </filter set>
</copy>
```

You can define a FilterSet and reference it later:

```
<filter set id="today.filter" begintoken="%" endtoken=";">
    <filter token="DATE" value="${TODAY}"/>
</filter set>

<copy file="${archives}/build.java" toFile="${source}/build.java">
    <filter set refid="today.filter"/>
</copy>
```

> If you just want to replace text in a file, you can use the Ant replace task. Here's an example:
>
> ```
> <replace file="${src}/index.html"
>          token="author" value="Ted"/>
> ```
>
> You can use the concat task, designed to concatenate files together, to concatenate text to the end of a file, like this:
>
> ```
> <concat
>     destfile="readme.txt">Copyright (C) 2005</concat>
> ```

You can see the attributes of this task in Table 2-15.

Table 2-15. The filter task's attributes

Attribute	Description	Required
filtersfile	The file from which you want filters to be read (you format this file like a property file).	Token and value attributes must be provided, or only the filtersfile attribute.
token	The token string to match (omit the beginning and end tokens).	Token and value attributes must be provided, or only the filtersfile attribute.
value	The string to replace the token with.	Token and value attributes must be provided, or only the filtersfile attribute.

2.3.8. Filtering and Modifying Text with FilterChains and FilterReaders

A FilterReader filters text and can modify that text. A FilterChain is a group of FilterReaders, applied in order, and functions much like piping one command to another in Unix. Using FilterReaders and FilterChains, you can process text data in advanced ways. A number of Ant tasks support filterchain elements:

- concat
- copy
- loadfile
- loadproperties
- move

You can create filter chains with your own Java classes or with one of the elements you see in Table 2-16.

Table 2-16. FilterChain nested elements

Element	Does this
classconstants	Filters and outputs constants as defined in a Java class.
concatfilter	Appends a file to the filtered file, or prepends a file to the filtered file. Two optional attributes: prepend (name of the file to prepend) and append (name of the file to append).
deletecharacters	Deletes characters that you specify in the filtered content. The required attribute, chars, holds the characters to delete.

Element	Does this
escapeunicode	Changes non US-ASCII characters into the matching Unicode escape sequence (\ plus 4 digits).
expandproperties	Replaces Ant properties (of the form ${...}) with the property's actual value.
filterreader	Defines a generic filter. Has one parameter, the required classname attribute. Supports classpath and param nested elements.
headfilter	Reads the header, that is, the first few lines, from the filtered data. Supports two optional attributes: lines (number of lines to read) and skip (number of lines from the beginning to skip).
linecontains	Filters out those lines that don't include lines that contain specified strings. One required attribute: contains (the substring to search for).
linecontainsregexp	Filters out lines that don't contain text-matching specified regular expressions. One required attribute: regexp (Pattern of the substring to be searched for).
prefixlines	Adds a prefix to every line. Required attribute: prefix (the prefix to use).
replacetokens	Filters text and replaces text between begintoken and endtoken with the text you specify.
stripjavacomments	Strips Java comments.
striplinebreaks	Strips line breaks from the filtered data. Set the optional linebreaks attribute to the line break text.
striplinecomments	Filters out lines that start with comments, as you specify. Set the comment attribute to the string that starts the line.
tabstospaces	Filters out tabs and replaces them with spaces (default is 8).
tailfilter	Reads the tail of the text, that is, the last few lines from the filtered text. Supports two optional attributes: lines (number of lines to read) and skip (number of lines from the end to skip).
tokenfilter	Tokenizes the filtered text into strings. One optional attribute: delimOutput (overrides the tokendelimiter returned by the tokenizer).

Each of these filters correspond to a Java class; for example, the head filter corresponds to org.apache.tools.ant.filters.HeadFilter. Here are a few examples: Suppose you want to read the first three lines of the file given by ${sourcefile} into the property sourcefile.header. You could use filterreader and the Ant filter reader class org.apache.tools.ant.filters.HeadFilter:

```
<loadfile srcfile="${sourcefile}" property="sourcefile.header">
    <filterchain>
        <filterreader classname="org.apache.tools.ant.filters.HeadFilter">
            <param name="lines" value="3"/>
        </filterreader>
    </filterchain>
</loadfile>
```

Ant gives you a shortcut with filter readers like this one, where you can use a task named `headfilter` to do the same thing:

```
<loadfile srcfile="${sourcefile}" property="sourcefile.header">
  <filterchain>
    <headfilter lines="3"/>
  </filterchain>
</loadfile>
```

The `linecontains` filter reader includes only those lines that contain all the strings you specify with `contains` elements. Here's an example, where I'm filtering only lines containing "apples" and "oranges":

```
<linecontains>
  <contains value="apples">
  <contains value="oranges">
</linecontains>
```

The `linecontainsregexp` filter reader includes only those lines that match the regular expression you've specified. For example, here's how to match only lines that contain lowercase letters:

```
<linecontainsregexp>
    <regexp pattern="^[a-z]$">
</linecontainsregexp>
```

The `stripjavacomments` filter reader strips away comments from the data, using Java syntax guidelines. Here's an example:

```
<loadfile srcfile="${src.file}" property="java.text">
    <filterchain>
        <stripjavacomments/>
    </filterchain>
</loadfile>
```

The `striplinecomments` filter reader removes all those lines that begin with strings that represent comments as specified by the user. For example, here's how to remove all lines that begin with `#`, `REM`, `rem`, and `//`:

```
<striplinecomments>
    <comment value="#"/>
    <comment value="REM "/>
    <comment value="rem "/>
    <comment value="//"/>
</striplinecomments>
```

The `tabstospaces` filter reader replaces tabs with spaces; here's an example:

```
<loadfile srcfile="${src.file}" property="src.file.detabbed">
    <filterchain>
        <tabstospaces/>
    </filterchain>
</loadfile>
```

The `classconstants` filter readers recovers constants defined in Java *.class* files. For example, say that you have a constant named `MAXFILES`:

```
public interface Files
{
    public static final String MAXFILES ="4";
}
```

To load the `MAXFILES` constant and make it accessible by name, you can use the `loadproperties` task and the `classconstants` filter reader:

```
<loadproperties srcfile="Files.class">
  <filterchain>
    <classconstants/>
        .
        .
        .
  </filterchain>
</loadproperties>
```

As you can gather from the name, you can use multiple filter readers in a filter chain, and we'll add the `prefixlines` filter reader to prefix constants we recover with the text "Files.":

```
<loadproperties  srcfile="Files.class">
  <filterchain>
    <classconstants/>
    <prefixlines prefix="Files."/>
  </filterchain>
</loadproperties>
```

Now you've recovered the constant `Files.MAXFILES` from a compiled *.class* file, and can display it with `echo`:

```
<echo>${Files.MAXFILES}</echo>
```

2.3.9. Transforming One Set of Files to Another with Mappers

Mappers are another Ant type, and they're used to map one set of files to another. For example, one of the mappers available in Ant is the `regexp` mapper that lets you grab a set of files and rename them. You can use mappers in `copy`, `move`, `apply`, `uptodate`, and a number of additional tasks.

Here's an example, where I'm copying a file set from a directory named*development* to a directory named *backup*, renaming *.java* files to *.backup* files. This works because whatever matches to the expression inside the parentheses in the regular expression in the`from` attribute can be referenced in the `to` attribute as `\1`; a match to a second pair of parentheses may be referenced as`\2`, and so on:

```
<copy todir="backup">
    <fileset dir="development" includes="**/*.java"/>
     <mapper type="regexp" from="([a-z]*).java" to="\1.backup" />
</copy>
```

Another mapper is the `flatten` mapper, which lets you copy files while stripping off any directory information from the filenames. That's how mappers typically work; you specify a file set and then add a mapper to refine or manipulate the set of files you want to work with.

To use a mapper, you use the Ant `mapper` element, which has the attributes you see in Table 2-17.

> The mapper `classpath` attribute holds a path, which means you can use a nested `classpath` element if you prefer.

Table 2-17. Mapper attributes

Attribute	Description	Required	Default
`classname`	Specifies the mapper using a class name	Either `type` or `classname`	
`classpath`	Specifies the classpath you want used when searching for `classname`	No	
`classpathref`	Specifies the classpath to use	No	
`from`	Sets the value of the `from` attribute	Depends on implementation	
`to`	Sets the value of the `to` attribute	Depends on implementation	
`type`	Specifies a built-in mapper	Either `type` or `classname`	

Experience shows that Ant will *not* automatically convert `/` or `\` characters in the `to` and `from` attributes to the correct directory separator for your current platform. If you need to specify a directory separator here, use `${file.separator}`.

What mappers can you use with the `mapper` element? You can see the available Ant mappers in Table 2-18.

Table 2-18. Ant mappers

Mapper	Does this
flatten	Flattens the target filename to the source filename but with all directory information stripped off from the front. To and from attributes are ignored.
glob	Lets you support wildcards (*) in the to and from attributes.
identity	Copies over the filename by making the target filename the same as the source filename. To and from attributes are ignored.
merge	Takes the target filename from the to attribute (from will be ignored).
package	Helps with Java package names by replacing directory separators with dots.
regexp	Lets you use regular expressions on the to and from values.
unpackage	Replaces any dots in the name of a package with legal directory separators (available since Ant 1.6).

When you use the identity mapper, the target filename is the same as the source filenamein other words, this one's transparent to Ant. Here's the way you'd use this mapper in a file set:

```
<mapper type="identity"/>
```

The flatten mapper is more interesting; this one strips all leading directory information off, allowing you to copy all files in a directory tree to a single directory. Here's an example:

```
<copy todir="backup">
    <fileset dir="development" includes="**/*.java"/>
    <mapper type="flatten" />
</copy>
```

The merge mapper copies multiple files to the same target file. Here's an example:

```
<mapper type="merge" to="backup.tar"/>
```

In the glob mapper, you can use filename patterns in the to and from attributes, and those patterns may contain at most one asterisk (*):

```
<copy todir="backup">
    <fileset dir="development" includes="**/*.java"/>
    <mapper type="glob" from="*.java" to="*.old"/>
</copy>
```

The regexp mapper lets you use regular expressions in the to and from attributes. You can create regular expression matches using parentheses in the `to` attribute value and refer to the matched values as `\1` through `\9` in the `from` attribute value. We've seen an example of this mapper at work:

```
<copy todir="backup">
    <fileset dir="development" includes="**/*.java"/>
     <mapper type="regexp" from="([a-z]*).java" to="\1.backup" />
</copy>
```

> For more on regular expressions, see *Mastering Regular Expressions* by Jeffrey Friedl (O'Reilly).

The `package` mapper is an interesting one as it replaces directory separators found in the matched source pattern with dots in the target pattern placeholder, reproducing Java package syntax. This inspiration here is that this mapper was designed to be useful to flatten directory structures where files have the fully qualified classname as part of their name (this mapper was designed for use with the `uptodate` and `junit` tasks). Here's an example:

```
<mapper type="package"
    from="*Beta.java" to="Beta*Beta.xml"/>
```

For example, if you used this mapper element on *org/steve/tools/ant/util/AntTaskBeta.java*, it will create *Beta.org.steve.tools.ant.util.AntTaskBeta.xml*, flattening the directory structure but still letting you see where files come from.

The `unpackage` mapper, new since Ant 1.6, is the reverse of the `package` mapper; that is, it replaces dots in a package name with directory separators. Here's an example:

```
<mapper type="package"
    from="Beta*Beta.xml" to="*Beta.java"/>
```

This is a useful one if you want to restore the original directory structure after flattening it with the `package` mapper. This example will take files such as *Beta.org.steve.tools.ant.util.AntTaskBeta.xml* back to *org/steve/tools/ant/util/AntTaskBeta.java*.

downloaded from: lib.ommolketab.ir

Chapter 3. Building Java Code

Ant is the premiere build tool for Java developers, and this chapter focuses on the Java build process from compiling Java code with the `javac` task through compressing and packaging the results with tasks such as `jar` and `tar`. Along the way, I'll discuss several central build issues, such as keeping track of the build number, storing that number in a JAR file's manifest file, getting input from the user and acting on that input, calling one Ant target from another, creating Javadoc with the `javadoc` task, and more.

3.1. Compiling Code

The javac task compiles Java source code. You've seen javac at work many times in this book but haven't exhausted what this task has to offer by any means. You can get an idea how extensive a task it is by its huge number of attributes, shown in Table 3-1.

Table 3-1. The javac task's attributes

Attribute	Description	Required	Default
bootclasspath	Specifies where to find any bootstrap class files.	No	
bootclasspathref	Specifies where to find any bootstrap class files, given as a reference.	No	
classpath	Specifies the classpath you want to use.	No	
classpathref	Specifies the classpath you want to use, given as a reference to a path.	No	
compiler	Specifies the compiler you want to use. If you don't set this attribute, this task will use the compiler pointed to by the build.compiler property, if set. If that property is not set, the default compiler for the current JVM is used.	No	
debug	Specifies whether or not your code should be compiled to include debug data. Corresponds to the compiler's -g option.	No	no
debuglevel	Specifies keywords that will be added to the command line with the -g switch. Possible values are none or a comma-separated list of these keywords: lines, vars, and source. This attribute requires debug to be set to true; if it's not, this attribute is ignored.	No	
depend	Specifies that you want to use dependency tracking if your compiler supports it.	No	
deprecation	Specifies that you want the compiler to display deprecation information.	No	no
destdir	Specifies the destination directory for the generated class files.	No	

Attribute	Description	Required	Default
`encoding`	Specifies the encoding of your Java files.	No	
`excludes`	Specifies a list of files that you want to exclude. A comma- or space-separated list of files.	No	
`excludesfile`	Specifies a file containing a list of files you want to exclude.	No	
`executable`	Specifies the path to the `javac` executable that will be used when `fork` is used. Defaults to the compiler currently used by Ant.	No	
`extdirs`	Specifies the location of installed extensions, if any.	No	
`failonerror`	Specifies if you want the build to fail if there are compilation errors.	No	`true`
`fork`	Specifies if to execute `javac` in a forked process.	No	`no`
`includeAntRuntime`	Specifies whether you want to make the Ant run-time libraries accessible to the compiler.	No	`yes`
`includeJavaRuntime`	Specifies whether you want to make the default runtime Java libraries accessible to the executing JVM.	No	`no`
`includes`	Specifies a list of files that you want to include. A comma- or space-separated list of files.	No	
`includesfile`	Specifies a file containing a list of files you want to include.	No	
`listfiles`	Specifies whether you want to list the source files to be compiled.	No	`no`
`memoryInitialSize`	Specifies the starting size of the memory for the JVM. Applies only if `javac` is run externally.	No	
`memoryMaximumSize`	Specifies the maximum size of memory you want to use for the JVM, if you're forking it.	No	
`nowarn`	Specifies whether you want to pass the `-nowarn` switch to the compiler.	No	`off`
`optimize`	Specifies whether you want to compile using optimization, using the `-O` switch.	No	`off`
`source`	Specifies whether you want to use the `-source` switch. Legal values are 1.3, 1.4, and 1.5.	No	no `-source` argument will be used

Attribute	Description	Required	Default
sourcepath	Specifies the source path to use.	No	The value of the srcdir attribute (or nested src elements)
sourcepathref	Specifies the source path you want to use, given in reference form.	No	
srcdir	Specifies where to find the Java source files you want to compile.	Yes, unless nested src elements are present	
target	Specifies that you want to generate class files for particular Java version (e.g., 1.1 or 1.2).	No	
tempdir	Specifies the directory where temporary files should go. Used only if the task is forked and the length of the command line arguments is over 4 K. Available since Ant 1.6.	No; default is the current working directory	
verbose	Specifies that you want the compiler to generate verbose output.	No	no

This is where the meat is for most Java authors. This taskwhich should be one of your staplesmakes sure the source directory will be recursively scanned for Java source files to compile and compiles them. Only Java files that have no corresponding *.class* file or where the class file is older than the *.java* file will be compiled.

The `javac` task forms an implicit FileSet and supports all attributes of `fileset` (note that `dir` becomes `srcdir`) as well as the nested `include`, `exclude` and `patternset` elements. And because the `javac` task's `srcdir`, `classpath`, `sourcepath`, `bootclasspath`, and `extdirs` attributes are path-like structures, they can be set via nested `src`, `classpath`, `sourcepath`, `bootclasspath` and `extdirs` elements.

3.1.1. Compiling Source Files

Here are a few `javac` examples, starting with a standard example that compiles all *.java* files in and under the `${src}` directory and stores the *.class* files in the `${bin}` directory. In this case, the classpath includes *common.jar*, and we're compiling with debug information turned on:

```
<javac srcdir="${src}"
    debug="on"
    destdir="${bin}"
    classpath="common.jar"
/>
```

This next example compiles *.java* files in and under the `${src}` and `${src2}` directories, storing *.class* files in `${bin}`, including *common.jar* in the classpath, and turns debug information on. In this case, only files in *packages/archive/*** and *packages/backup/*** will be includedand those in *packages/archive/betapackage/*** will be excluded:

```
<javac  srcdir="${src}:${src2}"
    destdir="${build}"
    includes="packages/archive/**,packages/backup/**"
    excludes="packages/archive/betapackage/**"
    classpath="common.jar"
    debug="on"
/>
```

Ant only uses the names of the source and class files to find the classes that need a rebuild. It doesn't read the source codes, and so has no knowledge about nested classes.If you want to specify dependencies that Ant is having trouble with, use the Ant`depend` task (covered in Chapter 6) for advanced dependency checking.

> One of the new aspects of Ant 1.6 is that it's OK to use 1.5, the newest version of Java, as the Java version in `javac` attributes as `source`.

3.1.1.1 Selecting which files to compile

You can make `javac` compile only files that you explicitly specify, as opposed to all files under the specified source directory. You do that by disabling the`javac` task's default searching mechanism by unsetting the `sourcepath` attribute and specifying the files you want to include and exclude explicitly, as here, where I'm including only *.java* files in the `${src}` directory:

```
<javac sourcepath="" srcdir="${src}"
    destdir="${bin}" >
    <include name="*.java" />
</javac>
```

3.1.1.2 Forking the compiler

Forking the Java compiler makes it run in a new process, something that's often useful if you want tc use another compiler or want to configure the compiler's runtime environment. When the compiler is used in unforked mode in Windows, it may lock the files in the classpath of the`javac` task. That means you won't be able to delete or move those files later in the build. If you need to change that, fork the compiler, using the `fork` attribute.

Here's an example that compiles all *.java* files under the `${src}` directory, stores the *.class* files in the `${bin}` directory, and forks the `javac` compiler into its own thread process:

```
<javac srcdir="${src}"
    fork="yes"
```

```
    destdir="${bin}"
/>
```

Here's an example showing how you can tell Ant which Java compiler you want to run after forking:

```
<javac srcdir="${src}"
    destdir="${bin}"
    fork="yes"
     executable="/opt/java/jdk1.3/bin/javac"
     compiler="javac1.3"
/>
```

> In the early days, if you were using Ant on Windows, a new DOS window would pop up for every use of an external compiler. If you use a JDK after 1.2, this won't be a problem.

3.1.2. Setting Command-Line Options

You can explicitly specify command-line arguments for the compiler with nested `compilerarg` elements:

```
<javac srcdir="${src}"
    destdir="${build}"
    classpath="xyz.jar"
    debug="on">
    <compilerarg value="-l -a"/>
</javac>
```

The attributes of the `compilerarg` element appear in Table 3-2.

Table 3-2. The compilerarg attributes

Attribute	Description	Required
`compiler`	Specifies the required version of the compiler you want to use; if the compiler is not of this version, the argument won't be passed to it. For possible values, see the Section 3.1.3.	No
`file`	Specifies the name of a file as a command-line argument.	Exactly one of `value`, `line`, `file`, or `path`.

Attribute	Description	Required
`line`	Specifies a list of command-line arguments, delimited by spaces.	Exactly one of `value`, `line`, `file`, or `path`.
`path`	Specifies a path-like string as a command-line argument. You can use `;` or `:` as path separators if you wish. (Ant will convert them to local path separators.)	Exactly one of `value`, `line`, `file`, or `path`.
`value`	Specifies a command-line argument.	Exactly one of `value`, `line`, `file`, or `path`.

Here's an example that stores the output of the compilation in a directory named*output1.4* if the compiler version is 1.3, 1.4, 1.5, all of which correspond to the "modern" option (see the section Section 3.1.3 for details on specifying the compiler version):

```
<javac srcdir="${src}"
    destdir="${build}">
    <compilerarg compiler="modern" value="-d output1.4"/>
</javac>
```

Here's an example where the compiler switches to use are in a file named*options*:

```
<javac srcdir="${src}"
    destdir="${build}">
    <compilerarg file="options"/>
</javac>
```

3.1.3. Using a Different Java Compiler

Using `javac`, you can specify the compiler you want to use with the global`build.compiler` property (which affects all `javac` tasks throughout the build) or with the `compiler` attribute (specific to the current `javac` task). Here's an example:

```
<javac srcdir="${src}"
    compiler="javac1.3 "
    destdir="${out}"
    classpath="servlet-api.jar"
/>
```

Here are the possible values for the `build.compiler` property or the `compiler` attribute:

`classic`

Specifies that you want to use the standard JDK 1.1/1.2 compiler; you can use `javac1.1` and `javac1.2` as aliases.

`extJavac`

Specifies that you want to use modern or classic in a JVM of its own.

`gcj`

Specifies that you want to use the `gcj` compiler from `gcc`.

`jikes`

Specifies that you want to use the Jikes compiler.

`jvc`

Specifies that you want to use the Command-Line compiler from Microsoft's Java/Visual J++. You can use `microsoft` as an alias.

`kjc`

Specifies that you want to use the kopi compiler.

`modern`

Specifies that you want to use the JDK 1.3/1.4/1.5 compiler. Here, you can use `javac1.3`, `javac1.4`, and `javac1.5` as aliases.

`sj`

Specifies that you want to use the Symantec Java compiler. You can use `symantec` as an alias.

3.2. Getting Input from the User

At some point in a build, you may need input from the user. For example, you might want to ask before deleting a directory with the `delete` task.

> The `delete` task is covered in detail in Chapter 4.

To get input from the user, use the `input` task, which creates a new property based on user input.

Example 3-1 puts `input` to work. This build file asks whether it's OK to delete the *bin* directory, and if it's not, the build fails. It queries the user using the `input` task, and creates a new property, `do.delete` , based on the user's input.

Example 3-1. Using the input task (ch03/input/build.xml)

```
<?xml version="1.0" ?>
<project default="main">

    <property name="message" value="Building the .jar file." />
    <property name="src" location="source" />
    <property name="output" location="bin" />

    <target name="main" depends="init, compile, compress">
        <echo>
            ${message}
        </echo>
    </target>

    <target name="init">
        <input
            message="Deleting bin directory OK?"
            validargs="y,n"
            addproperty="do.delete"
        />
        <condition property="do.abort">
            <equals arg1="n" arg2="${do.delete}"/>
        </condition>
        <fail if="do.abort">Build aborted.</fail>
        <delete dir="${output}" />
        <mkdir dir="${output}" />
    </target>
```

```
    <target name="compile">
        <javac srcdir="${src}" destdir="${output}" />
    </target>

  <target name="compress">
        <jar destfile="${output}/Project.jar" basedir="${output}" includes="*.class" />
  </target>
</project>
```

Here's what you see when you run Ant using this build file:

```
%ant
Buildfile: build.xml

init:
    [input] Deleting bin directory OK?(y,n)
y
    [delete] Deleting directory /home/steven/input/bin
    [mkdir] Created dir: /home/steven/input/bin

compile:
    [javac] Compiling 1 source file to /home/steven/input/bin

compress:
    [jar] Building jar: /home/steven/input/bin/Project.jar

main:
    [echo]
    [echo]             Building the .jar file.
    [echo]

BUILD SUCCESSFUL
Total time: 5 seconds
```

The attributes of this task appear in Table 3-3.

Table 3-3. The input task's attributes

Attribute	Description	Required
`addproperty`	Specifies the name of the property to create, using the input from the user.	No
`defaultvalue`	Specifies the default value to use for the created property; this default will be used if no input is read.	No
`message`	Specifies the prompt you want to display to prompt the user to enter text.	No

Attribute	Description	Required
validargs	Specifies the input values you consider valid, separated by commas. If you use this attribute, the task will not allow input that doesn't match one of these values.	No

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3.3. Calling Other Ant Tasks

You've seen that you can branch using true/false properties. Ant provides other powerful mechanism for branchingthe antcall task, which you can use to call one Ant task from another, and the ant task, which calls Ant tasks in other build files.

3.3.1. Calling Ant Tasks in the Same Build File

A better way to think of antcall is that you're starting a new instance of Ant and executing targets in it. When you call an Ant target with antcall, its dependent targets are executed in order, something that can be confusing if you think you're calling a single target. Generally, it's best to do things the standard way and let Ant sort out the dependencies as it's supposed to. However, Ant can make life easier, as when you have a build file that creates a distribution for many different servers, and when varying sets of tasks need to be executed for each. (Even in cases like that, however, you can still se things up easily enough with if and unless and true/false properties.)

When you use antcall, you can think of that call as creating a new project; all the properties of the current project are available in that new project by default. The attributes of the antcall task appear in Table 3-4.

Table 3-4. The antcall attributes

Attribute	Description	Required	Default
inheritAll	If true, means the task should pass all current properties to the new Ant project. Properties passed to the new project will override the properties that are set in the new project.	No	true
inheritRefs	If true, means the task should pass all current references to the new Ant project.	No	false
target	Specifies the target you actually want to run.	Yes	

You can set properties in the new project with nested param elements, which supports the same attributes as the property task. Such properties will be passed to the new project, no matter how inheritAll is set.

> Properties defined on the command line cannot be overridden by nested param elements.

You can use nested `reference` elements to copy references from the calling project to the new project. See the attributes of this element in Table 3-5.

> References from nested elements will override existing references that have been defined outside of targets in the new project but not those defined inside of targets.

Table 3-5. The reference element's attributes

Attribute	Description	Required	Default
`refid`	Specifies the `id` of the reference you want to use in the original project	Yes	
`torefid`	Specifies the `id` of the reference you want to use in the new project	No	The value of `refid`

> As of Ant 1.6, you can specify sets of properties to be copied into the new project with nested `propertyset` elements. This element works much like other Ant sets; you can create a set of properties and refer to them all at once by ID. This element can contain `propertyref`, `mapper`, and other `propertyset` elements.

Example 3-2 is an `antcall` example. In this case, the example calls a new target, `displayMessage`, to display some text. The example passes the text to display as a parameter named `msg`.

Example 3-2. Using antcall (ch03/antcall/build.xml)

```
<?xml version="1.0" ?>
<project default="main">

    <property name="message" value="Building the .jar file." />
    <property name="src" location="source" />
    <property name="output" location="bin" />

    <target name="main" depends="init, compile, compress">
        <antcall target="displayMessage">
            <param name="msg" value="${message}"/>
        </antcall>
    </target>

    <target name="displayMessage">
        <echo message="msg=${msg}"/>
    </target>
```

```
    <target name="init">
        <mkdir dir="${output}" />
    </target>

    <target name="compile">
        <javac srcdir="${src}" destdir="${output}" />
    </target>

    <target name="compress">
        <jar destfile="${output}/Project.jar" basedir="${output}"
             includes="*.class" />
    </target>
</project>
```

Here's what you see when you run Ant using this build file; the `msg` parameter was passed to the called target:

```
C:\ant\ch03\antcall>ant
Buildfile: build.xml

init:
    [mkdir] Created dir: C:\ant\ch03\antcall\bin

compile:
    [javac] Compiling 1 source file to C:\ant\ch03\antcall\bin

compress:
      [jar] Building jar: C:\ant\ch03\antcall\bin\Project.jar

main:

displayMessage:
     [echo] msg=Building the .jar file.

BUILD SUCCESSFUL
Total time: 6 seconds
```

This is something like a subroutine call, and when using it, there's a tendency to start turning build files into programs. That's almost always a mistake, however; if you find yourself using `antcall` frequently, you're probably not using Ant the way it was intended. There's a tendency to start writing build files as if you were writing programming code with subroutines, but the best way to write build files is to let Ant doing its thing and check the dependencies. If this seems like this is the second time you've heard this, it is because it's that important.

3.3.2. Calling Ant Tasks in Other Build Files

The `ant` task is nearly identical to the `antcall` task, except that it lets you call targets in other build files. Using this task, you can create subproject build files, which let you divide your builds into a core build file with ant tasks to call the other build files as needed. This kind of technique can be useful when your build files are enormous and things are getting too complex to handle in single files; this is one of the ways that Ant scales to meet project needs.

Here's an example using ant, where I'm setting the value of a property named parameter and loading properties from a file:

```
<ant antfile="subproject/subbuild.xml">
     <property name="parameter" value="4096"/>
    <property file="config/subproject/build.properties"/>
</ant>
```

You can see the attributes of this task in Table 3-6.

Table 3-6. The ant task's attributes

Attribute	Description	Required	Default
antfile	Specifies the build file where the target to call is	No	*build.xml*
dir	Directory where the build file is	No	The current project's basedir, unless inheritall has been set to false, in which case there is no default value
inheritAll	If true, makes the task pass all current properties to the new Ant project	No	true
inheritRefs	If true, makes the task pass all current references to the new Ant project	No	false
output	Specifies the filename where the task should write output	No	
target	Specifies the target in the Ant project that you want to call	No	The new project's default target

If you don't specify a value for the antfile attribute, the file *build.xml* in the directory given by the dir attribute is used. If no target attribute is supplied, the default target of the new project will be used.

Passing properties to the new project works as it does with the antcall task, except that here you use nested property elements instead of param elements to pass properties. You can use nested reference elements and nested propertyset elements as with antcall.

The basedir attribute of the new project's project element is affected by the attributes dir and inheritall in ant. Take a look at Table 3-7, which shows how basedir is set based on how you set these two attributes.

Table 3-7. Using dir and inheritAll in ant

dir	inheritAll	basedir in the new project
Value assigned	true	The value of the dir attribute
Value assigned	false	The value of the dir attribute
Omitted	true	The basedir of calling project
Omitted	false	The basedir attribute of the project element of the new project

> If you need to start breaking your build files up, consider the subant task, which executes Ant in various subdirectories.

3.4. Importing Other Build Files

With ant, you can execute build files outside the current build file, and you can *include* other build files in the current file. The old way of doing this was to rely on XML and the Ant XML parser to do the work for you. For example, if you wanted to include the entire contents of a document named *shared.xml* at a specific point in a build file, you could start by declaring an XML entity named, say, shared in your build file:

```
<?xml  version="1.0"?>

<!DOCTYPE project [
    <!ENTITY shared SYSTEM "file:shared.xml">
]>
        .
        .
        .
```

To insert the contents of the *shared.xml* build file into the current build file, you can use an XML entity reference, &shared;, like this:

```
<?xml  version="1.0"?>

<!DOCTYPE project [
    <!ENTITY shared SYSTEM "file:shared.xml">
]>

<project default="main" basedir=".">

    &shared;

    <target name="init">
        .
        .
        .
    </target>
        .
        .
        .
</project>
```

Since Ant 1.6, however, there is a new import task that can be used to include build files. The referenced files have to be complete Ant build files, which are inserted whole (minus the XML declaration and <project> and </project> tags). Here's how the above example would work using the import task:

```
<?xml  version="1.0"?>
<project default="main" basedir=".">

  <import file="shared.xml"/>

    <target name="init">
        .
        .
        .
    </target>
        .
        .
        .
</project>
```

The attributes of the `import` task appear in Table 3-8.

Table 3-8. The import task's attributes

Attribute	Description	Required	Default
`file`	Specifies the name of the build file you want to import	Yes	
`optional`	Specifies whether you want to stop the build if the build file to import does not exist	No	`false`

> Unlike entity includes, you can deference a property with `${` and `}` to set the name of the file to import with the `import` task. In addition, if a target with the same name exists, it takes precedence over the target you're importing.

The `import` task makes it easier to handle relative paths as defined in the imported build file. It does this by creating a new property corresponding to the absolute path of the imported build file so you can resolve relative file references.

Ant has a property called `ant.file` that contains the absolute path of the build file (see Chapter 1), so this task creates a new property based on the name of the file you're importing. For example, if you import a build file named *newbuild*, the new location property will be named `ant.file.newbuild`.

Now that you've built your application with the various tasks seen in this chapter, it's time for some documentation.

3.5. Documenting Code

Creating applications in a commercial environment frequently means creating documentation, and Ant is up for that with the `javadoc` task. This task creates documentation using the Java `javadoc` tool, a process that involves compilation, which merits including this task in this chapter. This is one of the largest tasks in Ant because of the enormous number of `javadoc` options.

Here's an example, stored in the *javadoc* folder in the code for this book. Suppose you add a documentation-type comment to the *Project.java* file:

```
/** This application prints out "No worries." */
public class Project
{
    public static void main(String args[])
    {
        System.out.println("No worries.");
    }
}
```

You can create Javadoc for the project using the `javadoc` task in a new target I'll name `doc`, which will put the generated Javadoc in a *doc* directory, as you see in Example 3-3.

> Note the XML `<![CDATA[...]>` sections, which the build file uses to pass data to the `javadoc` tool.

Example 3-3. Creating javadoc (ch03/javadoc/build.xml)

```
<?xml version="1.0" ?>
<project default="main">

    <property name="message" value="Building the .jar file." />
    <property name="src" location="source" />
    <property name="docs" location="docs" />
    <property name="output" location="bin" />

    <target name="main" depends="init, compile, doc, compress">
        <echo>
            ${message}
        </echo>
    </target>

    <target name="init">
```

```
        <mkdir dir="${output}" />
        <mkdir dir="${docs}" />
    </target>

    <target name="compile">
        <javac srcdir="${src}" destdir="${output}" />
    </target>

    <target name="doc">
        <javadoc
            sourcefiles="${src}/Project.java"
            destdir="${docs}"
            author="true"
            version="true"
            use="true"
            windowtitle="Project API">
              <doctitle><![CDATA[<h1>Project API</h1>]]></doctitle>
              <bottom><![CDATA[<i>Copyright &#169; 2005</i>]]></bottom>
        </javadoc>
    </target>

    <target name="compress">
        <jar destfile="${output}/Project.jar" basedir="${output}" includes="*.class" />
    </target>

</project>
```

You can see the `javadoc` task at work when the build file runs:

```
%ant
Buildfile: build.xml

init:
     [mkdir] Created dir: /home/steven//ch03/javadoc/bin
     [mkdir] Created dir: /home/steven//ch03/javadoc/docs

compile:
    [javac] Compiling 1 source file to /home/steven//ch03/javadoc/bin

doc:
  [javadoc] Generating Javadoc
  [javadoc] Javadoc execution
  [javadoc] Loading source file /home/steven//ch03/javadoc/source/Project.java..  .
  [javadoc] Constructing Javadoc information...
  [javadoc] Standard Doclet version 1.4.0

  [javadoc] Building tree for all the packages and classes...
  [javadoc] Building index for all the packages and classes...
  [javadoc] Building index for all classes...

  [javadoc] Generating /home/steven//ch03/javadoc/docs/stylesheet.css..  .
```

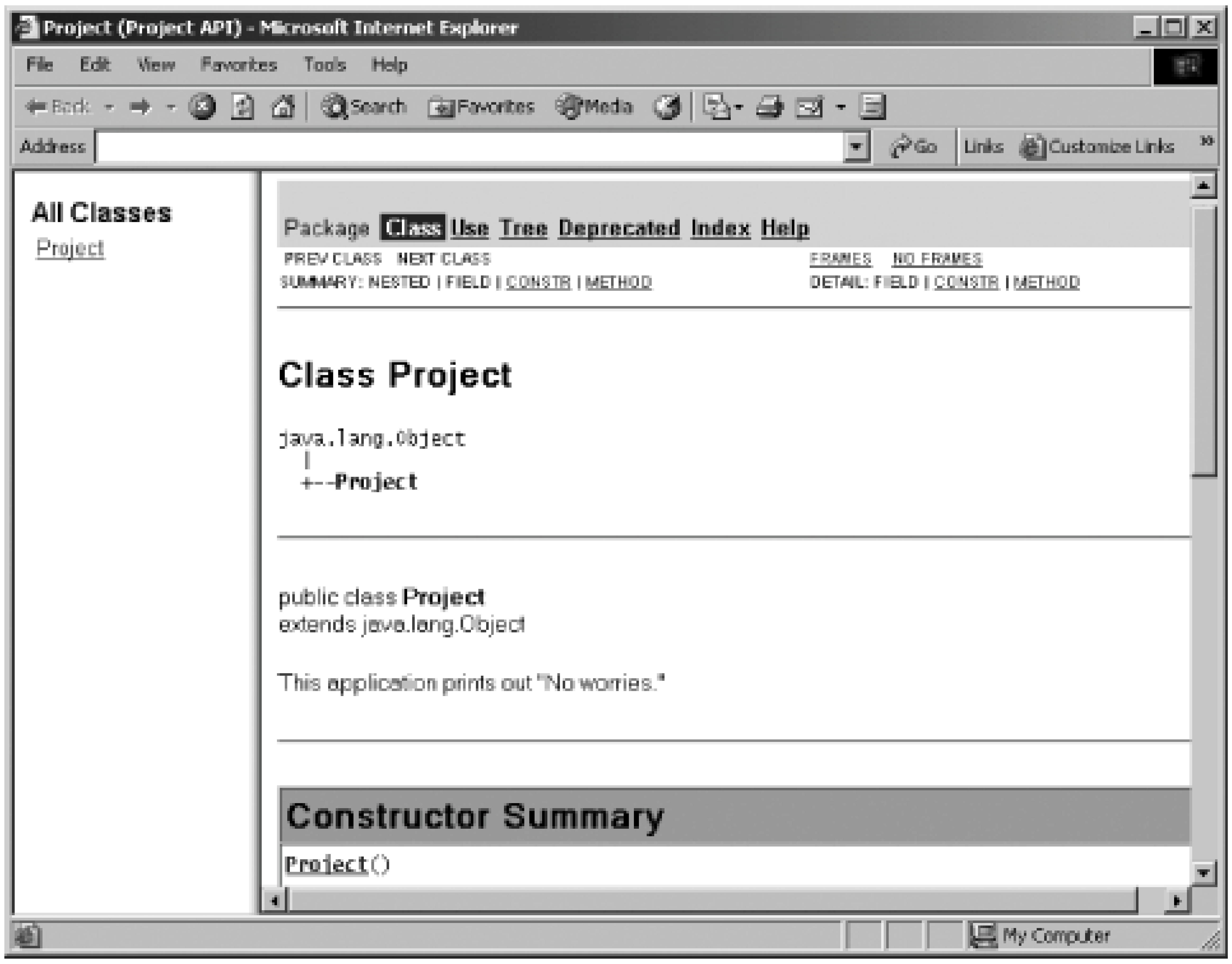
```
compress:
       [jar] Building jar: /home/steven//ch03/javadoc/bin/Project.jar

main:
     [echo]
     [echo]             Building the .jar file.
     [echo]

BUILD SUCCESSFUL
Total time: 10 seconds
```

And you can see the *index.html* Javadoc result in Figure 3-1 . Note the message "This application prints out `No worries.'"

Figure 3-1. New Javadoc for the project



You can see the huge number of attributes of this task in Table 3-9

Since the javadoc tool calls the System.exit method, javadoc cannot be run inside the same JVM as Ant. For this reason, javadoc *always* forks the JVM.

Table 3-9. The javadoc task's attributes

Attribute	Description	Required	Default
`access`	Sets the access mode; you can use these values: `public` , `protected` , `package` , or `private` .	No	`protected`
`additionalparam`	Specifies additional parameters for the `javadoc` command line. Any parameters with spaces should be quoted using `"` .	No	
`author`	Specifies you want to include `@author` paragraphs.	No	
`bootclasspath`	Specifies you want to override the classpath set by the boot class loader.	No	
`bootclasspathref`	Specifies you want to override class file references set by the boot class loader.	No	
`bottom`	Sets the bottom text for each page.	No	
`breakiterator`	Specifies you want to use the breakiterator algorithm, which is used in debugging. Set to yes or no.	No	`no`
`charset`	Specifies the character set to use.	No	
`classpath`	Specifies the classpath for user class files.	No	
`classpathref`	Specifies where to find user class files by reference.	No	
`defaultexcludes`	Specifies whether you want default excludes to be used. Set to yes or no.	No	Default excludes are used.
`destdir`	Sets the output directory.	Yes	
`docencoding`	Sets the output file encoding to use.	No	
`doclet`	Specifies the class file used to start the doclet that will generate the documentation.	No	
`docletpath`	Specifies the path to the doclet given by the `-doclet` option.	No	
`docletpathref`	Specifies the path to the doclet given by the `-doclet` option by reference.	No	

Attribute	Description	Required	Default
doctitle	Sets the title for the package index page.	No	
encoding	Specifies the encoding of the source file.	No	
excludepackagenames	Specifies the packages to exclude in the documentation. Give as a comma-separated list.	No	
extdirs	Specifies you want to override the location of installed extensions.	No	
failonerror	Specifies you want to stop the build process if the task exits with a non-zero return code.	No	
footer	Specifies the footer text for each page.	No	
group	Specifies you want to group particular packages in the generated overview page.	No	
header	Specifies the header text you want to use for each page.	No	
helpfile	Specifies the HTML help file you want to use, if any.	No	
link	Specifies you want to create links to the Javadoc output at the given URL.	No	
linkoffline	Specifies you want to link to the documentation at a specific URL using a package list at at another URL.	No	
linksource	Indicates you want to generate hyperlinks to source files; available since Ant 1.6.	No	no
locale	Sets the locale to be used for generating documentation, such as "en_US".	No	
maxmemory	Specifies the maximum amount of memory to allocate to the javadoc task.	No	
nodeprecated	Specifies you do not want to include @deprecated information in the generated documentation.	No	
nodeprecatedlist	Specifies you do not want to generate a deprecated list.	No	

Attribute	Description	Required	Default
nohelp	Specifies you do not want to generate a link to help documentation.	No	
noindex	Specifies you do not want to generate an index.	No	
nonavbar	Specifies you don't want a navigation bar.	No	
noqualifier	Allows you to use the -noqualifier argument. Set this attribute to "all" or a colon-separated list of packages. Available since Ant 1.6.	No	
notree	Specifies you don't want a class hierarchy to be generated.	No	
old	Specifies you want to generate output using JDK 1.1.	No	
overview	Specifies where to get the overview documentation.	No	
package	Indicates you want to include package/protected/public information.	No	
packagelist	Specifies the name of a file that holds the packages to include in the generated documentation.	No	
packagenames	Specifies a list of packages to include.	No	
private	Specifies you want to show all private classes and members.	No	
protected	Specifies you want to show all protected/public classes and members. This is the default.	No	
public	Specifies you want to show only public classes and members.	No	
serialwarn	Specifies you want to be warned about the @serial tag, if encountered.	No	
source	Sets this attribute to 1.4 to document code that compiles using javac -source 1.4 .	No	
sourcefiles	Specifies the source files. Use a comma-separated list.	At least one of sourcepath , sourcefiles , sourcefiles , or a nested sourcepath , fileset , or packageset .	

Attribute	Description	Required	Default
sourcepath	Specifies where to you want to find source files.	At least one of sourcepath , sourcefiles , sourcefiles , or a nested sourcepath , fileset or packageset .	
sourcepathref	Specifies where you want to find source files by reference.	At least one of sourcepath , sourcefiles , sourcefiles , or a nested sourcepath , fileset , or packageset .	
splitindex	Specifies you want to split the generated index into one file for each letter.	No	
stylesheetfile	Specifies the CSS stylesheet you want to use.	No	
use	Specifies you want to create class and package usage pages.	No	
useexternalfile	Specifies whether the source filename(s) should be written to a temporary file. Set to yes or no.	No	no
verbose	Specifies you want this task to display messages of what it's doing.	No	
version	Specifies you want to include @version paragraphs.	No	
windowtitle	Sets the title of the browser window for the documentation.	No	

For more on how to use the javadoc tool, look at the JDK documentation, available online at http://java.sun.com/j2se/1.4.2/docs/index.html .

Here's another example. This one passes Java packages starting with gui to javadoc to document them, excludes a few specific packages, sets the header text for each page, groups the packages gui.steve.api.* together on the first page under the title "Group 1 Packages," and includes a link to the Java 1.4.2 docs:

```
<javadoc destdir="api" version="true">

    <packageset dir="code">
        <include name="gui/**" />
```

```
            <exclude name="gui/debug/**"/>
        </packageset>

        <header><![CDATA[Preliminary API Specification]]></header>
         <doctitle><![CDATA[<h1>Test</h1>]]></doctitle>
        <group title="Group 1 Packages" packages="gui.steve.api.*"/>
         <link href="http://java.sun.com/j2se/1.4.2/docs/api/"/>
    </javadoc>
```

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3.6. Creating JAR Files

The `jar` task JARs files for you. Example 3-4 is a fairly complex example, which creates a new JAR file with an included manifest, *MANIFEST.MF*, that contains several attributes.

Example 3-4. Using the jar task (ch03/jar/build.xml)

```
<?xml version="1.0" ?>
<project default="main">

    <property name="message" value="Building the .jar file." />
    <property name="src" location="source" />
    <property name="output" location="bin" />

    <target name="main" depends="init, compile, compress">
        <echo>
            ${message}
        </echo>
    </target>

    <target name="init">
        <mkdir dir="${output}" />
    </target>

    <target name="compile">
        <javac srcdir="${src}" destdir="${output}" />
    </target>

    <target name="compress">
        <jar destfile="${output}/Project.jar" basedir="${output}"
            includes="*.class" >
            <manifest>
                <attribute name="Author" value="${user.name}"/>
                <section name="Shared">
                    <attribute name="Title" value="Example"/>
                    <attribute name="Vendor" value="MegaAntCo"/>
                </section>
                <section name="Copyright">
                    <attribute name="Copy" value="(C) MegaAntCo 2005"/>
                </section>
            </manifest>
        </jar>
    </target>
</project>
```

The created JAR file contains *Project.class* and *MANIFEST.MF*; this latter file contains these contents:

```
Manifest-Version: 1.0
Ant-Version: Apache Ant 1.6.1
Created-By: 1.4.2_03-b02 (Sun Microsystems Inc.)
Author: Steven Holzner

Name: Shared
Title: Example
Vendor: MegaAntCo

Name: Copyright
Copy: (C) MegaAntCo 2005
```

Want to sign your JAR file for distribution? Use the `jarsign` task like this:

```
<signjar jar="jarfile.jar" alias="development"
         keystore="local.keystore"
         storepass="secret"/>
```

The attributes of the `jar` task are listed in Table 3-10. For more on creating manifests, take a look at the Section 3.6.2.

Table 3-10. The jar task's attributes

Attribute	Description	Required	Default
`basedir`	Specifies the directory where the task should find files to JAR.	No	
`compress`	Specifies you want to compress data besides storing it.	No	`true`
`defaultexcludes`	Specifies whether you want to use default excludes or not (set to yes or no).	No	`yes`
`destfile`	Specifies the new JAR file to create.	Yes	
`duplicate`	Specifies what you want to do when a duplicate file is found. Possible values are `add`, `preserve`, and `fail`.	No	`add`
`encoding`	Specifies the character encoding to use for file-names in the JAR file.	No	`UTF-8`

Attribute	Description	Required	Default
excludes	Specifies files to exclude. Give as a comma- or space-separated list.	No	No files (except default excludes) are excluded.
excludesfile	Specifies the name of a file containing exclude patterns, one to a line.	No	
filesetmanifest	Specifies what you want the task to do when a manifest is found in a zipfileset or a zipgroupfileset file is found. Valid values are skip, merge, and mergewithoutmain.	No	skip
filesonly	Specifies you want to store only files in the JAR file.	No	false
includes	Specifies files to include. Give as a comma- or space-separated list of patterns.	No	
includesfile	Specifies the name of a file containing include patterns, one to a line.	No	
index	Specifies whether to create an index. This can aid when loading classes.	No	false
keepcompression	Specifies what you want to do with items from existing archives (as with nested JAR files). Available since Ant 1.6.	No	false
manifest	Specifies the manifest file to use. Set to the location of a manifest, or the name of a JAR added through a fileset. If you're using the name of an added JAR file, the task expects the manifest to be in the JAR at *META-INF/MANIFEST.MF*.	No	
manifestencoding	Specifies the encoding used to read the JAR manifest.	No .	The platform encoding.
update	Specifies whether if you want to update or overwrite the output file in case it exists.	No	false
whenempty	Specifies what this task should do when when no files match. Possible values are fail, skip, and create.	No	skip

You can refine the set of files to JAR with the includes, includesfile, excludes, excludesfile, and defaultexcludes attributes. The jar task forms an implicit FileSet and supports all attributes of fileset (though dir becomes basedir) as well as the nested include, exclude and patternset elements. You can use nested file sets for more flexibility, and specify multiple ones to merge together different trees of files into one JAR.

The update parameter controls what happens if the *.jar* file exists. When set to

yes

, the *.jar* file is updated with the files specified. When set to

`no`

(the default), the *.jar* file is overwritten.

Besides nested `include`, `exclude` and `patternset` elements, you can nest `metainf` and `manifest` elements in the `jar` task.

3.6.1. Working with the META-INF Directory

The nested `metainf` element specifies a FileSet. All files included in this fileset will end up in the *META-INF* directory of the JAR file. If this fileset includes a file named*MANIFEST.MF*, the file is ignored (but you'll get a warning telling you what's going on).

3.6.2. Creating Manifest Files

You use this task to write data into a JAR manifest file. The`manifest` task supports two nested elements: `attribute`, which you can use to set attributes in a manifest file, and`section`, which can create a section in a manifest file. The `attribute` element has two attributes: `name` (the name of the attribute) and `value` (the value of the attribute). The `section` element has one attribute, `name` (the name of the new section). Here's an example, which creates a manifest with attributes and sections:

```
<target name="compress">
      <jar destfile="${output}/Project.jar" basedir="${output}"
          includes="*.class" >
          <manifest>
              <section name="Credits">
                  <attribute name="Author" value="Steve"/>
              </section>
              <section name="Title">
                  <attribute name="Title" value="Profits"/>
                  <attribute name="Company" value="YourCoInc"/>
              </section>
          </manifest>
   </jar>
</target>
```

For a more substantial example, see Example 3-5 coming up in this chapter. You can see the attributes of this task in Table 3-11.

Table 3-11. The manifest attributes

Attribute	Description	Required	Default
`file`	Specifies the name of the manifest file to create.	Yes	
`mode`	Specifies what you want to do with the manifiest file. Possible values are `update` or `replace`.	No	`replace`
`encoding`	Specifies the encoding you want to use when reading a manifest to update.	No	`UTF-8 encoding`

There's more you can put into JAR manifests as well, such as an automatically incremented build number and a time stamp, both coming up next.

> Need to un-JAR a JAR file? Use Ant's `unjar` task. Just set the `src` attribute to the JAR file to un-jar and set the `dest` attribute to the directory where you want the output.

3.7. Setting Build Numbers

Anyone who has released software commercially knows how important it is to keep track of build numbers. The first version of your software might be 1.0.0, an update might be 1.0.1, a major update might be 2.0.0, and so on. The `buildnumber` task is a basic task that can be used to track these kinds of build numbers.

This task will first attempt to read a build number from a file (by default, *build.number* in the current directory) and set the property `build.number` to the value that was read in (or to 0, if no value was read). It will increment the number by one and write the new value back to the file.

This task has only one attribute, `file`, which holds the name in which you want to store the build number. This attribute is not required. I'll take a look at an example using `buildnumber` after discussing time stamps, the next topic.

3.8. Setting Timestamps

The `tstamp` task sets properties holding the current time so you can time stamp your builds. This task creates the `DSTAMP` (day stamp), `TSTAMP` (time stamp) and `TODAY` properties in the current project. By default, the `DSTAMP` property is in the format "yyyyMMdd", `TSTAMP` is in the format "hhmm", and `TODAY` is in the format "MMMM dd yyyy". If you use this task, it's almost invariably run in an initialization target.

You can see how this works in Example 3-5, which stores the build number and creation date in the project's *.jar* file, using `buildnumber` and `tstamp`.

Example 3-5. Using the build number and tstamp tasks (ch03/buildnumber/build.xml)

```
<?xml version="1.0" ?>
<project default="main">

    <property name="message" value="Building the .jar file." />
    <property name="src" location="source" />
    <property name="output" location="bin" />

    <target name="main" depends="init, compile, compress">
        <echo>
            ${message}
        </echo>
    </target>

    <target name="init">
        <buildnumber/>
        <tstamp/>
        <delete dir="${output}"/>
        <mkdir dir="${output}" />
    </target>

    <target name="compile">
        <javac srcdir="${src}" destdir="${output}" />
    </target>

  <target name="compress">
        <jar destfile="${output}/Project.jar" basedir="${output}"
            includes="*.class" >
            <manifest>
            <attribute name="Author" value="${user.name}"/>
            <section name="Shared">
                <attribute name="Title" value="Example"/>
```

```
                <attribute name="Vendor" value="MegaAntCo"/>
                <attribute name="Build" value="${build.number}"/>
                <attribute name="Date" value="${TODAY}"/>
            </section>
            <section name="Copyright">
                <attribute name="Copy" value="(C) MegaAntCo 2005"/>
            </section>
        </manifest>
     </jar>
  </target>
</project>
```

Here's the resulting manifest file from the JAR file, including build number and creation date:

```
Manifest-Version: 1.0
Ant-Version: Apache Ant 1.6.1
Created-By: 1.4.2_03-b02 (Sun Microsystems Inc.)
Author: Steven Holzner

Name: Shared
Title: Example
Vendor: MegaAntCo
Build: 3
Date: June 10 2005

Name: Copyright
Copy: (C) MegaAntCo 2005
```

This task has only one attribute, `prefix`, which is optional and sets a prefix for the `DSTAMP`, `TSTAMP`, and `TODAY` properties. For example, if `prefix="time"`, these properties will be `time.TSTAMP`, `time.TSTAMP`, and `time.TODAY`, allowing you to name the properties created by this task yourself (at least to the extent of calling giving them names like name.TSTAMP instead of just TSTAMP).

The `tstamp` task supports a `format` nested element that lets you set the date and time format. Here's an example that creates a timestamp in the property `timestamp`:

```
  <tstamp>
      <format property="timestamp" pattern="MM/dd/yyyy hh:mm:ss"/>
  </tstamp>
```

You can see the attributes of the `format` element in Table 3-12.

> The date/time patterns used by `format` are the same as used by the Java `SimpleDateFormat` class. For more info on those patterns, see http://java.sun.com/j2se/1.4.2/docs/api/java/text/SimpleDateFormat.html.

Table 3-12. The format task's attributes

Attribute	Description	Required
`locale`	Specifies the locale for the date/time string. Make this of the *`language`*, *`country`*, *`variant`*. The possible values are defined in the Java `Locale` class.	No
`offset`	Specifies the offset you want to add to or subtract from the current time, if any.	No
`pattern`	Specifies the date/time pattern you want to use. The possible values are defined in the Java `SimpleDateFormat` class.	Yes
`property`	Specifies the property in which you want to store the date/time string.	Yes
`timezone`	Specifies the time zone used for generating the time. Possible values are defined in the Java `TimeZone` class.	No
`unit`	Specifies the unit of the offset you've specified in `offset`. Possible values are `millisecond`, `second`, `minute`, `hour`, `day`, `week`, `month`, or `year`.	No

Chapter 4. Deploying Builds

This chapter starts coverage of one of the things Ant does best: deployment. This chapter covers tasks to package applications for deployment like `tar`, `gzip`, and `zip`; tasks to prepare directories for deployment like `delete` and `mkdir`; and tasks to deploy applications like `copy` and `move` for local and network deployment, as well as `ftp`, `telent`, `sshexec`, and `mail` for remote deployment. You'll see other deployment-related tasks, such as `touch` to set the deployed files' modification dates to a specific value (as is done for commercial software deployments), `fixcrlf` to fix text file line endings (as in readme, *.sh*, *.bat*, .html, or *.ini* files) for different platforms, and more. Finally, you'll learn how to handle build automation, setting up builds to run on their own, at a schedule of your choosing.

> There's more on deployment coming up in this book. Ant has a lot of support for deploying web applications, so much so that it'll take more than just this chapter to cover. Chapter 8 covers how to package and deploy web applications, including using `get` (used to send administrative commands to web servers remotely), `serverdeploy`, `war`, and other Ant tasks designed to load web applications to various servers. Chapter 8 and part of Chapter 9 also specifically discuss how to deploy to Enterprise JavaBean© (EJB) application servers.

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4.1. Packaging Applications for Deployment

We're going to start with deployment tasks designed to package applications for deployment: `tar`, `gzip`, and `zip`. These are not the only way to package applications; the `jar` task was covered in Chapter 3 on Java Development, and the `war` task, a special form of the `jar` task for Web applications that makes allowances for files like the deployment descriptor *web.xml*, will be covered in Chapter 8.

4.1.1. Creating TAR Files

The `tar` task creates a TAR archive, handy for archiving files for distribution. This task is directory-based and, like other such tasks, forms an implicit FileSet that defines which filesrelative to the `basedir` attribute settingwill be included in the archive.

If you set the `compression` attribute to `gzip` or `bzip2`, you can compress the output *.tar* file to the specified format. For instance, Example 4-1 compiles code and places the resulting *Project.class* file in a *.tar.gz* file, *Project.tar.gz*, by setting the `compression` attribute to `gzip`.

Example 4-1. Tarring a file (ch04/tar/build.xml)

```
<?xml version="1.0" ?>
<project default="main">

    <property name="message" value="Building the .tar.gz file." />
    <property name="src" location="source" />
    <property name="output" location="bin" />

    <target name="main" depends="init, compile, compress">
        <echo>
            ${message}
        </echo>
    </target>

    <target name="init">
        <mkdir dir="${output}" />
    </target>

    <target name="compile">
        <javac srcdir="${src}" destdir="${output}" />
    </target>

  <target name="compress">
        <tar
            destfile="${output}/Project.tar.gz"
            basedir="${output}"
```

```
            includes="*.class"
            compression="gzip"/>
  </target>
</project>
```

The attributes of this task appear in Table 4-1.

Table 4-1. The tar task's attributes

Attribute	Description	Required	Default
basedir	Specifies the directory from which to get the files to TAR.	No	
compression	Sets the compression method, if any. Legal values are none, gzip and bzip2.	No	none
defaultexcludes	Specifies if you want to use default excludes. Set to yes/no.	No	Default excludes are used.
destfile	Specifies the name of the TAR file you want to create.	Yes	
excludes	Specifies the patterns matching files to exclude, as a comma- or space-separated list.	No	No files (except default excludes) are excluded.
excludesfile	Specifies the name of a file where each line is a pattern matching files to exclude.	No	
includes	Specifies the patterns matching files to include, as a comma- or space-separated list.	No	All files are included.
includesfile	Specifies the name of a file where each line is a pattern matching files to include.	No	
longfile	Specifies how you want to handle long file paths (more than 100 characters). Possible values are truncate, fail, warn, omit and gnu.	No	warn

Here's another example that uses the Ant gzip task after the `tar` task to create *Project.tar.gz*:

```
<tar tarfile="${dist}/Project.tar" basedir="${output}"/>
<gzip zipfile="${dist}/Project.tar.gz" src="${dist}/project.tar"/>
```

This next example does the same thing, except that it excludes files from the *beta* directory and any *todo.html* files:

```
<tar tarfile="${dist}/Project.tar" basedir="${output}"
```

```
    excludes="beta/**, **/todo.html"/>
<gzip zipfile="${dist}/Project.tar.gz" src="${dist}/project.tar"/>
```

The `tar` task supports nested `tarfileset` elements. These are specially extended FileSet types that support all the `fileset` attributes, and the additional attributes you see in Table 4-2.

> The `tarfileset` type gives you control over the access mode, username, and groupname to be applied to the TAR entries. This is handy, for example, when preparing archives for Unix systems where certain files need to have execute permissions.

Table 4-2. The additional tarfileset attributes

Attribute	Description	Required	Default
`dirmode`	Specifies a 3-digit octal string which gives the user and group using normal Unix conventions. Applies to directories only. Available since Ant 1.6.	No	`755`
`fullpath`	Using this attribute means the file in the fileset is written with this path in the compressed file.	No	
`group`	Specifies the group name for the TAR item.	No	
`mode`	Specifies a 3-digit octal string, which gives the user and group using normal Unix conventions. Applies to plain files only.	No	`644`
`prefix`	Specifies a path with which to prefix all files in the compressed file.	No	
`preserveLeadingSlashes`	Specifies if you want to preserve leading slashes (`/`) in filenames.	No	`false`
`username`	Specifies the username for this TAR item.	No	

This next, longer example uses GNU extensions for long paths and uses`tarfileset` elements to mark some files as executable (specifically, using Unix file mode 755, which means executable and readabl by all, and writeable by the owner):

```
<tar  longfile="gnu"
    destfile="${dist}" >
     <tarfileset dir="${bin}" mode="755" username="developer" group="ant">
        <include name="${bin}/bootstrap.sh"/>
        <include name="${bin}/build.sh"/>
    </tarfileset>
    <tarfileset dir="${dist}" username="developer" group="ant">
        <include name="${dist}/**"/>
```

```
        <exclude name="${dist}/*.sh"/>
    </tarfileset>
</tar>
```

Want to un-TAR a *.tar* archive? Ant has an `untar` task.

4.1.2. Compressing Using gzip and bzip2

The `gzip` and `bzip2` tasks pack files using the GZip or BZip2 algorithms. Here's an example that GZips a *.tar* file:

```
<gzip src="Project.tar" destfile="Project.tar.gz"/>
```

Here's a similar example that BZips a *.tar* file:

```
<bzip2  src="Project.tar"  destfile="Project.tar.bz2"/>
```

Ant supports `gunzip` and `bunzip2` tasks for uncompressing archives.

The supported attributes for these tasks appear in Table 4-3.

Table 4-3. The gzip and bunzip2 tasks' attributes

Attribute	Description	Required
`destfile`	Specifies the file you want to create.	Exactly one of `destfile` or `zipfile`
`src`	Specifies the file you want to GZip or BZip.	Yes
`zipfile`	Deprecated. Use `destfile`.	Exactly one of `destfile` or `zipfile`

4.1.3. Creating ZIP Files

The `zip` task creates ZIP files, useful for packaging files for deployment. The `zip` task is easy enough to use; here's how to zip all files in the *${dist}/docs* directory into *docs.zip*. If *docs.zip* doesn't exist, it's created; if it does, the files in it are updated:

```
<zip destfile="${dist}/docs.zip"
    basedir="${dist}/docs"
    update="true"
/>
```

This next example zips all files in the *${dist}/docs* directory. Only .html files in the directory *api* will be zipped, and files with the name *beta.html* are excluded:

```
<zip destfile="${dist}/docs.zip"
    basedir="${dist}/docs"
    includes="api/**/*.html"
    excludes="**/beta.html"
/>
```

The attributes of this task appear in Table 4-4.

> A JAR archive is a ZIP file with a manifest; if you don't want a manifest in a JAR file, use `zip` instead of `jar`.

Table 4-4. The zip task's attributes

Attribute	Description	Required	Default
`basedir`	Specifies the directory where the files you want to zip are.	No	
`compress`	Specifies that you don't want to store data but want to compresses it.	No	`true`
`defaultexcludes`	Specifies whether you want default excludes to be used or not (`yes`/`no`).	No	Default excludes are used
`destfile`	Specifies the ZIP file you want to create.	Exactly one of `destfile` or `zipfile`.	
`duplicate`	Specifies what you want to do when a duplicate file is found. Valid values are `add`, `preserve`, and `fail`.	No	`add`
`encoding`	Specifies the character encoding you want to use inside the ZIP file.	No	The platform's default character encoding.

Attribute	Description	Required	Default
excludes	Specifies the patterns matching files to exclude, as a comma- or space-separated list.	No	No files (except default excludes) are excluded.
excludesfile	Specifies the name of a file where each line is a pattern matching files to exclude.	No	
filesonly	Stores only file entries.	No	false
includes	Specifies the patterns matching files to include, as a comma- or space-separated list.	No	All files are included.
includesfile	Specifies the name of a file where each line is a pattern matching files to include.	No	
keepcompression	Preserves the compression as it has been in archives you're compressing instead of using the compress attribute. Available since Ant 1.6.	No	false
update	Specifies whether you want to update or overwrite the destination file in case it exists.	No	false
whenempty	Specifies what you want to do when no files match. Possible values are fail, skip, and create.	No	skip
zipfile	Deprecated. Use destfile.	One of destfile or zipfile	

This task supports any number of nested fileset elements to specify the files to be included in the ZIP file. The zip task supports any number of nested zipfileset elements, which support all the attributes of fileset (see Table 2-8) as well as the ones you see in Table 4-5.

Table 4-5. The additional zipfileset attributes

Attribute	Description	Required	Default
dirmode	Specifies a 3-digit octal string, which gives the user and group using normal Unix conventions. Applies to directories only.	No	755
filemode	Specifies a 3-digit octal string, which gives the user and group using normal Unix conventions. Applies to plain files only.	No	644
fullpath	Using this attribute means that the file in the fileset is written with this path in the compressed file.	No	

Attribute	Description	Required	Default
`prefix`	Specifies a path to with which prefix all files in the compressed file.	No	
`src`	Specifies a ZIP file instead of a directory as the source of files.	No	

You can nest `zipgroupfileset` elements in a `zip` task. These elements allow you to add multiple ZIP files in the archive. The attributes for the `zipgroupfileset` type are the same as for the `fileset` type and include the extra attributes for `zipfileset` elements (see Table 4-5).

> Because the `zip` task forms an implicit FileSet (`dir` becomes `basedir`), you can use nested `include`, `exclude`, and `patternset` elements.

This example zips all files in the *docs* directory into the *docs/guide* directory in the archive, adds the file *readme.txt* in the current directory as *docs/readme.txt*, and includes all the html files in *examples.zip* under *docs/examples*:

```
<zip destfile="${dist}/docs.zip">
    <zipfileset dir="docs" prefix="docs/guide"/>
    <zipfileset dir="${dist}" includes="readme.txt" fullpath="docs/readme.txt"/>
    <zipfileset src="examples.zip" includes="**/*.html" prefix="docs/examples"/>
</zip>
```

Ant provides an `unzip` task if you want to decompress ZIP files.

4.1.4. Fixing Carriage Returns

If you've ever deployed documentation files from Unix to Windows or Windows to Unix, you've probably run into problems with line endings. Lines in Unix text files typically end with a newline (`/n`) while those in DOS and Windows typically end with a carriage return/line feed pair (`/r/n`). To modify text files before deploying them to other operating systems, use `fixcrlf`. Like other directory-based Ant tasks, this task forms an implicit FileSet and supports all attributes of `fileset` (`dir` becomes `srcdir`) as well as the nested `include`, `exclude` and `patternset` elements.

Say, for example, that you wanted to convert the end of line characters in Unix shell scripts (**.sh*) to be uploaded from Windows to a Unix server to a linefeed, and remove any DOS-style end-of-file (EOF) characters (`^Z`). You could do that like this:

```
<fixcrlf srcdir="${src}"
    eol="lf"
    eof="remove"
```

```
    includes="**/*.sh"
/>
```

Here's how you might go the other way, replacing all end-of-line (EOL) characters with a cr-lf pair in DOS batch (*.bat*) files in preparation to downloading them to Windows:

```
<fixcrlf srcdir="${src}"
    eol="crlf"
    eof="add"
    includes="**/*.bat"
/>
```

This example converts all **.txt* files according to the convention of the host operating system and replaces tabs with spaces:

```
<fixcrlf srcdir="${src}"
    tab="remove"
    includes="**/*.txt"
/>
```

As demonstrated by the previous example, `fixcrlf` is good for removing or inserting tabs. That's useful because some software (e.g., Make) is finicky about tabs.

The attributes of this task appear in Table 4-6.

Table 4-6. The fixcrlf task's attributes

Attribute	Description	Required	Default
`cr`	Deprecated. Use `eol`.	No	
`defaultexcludes`	Specifies if you want to use default excludes or not Set to `yes`/`no`.	No	Default excludes are used.
`destDir`	Specifies where you want the modified files.	No	The value of `srcDir`.
`encoding`	Specifies the encoding of the files you're working on.	No	The default JVM encoding.
	Specifies how you want to handle DOS end-of-file (^Z) characters. Possible values are:		

Attribute	Description	Required	Default
eof	add Makes sure an EOF character is at the end of the file. asis Leaves EOF characters alone. remove Removes any EOF character found at the end.	No	The default is based on platform. In Unix, the default is remove. For Windows/DOS systems, the default is asis.
eol	Specifies how you want to handle end-of-line (EOL) characters. Possible values are: asis Leaves EOL characters alone. cr Converts all EOLs to a single CR. lf Converts all EOLs to a single LF. crlf	No	The default is based on platform. In Unix, the default is lf. For Windows/DOS systems, the default is crlf. For Mac OS, the default is cr.

Attribute	Description	Required	Default

	Converts all EOLs to the pair CRLF.
	
	`mac`
	
	Converts all EOLs to a single CR.
	
	`unix`
	
	Converts all EOLs to a single LF.
	
	`dos`
	
	Converts all EOLs to the pair CRLF.		

`excludes`	Specifies the patterns matching files to exclude, as a comma- or space-separated list.	No	
`excludesfile`	Specifies the name of a file where each line is a pattern matching files to exclude.	No	
`fixlast`	Specifies whether you want to add an EOL to the last line of a processed file. Available since Ant 1.6.1.	No	`true`
`includes`	Specifies the patterns matching files to include, as a comma- or space-separated list.	No	
`includesfile`	Specifies the name of a file where each line is a pattern matching files to include.	No	
`javafiles`	Specifies if the file is a Java code file. Used with the `tab` attribute. Set to `yes`/`no`.	No	`no`
`srcDir`	Specifies where to find the files you want to fix.	Yes	
	Specifies how you want to handle tab characters. Possible		

Attribute	Description	Required	Default

tab	values are:
	
	`add`
	Converts sequences of spaces span a tab stop to tabs.
	
	`asis`
	Leaves tab and space characters alone.
	
	`remove`
	Converts tabs to spaces.
		No	`asis`

`tablength`	Specifies the tab character interval. Possible values range from `2` to `80`.	No	`8`

The output file is only written if it is a new file, or if it differs from the existing file. The idea is to prevent bogus rebuilds based on unchanged files that have been regenerated by this task.

4.1.5. Checking File Contents Using Checksums

A checksum is a numerical value corresponding to the contents of a file, and it can tell you if the copy of the file you've deployed is a good copy. This task lets you create an MD5 checksum for a file or set of files. Here's an example using this task; in this case, I'm creating an MD5 checksum for *Project.jar*, which will be stored in a file named *Project.jar.MD5*:

```
<checksum file="Project.jar"/>
```

You can generate a similar checksum for the file after it's been deployed to check if it's OK.

Build files can be used to verify checksum values when testing a deployment; for example, you can generate an MD5 checksum for *Project.jar*, compare that value to a value you've hard-coded into a property named `checksum`, and set the property `checksumOK` if the two values match:

```
<checksum file="Project.jar" property="${checksum}" verifyProperty="checksumOK"/>
```

You can see the attributes of the checksum task in Table 4-7.

Table 4-7. The checksum task's attributes

Attribute	Description	Required	Default
algorithm	Specifies the algorithm you want to use to compute the checksum.	No	MD5
file	Specifies the file you want to generate the checksum for.	One of file or at least one nested fileset element.	
fileext	Specifies the extension of the file for the generated checksum.	No	Defaults to the algorithm name being used.
forceoverwrite	Specifies whether you want to overwrite existing files.	No	no
property	If verifyproperty is not set, property specifies the name of the property to hold the checksum value. If verifyproperty is set, property specifies the actual checksum value you expect.	No	
provider	Specifies the algorithm provider.	No	
readbuffersize	Specifies the size of the buffer the task should use when reading files, in bytes.	No	8192
todir	Specifies the directory where you want checksums to be written. Available since Ant 1.6.	No	Checksum files are written to the same directory as the source files.
totalproperty	Specifies the name of the property that you want to hold a checksum of all the generated checksums and file paths. Available since Ant 1.6.	No	
verifyproperty	Specifies the name of the property to be set true or false depending upon whether the generated checksum matches the existing checksum.	No	

> The `checksum` task can contain nested `fileset` elements. By now, this should be old hat to you.

4.1.6. Setting Creation Time and Date

When you're deploying files, you can set the creation date and time of those files to a single value to make the deployment look more professional (as you'll usually see with commercial software). The `touch` task will do this for you; besides setting the creation time and date for a single file, you can do the same thing for whole directories of files if you include a fileset.

If you only specify a single file, its modification time and date is set to the current time and date:

```
<touch file="Project.jar"/>
```

Here's an example that sets the modification time and date of all the files in `${src}` to January 1, 2005, at 5:00 PM:

```
<touch datetime="01/01/2005 5:00 pm">
    <fileset dir="${src}"/>
</touch>
```

> If the file you're touching doesn't exist, `touch` will create it for you, which is one of the few ways you can use Ant to create empty files (you can create files with text in them with the `echo` task, using the `file` attribute). Want to give the file a name that's guaranteed to be unique? Use Ant's `tempfile` taskfor example, `<tempfile property="temp.file" />` will store the unique name of a file in the `temp.file` property, and `<touch file="${temp.file}" />` will create that file.

You can see the attributes of this task in Table 4-8.

Table 4-8. The touch task's attributes

Attribute	Description	Required
`datetime`	Specifies the new modification time of the file. Use the formats MM/DD/YYYY HH:MM AM_or_PM or MM/DD/YYYY HH:MM:SS AM_or_PM.	No
`file`	Specifies the name of the file whose time and/or date information you want to change.	Yes, unless you use a nested `fileset` element.

Attribute	Description	Required
millis	Specifies the new modification time of the file, given in epoch milliseconds (that is, since midnight, Jan 1, 1970).	No

The touch task can contain nested fileset elements to touch multiple files at once.

Team LiB

4.2. Preparing to Deploy

Ant supports several tasks for setting up a deployment environment, such as `delete` and `mkdir` . Both these tasks can be used locally or on a network to set up the directory structure you need to deploy applications.

> If you want to create and delete directories remotely, take a look at the `ftp` task, coming up later in this chapter.

4.2.1. Deleting Existing Files

When deploying, `delete` is great to clean up a previous installation or to clean deployment directories before installing. This task deletes a single file, a directory and all its files and subdirectories, or a set of files specified by one or more FileSets.

Using this task, you can delete a single file:

```
<delete file="/lib/Project.jar"/>
```

Or you can delete an entire directory, including all files and subdirectories:

```
<delete dir="${dist}"/>
```

You can use filesets:

```
<delete includeEmptyDirs="true">
    <fileset dir="${dist}"/>
</delete>
```

You've seen `delete` at work in various places throughout the book, as in the build file in the *input* folder for Chapter 3 s code (repeated in Example 4-2), where the user is asked for confirmation before deleting anything.

Example 4-2. Using the delete task (ch03/input/build.xml)

```
<?xml version="1.0" ?>
<project default="main">

    <property name="message" value="Building the .jar file." />
```

```
    <property name="src" location="source" />
    <property name="output" location="bin" />

    <target name="main" depends="init, compile, compress">
        <echo>
            ${message}
        </echo>
    </target>

    <target name="init">
        <input
            message="Deleting bin directory OK?"
            validargs="y,n"
            addproperty="do.delete"
        />
        <condition property="do.abort">
            <equals arg1="n" arg2="${do.delete}"/>
        </condition>
        <fail if="do.abort">Build aborted.</fail>
        <delete dir="${output}" />
        <mkdir dir="${output}" />
    </target>

    <target name="compile">
        <javac srcdir="${src}" destdir="${output}" />
    </target>

  <target name="compress">
        <jar destfile="${output}/Project.jar" basedir="${output}" includes="*.class" />
  </target>
</project>
```

If you use this task to delete temporary files created by editors or other software and it doesn't work, try setting the `defaultexcludes` attribute to `no` .

You can see the attributes of this task in Table 4-9.

The `includes` , `includesfile` , `exclude` , and `excludesfile` attributes are deprecated and are being replaced by `fileset` . This makes me suspect that other tasks will follow this same pattern.

Table 4-9. The delete task's attributes

Attribute	Description	Required	Default
defaultexcludes	Specifies if you want to use default excludes. Set to yes /no .	No	Default excludes are used.
dir	Specifies the name of a directory to delete. All its files and subdirectories will be deleted.	At least one of file or dir (unless a fileset element is specified).	
excludes	Deprecated. Use a fileset element. Specifies the patterns matching files to exclude, as a comma- or space-separated list.	No	No files (except default excludes) are excluded.
excludesfile	Deprecated. Use a fileset element. Specifies the name of a file where each line is a pattern matching files to exclude.	No	
failonerror	Specifies if you want an error to stop the build. Only used if if quiet is false .	No	TRue
file	Specifies the file you want to delete.	At least one of file or dir (unless a fileset element is specified).	
includeEmptyDirs	Specifies if you want to delete empty directories when using file sets.	No	false
includes	Deprecated. Use a nested fileset element. Specifies the patterns matching files to include, as a comma- or space-separated list.	No	All files are included.
includesfile	Deprecated. Use a nested fileset element. Specifies the name of a file where each line is a pattern matching files to include.	No	
quiet	Suppresses most diagnostic messages.	No	
verbose	Specifies that you want to show the name of each deleted file (true /false).	No	false

The delete task can contain nested fileset elements.

Here's something you might not have expected: empty directories are *not* deleted by default. To remove empty directories, use the includeEmptyDirs attribute.

4.2.2. Creating New Directories

Want to create the directory structure for local or network deployment? Use `mkdir` . This one's so important that you've seen it in use since Chapter 1. And it's easy to use with only one attribute, as you can see in Table 4-10.

Table 4-10. The mkdir task's attributes

Attribute	Description	Required
`dir`	Specifies the directory you want to create	Yes

Want to create a directory? Just do it:

```
<mkdir dir="${dist}"/>
```

> Just realized that you've asked `mkdir` to create a directory whose parent directories don't exist? That's not a problem since `mkdir` creates parent directories as needed.

4.3. Deploying Applications

As you'd expect, Ant excels at deploying applications, and there are a number of tasks to choose from. You've saw the `javac` task's `destdir` attribute for deployment back in Chapter 1. In this section, you'll see `copy`, `move`, `ftp`, `telnet`, and `sshexec`.

The `copy` and `move` tasks are useful for local and network deployments, and tasks like `ftp` are great for remote deployments. Additionally, Chapter 8 will cover deployment to web servers with tasks like `get`, which you can use to send administrative commands to servers like Tomcat (I'll cover Tomcat's built-in custom Ant tasks), and `serverdeploy`.

> Want to get a file's name without the path attached? Pass the filename to the `basename` task. Want to get just the path? Use `dirname`. The `pathconvert` task converts a nested `path` or reference to a Path, FileSet, DirSet, or FileList into a path (automatically adjusted for the target platform) and stores the result in a given property.

4.3.1. Deploying by Copying

This task copies a file, or a fileset, to a new file or a new directory. This is Ant's most basic deployment task for local and network deployment. Here are a few examples, starting with copying just one file:

```
<copy file="file.txt" tofile="backup.txt"/>
```

This example copies a file to a new location:

```
<copy file="file.txt" todir="../backup"/>
```

This example copies an entire directory to a new location:

```
<copy todir="../backup">
    <fileset dir="${src}"/>
</copy>
```

This copies a set of files to a new directory:

```
<copy todir="../backup">
    <fileset dir="src">
        <include name="**/*.java"/>
    </fileset>
```

```
</copy>
```

Want to copy files and change their names? Use a `mapper` element like this:

```
<copy todir="../backup">
    <fileset dir="src"/>
    <mapper type="glob" from="*" to="*.old"/>
</copy>
```

Here's how to copy a set of files to a directory, replacing `@TODO@` with "`DONE`" in all copied files:

```
<copy todir="../backup">
    <fileset dir="src"/>
    <filter set>
        <filter token="TODO" value="DONE"/>
    </filter set>
</copy>
```

> In Unix, file permissions are not retained when files are copied; files end up with the default `UMASK` permissions instead. If you need a permission-preserving copy function, use the system copy utilitiessee the `exec` task in Chapter 7 (you'd use `<exec executable="cp" ... >` here). Or use the `chmod` task, coming up in this chapter, after the copy.

Example 4-3 uses `copy` to copy a documentation file to make sure it's included in the final JAR for a project and then deploys the JAR file to a directory named *user*.

Example 4-3. Using the copy task (ch04/copy/build.xml)

```
<?xml version="1.0" ?>
<project default="main">

    <property name="message" value="Deploying the .jar file." />
    <property name="src" location="source" />
    <property name="output" location="bin" />
    <property name="dist" location="user" />

    <target name="main" depends="init, compile, compress, deploy">
        <echo>
            ${message}
        </echo>
    </target>

    <target name="init">
        <mkdir dir="${output}" />
        <mkdir dir="${dist}" />
```

```
    </target>

    <target name="compile">
        <javac srcdir="${src}" destdir="${output}" />
    </target>

    <target name="compress">
        <copy todir="${output}" file="${src}/readme.txt"/>
        <jar destfile="${output}/Project.jar" basedir="${output}">
            <include name="*.class"/>
            <include name="*.txt"/>
        </jar>
    </target>

    <target name="deploy">
        <copy todir="${dist}">
            <fileset dir="${output}">
                <exclude name="*.java"/>
                <exclude name="*.class"/>
                <exclude name="*.txt"/>
            </fileset>
        </copy>
    </target>

</project>
```

You can see the attributes of this task in Table 4-11.

Table 4-11. The copy task's attributes

Attribute	Description	Required	Default
`enablemultiplemappings`	Specifies that you want to use multiple `mapper` elements. Available since Ant 1.6.	No	`false`
`encoding`	Specifies the encoding to use. For use when copying files using filters.	No	Defaults to default JVM encoding.
`failonerror`	Specifies whether you want the task to fail if there is an error.	No	`TRue`
`file`	Specifies the file you want to copy.	Yes, unless a nested `fileset` element is used.	
	Specifies whether you		

Attribute	Description	Required	Default
filtering	want to use filtering. Nested filterset elements will always be used; you don't have to set this attribute to true for that.	No	false
flatten	Specifies you want to ignore the directory structure of source files, copying all files into the directory given by the todir attribute.	No	false
includeEmptyDirs	Specifies you want to copy any empty directories as well.	No	TRue
outputencoding	Specifies the encoding you want to use when writing files. Available since Ant 1.6.	No	Defaults to the value of the encoding attribute if given, or the default JVM encoding otherwise.
overwrite	Specifies whether you want to overwrite existing files.	No	false
preservelastmodified	Specifies you want copied files to have the same modified time as the source files.	No	false
todir	Specifies the directory the files should be copied to.	If you use the file attribute, tofile or todir can be used. If you use nested fileset elements and if the number of files is more than 1 or if only the dir attribute is specified in the fileset, then only todir is allowed.	
tofile	Specifies the file you want to copy to.	If you use the file attribute, tofile or todir can be used. If you use nested fileset elements and if the number of files is more than 1 or if only the dir attribute is specified in the fileset, then only todir	

Attribute	Description	Required	Default
		is allowed.	
`verbose`	Specifies you want to see filenames displayed as the files are being copied.	No	`false`

> By default, files are only copied if the source file is newer than the destination file or when the destination file does not exist. However, you can explicitly overwrite files with the `overwrite` attribute.

You can use `fileset` elements inside `copy` elements to create a fileset to copy. If you want to use a fileset, the `todir` attribute must be set. You can use nested `mapper` elements, and `filter set` elements and the `copy` task supports nested FilterChains.

> If you use filters in your copy operation, limit the operation to text files. Binary files will be corrupted by that kind of copy operation. This is true whether the filters are implicitly defined by the filter task or explicitly provided to the copy operation as filter sets.

4.3.2. Moving Files

The `move` task moves a file (copies and then deletes the original) to a new file or a new directory or it moves sets of files to a new directory. The attributes and nested elements are the same as for `copy` (see Table 4-11 and related sections).

> By default, the destination file is overwritten if it already exists. When `overwrite` is turned off, files are only moved if the source file is newer than the destination file, or when the destination file does not exist.

Here's an example that moves a single file (the net result is that the file is renamed):

```
<move file="file.txt" tofile="file.backup"/>
```

Here's how to move a directory to a new directory:

```
<move todir="source">
    <fileset dir="backup"/>
</move>
```

Example 4-4 uses move to deploy the files it creates.

Example 4-4. Moving a file (ch04/move/build.xml)

```
<?xml version="1.0" ?>
<project default="main">

    <property name="message" value="Deploying the .jar file." />
    <property name="src" location="source" />
    <property name="output" location="bin" />
    <property name="dist" location="user" />

    <target name="main" depends="init, compile, compress, deploy">
        <echo>
            ${message}
        </echo>
    </target>

    <target name="init">
        <mkdir dir="${output}" />
        <mkdir dir="${dist}" />
    </target>

    <target name="compile">
        <javac srcdir="${src}" destdir="${output}" />
    </target>

  <target name="compress">
        <jar destfile="${output}/Project.jar" basedir="${output}"
            includes="*.class" />
  </target>

  <target name="deploy">
    <move todir="${dist}">
      <fileset dir="${output}">
          <exclude name="*.java"/>
          <exclude name="*.class"/>
      </fileset>
    </move>
  </target>

</project>
```

For more examples, look at the section "Deploying By Copying".

4.3.3. Deploying Remotely Using FTP

The `ftp` task is handy for remote deployment. This task can send, receive, list, delete files, and create directories. This is one of Ant's optional tasks, so you'll need two JAR files, which you place in the Ant *lib* directory: *jakarta-oro.jar* (available from http://jakarta.apache.org/oro/) and *commons-net.jar* (available from http://jakarta.apache.org/commons/net/index.html).

> If you want to use this task with MS FTP servers, you need a version of *commons-net.jar* and *jakarta-oro.jar* released after 02/01/2004, or a release of *commons-net.jar* after 1.1.0 and *jakarta-oro.jar* after 2.0.8.

Here's an example that deploys the results of a build to the directory */cgi-bin* on a remote server. Since it's a bad idea to hardcode the username and password in build files, I'll set those as properties on the command line (you can use the `input` task here) using the properties `name` and `password`:

```
%ant -Dname=Steve -Dpassword=let_me_in
```

The build file is shown in Example 4-5. Before running the file, supply the IP address of the server by changing the value of the `server` attribute from "000.000.000.000" to the IP address of your server or use the name of the server, like "ftp.apache.org." Though you usually supply an `action` attribute telling `ftp` what to do, the default action is to send files (`action="send"`), so you can omit `action` here.

Example 4-5. Using ftp (ch04/ftp/build.xml)

```
<?xml version="1.0" ?>
<project default="main">

    <property name="message" value="Deploying the .jar file." />
    <property name="src" location="source" />
    <property name="output" location="bin" />

    <target name="main" depends="init, compile, compress, deploy">
        <echo>
            ${message}
        </echo>
    </target>

    <target name="init">
        <mkdir dir="${output}" />
    </target>

    <target name="compile">
        <javac srcdir="${src}" destdir="${output}" />
    </target>

    <target name="compress">
```

```
        <jar destfile="${output}/Project.jar" basedir="${output}">
            <include name="*.class"/>
            <include name="*.txt"/>
        </jar>
    </target>

    <target name="deploy">
         <ftp server="000.000.000.000" binary="true" verbose="true"
            userid="${name}" password="${password}" remotedir="/cgi-bin">
            <fileset dir="${output}">
                <exclude name="*.java"/>
                <exclude name="*.class"/>
                <exclude name="*.txt"/>
            </fileset>
        </ftp>
    </target>

</project>
```

Here's what running this build file looks like in Windows when uploading the results of a build to a remote server:

```
C:\ant\ch04\ftp>ant  -Dname=steven  -Dpassword=let_me_in
Buildfile: build.xml

init:
    [mkdir] Created dir: C:\ant\ch04\ftp\bin

compile:
    [javac] Compiling 1 source file to C:\ant\ch04\ftp\bin

compress:
      [jar] Building jar: C:\ant\ch04\ftp\bin\Project.jar

deploy:
      [ftp] sending files
      [ftp] transferring C:\ant\ch04\ftp\bin\Project.jar
      [ftp] 1 files sent

main:
     [echo]
     [echo]             Deploying the .jar file.
     [echo]

BUILD SUCCESSFUL
Total time: 10 seconds
```

That's it; you've deployed the results of the build remotely. Very cool!

> If you want to build in delay times to take into account delays in getting responses from a server, use the Ant `waitfor` task. You can use the `sleep` task for this purpose.

To retrieve files from the server using `ftp`, you set `action` to `get`, the `remotedir` attribute to the remote directory, and the `dir` attribute to the directory you want the retrieved files stored in locally:

```
<ftp action="get"
     server="000.000.000.000"
    remotedir="/cgi-bin"
    userid="${name}"
    password="${password}">
    <fileset dir="docs">
        <include name="**/*.html"/>
    </fileset>
</ftp>
```

To delete files, set `action` to "del":

```
<ftp action="del"
     server="000.000.000.000"
    remotedir="/cgi-bin"
    userid="${name}"
    password="${password}">
    <fileset>
        <include name="**/*.html"/>
    </fileset>
</ftp>
```

To list files, set `action` to "list;" here's how to store the listing of files in the remote */cgi-bin* directory in a file named *file.list*:

```
<ftp action="list"
     server="000.000.000.000"
    remotedir="/cgi-bin"
    userid="${name}"
    password="${password}"
    listing="ftp.list">
    <fileset>
        <include name="**"/>
    </fileset>
</ftp>
```

Here's how to create a directory, */cgi-bin*, by setting `action` to "mkdir:"

```
<ftp action="mkdir"
     server="000.000.000.000"
```

```
remotedir="/cgi-bin"
userid="${name}"
password="${password}"/>
```

> You can remove directories; set `action` to `rmdir`.

You can see the attributes of this task in Table 4-12.

Table 4-12. The ftp task's attributes

Attribute	Description	Required	Default
`action`	Specifies the ftp action you want to perform. Possible values: `put`, `get`, `del`, `list`, `chmod`, `mkdir` and `rmdir`.	No	`send`
`binary`	Specifies the transfer mode. Possible values: binary-mode (`yes`) or text-mode (`no`).	No	`yes`
`chmod`	Specifies the file permissions for new or existing files (Unix only).	No	
`depends`	Specifies you want to transfer only new or changed files. Set to `yes`/`no`.	No	`no`
`ignoreNoncriticalErrors`	Specifies you want to allow the task to continue despite some non-fatal error codes.	No	`false`
`listing`	Specifies a file to write output from the "list" action.	Required for the "list" action, but ignored otherwise.	
`newer`	The same as the `depends` attribute.	No	
`passive`	Specifies you want to use passive transfers.	No	`no`
`password`	Specifies the login password for the FTP server.	Yes	
`port`	Specifies the port of the FTP server.	No	`21`
`preservelastmodified`	Specifies whether you want to give downloaded files the same modified time as the original files.	No	`false`

Attribute	Description	Required	Default
remotedir	Specifies a directory on the FTP server you want to use.	No	
separator	Specifies the directory separator used on the target FTP server.	No	/
server	Specifies the address of the FTP server.	Yes	
skipFailedTransfers	Specifies unsuccessful transfers should be skipped (with a warning).	No	false
timediffauto	Specifies if to make this task calculate the time difference between you and server. Available in Ant 1.6 or later.	No	
timediffmillis	Specifies the number of milliseconds between times on the target machine compared to the local machine. Available since Ant 1.6.	No	
umask	Specifies the default file permission (unix only).	No	
userid	Specifies the login you want to use on the FTP server.	Yes	
verbose	Specifies whether you want to see information on each file as it's transferred. Set to yes/no.	No	no

The condition task lets you probe if remote systems are available before attempting an FTP operationYou can use two nested elements incondition: http (which can test can probe for remote servers) and socket (which can send messages to remote servers).

The ftp task supports any number of nested fileset elements, which is how you specify the files to be retrieved, deleted, or listed, or whose mode you want to change.

4.3.4. Deploying Remotely Using Telnet

Ant includes a telnet task that you can use when deploying remotely. For security reasons, Telnet is losing popularity (in favor of SSH), but I'll take a look attelnet, followed by the sshexec task. This is one of Ant's optional tasks, so you'll need*commons-net.jar* (available from http://jakarta.apache.org/commons/net/index.html) in the Ant *lib* directory.

This task uses nested read elements to indicate strings to wait for andwrite elements to specify text to send. Here's an example that connects to a server, and asks for a listing of the directory */home/steven*:

```
<telnet  userid="steven"  password="let_me_in"  server="000.000.000.000">
     <read>/home/steven</read>
     <write>ls</write>
</telnet>
```

You can see the attributes of this task in Table 4-13.

Table 4-13. The telnet task's attributes

Attribute	Values	Required	Default
`initialCR`	Specifies that you want to send a carriage return after connecting to the server.	No	`no`
`password`	Specifies the login password you want to use on the Telnet server.	Yes, if `userid` is specified.	
`port`	Specifies the port on the Telnet server to use.	No	`23`
`server`	Specifies the address of the remote Telnet server you want to use.	Yes	
`timeout`	Specifies a default timeout for Telnet actions (in seconds).	No	No timeout
`userid`	Specifies the username to use to log into the Telnet server.	Yes, if `password` is specified.	

4.3.5. Deploying Remotely Using SSH

The more secure SSH protocol is replacing Telnet in general use, and Ant 1.6 added the `sshexec` task to execute SSH commands on a remote system. This is an optional task, so you'll need *jsch.jar* (which you can get at http://www.jcraft.com/jsch/index.html) in the Ant *lib* directory. Here's an example that runs a command, `touch`, on a remote machine, using `sshexec`:

```
<sshexec  host="000.000.000.000"
    username="${name}"
    password="${password}"
    command="touch index.html"/>
```

You can find the attributes of this task in Table 4-14.

> See the `scp` task for copying files for deployment to web servers using SSH in Chapter 8.

Table 4-14. The sshexec task's attributes

Attribute	Description	Required	Default
append	Specifies if you want the output file to be appended to or overwritten.	No	false
command	Specifies the command to run remotely.	Yes	
failonerror	Specifies whether you want to stop the build if there are errors.	No	true
host	Specifies the host you want to work with.	Yes	
keyfile	Specifies the name of a file holding a private key.	Yes, if you are using key-based authentication.	
knownhosts	Specifies the known hosts file. Used to check the identity of remote hosts. Must be an SSH2 format file.	No	*${user.home}/.ssh/known_hostswn_hostts*
output	Specifies the name of a file in which you want output written.	No	
outputproperty	Specifies the name of a property in which you want output written.	No	
passphrase	Specifies a passphrase you want to use for your private key.	No	""
password	Specifies the password to use for SSH.	No	

Attribute	Description	Required	Default
port	Specifies the port to connect to.	No	22
timeout	Specifies whether you want the operation stopped if it timed out (in milliseconds).	No	0 (wait forever)
TRust	Specifies if to trust all unknown hosts if set to "yes."	No	no
username	Specifies the username you want to use.	Yes	

4.3.6. Deploying Remotely Through Email

You can deploy using email with the mail task, attaching files you want to deploy (attachments can be sent using the files attribute or nested fileset elements). You'll need access to an SMTP server, which you specify in the mailhost attribute and need two JAR files in the Ant *lib* directory: *mail.jar* (which you can get from http://java.sun.com/products/javamail/) and *activation.jar* (which you can get from http://java.sun.com/products/javabeans/glasgow/jaf.html).

Here's an example, where the results of a build are deployed as an attachment to an email message. This email has the subject "New Build", the message body "Here is the new build.", and has the build's newly created *.tar.gz* files attached:

```
<target name="deploy">
     <mail mailhost="smtp.isp.com" mailport="1025" subject="New Build">
        <from address="developer@isp.com"/>
        <replyto address="developer@isp.com"/>
        <to address="list@xyz.com"/>
        <message>Here is the new build.</message>
        <fileset dir="dist">
            <includes name="**/*.tar.gz"/>
        </fileset>
    </mail>
</target>
```

Now you're deploying via email using Ant. You can see the attributes of the mail task in Table 4-15.

Table 4-15. The mailTask's attributes

Attribute	Description	Required	Default
bcclist	List of addresses to send a blind copy of the email to. A comma-separated list.	At least one of tolist, cclist, bcclist, or the equivalent elements (to, cc, or bcc).	
cclist	List of addresses to send a copy of the email to. A comma-separated list.	At least one of tolist, cclist, bcclist, or the equivalent elements (to, cc, or bcc).	
charset	Specifies the character set you want to use in the email.	No	
encoding	Specifies the encoding to use. Possible values are mime, uu, plain, or auto.	No	auto
failonerror	Specifies whether you want to stop the build if there are errors.	No	TRue
files	Specifies files you want to send as attachments. Use a comma-separated list. You can use nested fileset elements.	No	
from	Specifies the email address of the sender.	Either a from attribute or a from element.	
includefilenames	Specifies whether you want to include filename(s) before file contents.	No	false
mailhost	Specifies the hostname of the SMTP server.	No	localhost
mailport	Specifies the TCP port of the SMTP server to use.	No	25
message	Specifies the email's body.	One of message, messagefile, or a message element.	
messagefile	Specifies a file to send as the email's body.	One of message, messagefile, or a message element.	
messagemimetype	Specifies the type of the message's content.	No	text/plain
password	Specifies the password for SMTP authorization.	Yes, if SMTP authorization is required on your SMTP server.	
replyto	Specifies the reply-to address.	No	
ssl	Specifies if you want to use TLS/SSL.	No	

Attribute	Description	Required	Default
subject	Specifies the email's subject.	No	
tolist	Specifies a list of recipients. A comma-separated list.	At least one of tolist, cclist, bcclist, or the equivalent elements (to, cc, or bcc).	
user	Specifies the username used to log into the SMTP server.	Yes, if SMTP authorization is required on your SMTP server.	

The mail task can take nested to, cc, bcc, from, and replyto elements, which hold email addresses. Here are the attributes of these elements (these attributes are common across all these elements):

address

: Specifies the email address

name

: Specifies the display name for the email address

In addition, the nested message element sets the message to include in the email body. Here are the attributes of this element (all are optional):

charset

: Specifies the character set used in the message

mimetype

: Specifies the content type of the message

src

: Specifies the file to use as the message

You can use email to send the results of a build with the mail logger, which is useful if you've set up unattended nightly builds with utilities like at in Windows or crontab in Unix (see Chapter 7 for coverage of both of these). Here's how you use this logger:

```
%ant -logger org.apache.tools.ant.listener.MailLogger
```

You set these properties in the build file to set up the email you want sent:

`MailLogger.mailhost`

Specifies the mail server to use (default: localhost)

`MailLogger.port`

Specifies the default port for SMTP (default: 25)

`MailLogger.from`

Specifies the mail "from" address (required)

`MailLogger.failure.notify`

Specifies if to send on failure (default: true)

`MailLogger.success.notify`

Specifies if to send on success (default: true)

`MailLogger.failure.to`

Specifies the address to send failure messages to (required if failure mail to be sent)

`MailLogger.success.toSpecifies`

The address to send success messages to (required if success mail to be sent)

`MailLogger.failure.subject`

Specifies the subject of failed build (default: "Build Failure")

`MailLogger.success.subject`

Specifies the subject of successful build (default: "Build Success")

4.3.7. Setting File Protections with chmod

The `chmod` task changes the permissions of a file or files, and it's useful in deployment after you've got your files deployed in case you need to set file permissions. You set the permissions in Unix style (just as the arguments for the Unix `chmod` command).

Here's an example that makes *run.sh* readable, writable and executable for the owner on a Unix system, and readable and executable for others:

```
<chmod  file="${dist}/run.sh"  perm="755"/>
```

This makes all *.sh* files in and below `${dist}` readable and executable for anyone on a Unix system:

```
<chmod dir="${dist}" perm="ugo+rx"
    includes="**/*.sh"/>
```

You can see the attributes for this task in Table 4-16.

At present, the `chmod` task only works in Unix and the NonStop Kernel (Tandem).

Table 4-16. The chmod task's attributes

Attribute	Description	Required	Default
`defaultexcludes`	Specifies if you want to use default excludes. Set to `yes`/`no`.	No	Default excludes are used.
`dir`	Specifies the directory holding the files to work on.	One of `file`, `dir`, or nested `fileset/list` elements.	
`excludes`	Specifies the patterns matching files to exclude, as a comma- or space-separated list.	No	

Attribute	Description	Required	Default
`file`	Specifies the file or single directory where you want permissions to be changed.	One of `file`, `dir`, or nested `fileset/list` elements.	
`includes`	Specifies the patterns matching files to include, as a comma- or space-separated list.	No	
`maxparallel`	Specifies limits on how many files to pass at once. Set this attribute to 0 or negative values for unlimited parallelism. Available in Ant 1.6 or later.	No	`unlimited`
`parallel`	Specifies the task should process multiple files using a single `chmod` command.	No	`true`
`perm`	Specifies the new permissions you want.	Yes	
`type`	Specifies the target type. Possible values: `file`, `dir`, or `both`.	No	`file`
`verbose`	Specifies whether the task should display what it's doing as it does it. Available in An 1.6 or later.	No	`false`

This task holds an implicit FileSet and supports all of FileSet's attributes and nested elements directly Since Ant 1.6, you can specify nested `fileset` or `dirset` elements, and you can use nested filelists.

4.4. Scheduling Automatic Builds

It's time to add some automation to the build process. When you're working alone, you probably won't r
automate nightly builds, but as part of a team, it's a good idea. Larger projects typically have nightly bu
posted to a web site, and using various automation tools and tasks like ftp , that's no problem. I'll take a
at various options here.

4.4.1. Unix

You can schedule recurring builds with Unix utilies like crontab , which you use to configure the cron daei
For example, say you have a shell script that runs your nightly build, *dobuild.sh* , something like this:

```
export ANT_HOME=/usr/local/ant
export  JAVA_HOME=/usr/local/jdk1.4
export PATH=${PATH}:${ANT_HOME}/bin
cd /home/work
ant -f nightlybuild.xml
```

You can schedule that build to happen at various times with crontab by starting its editing mode:

```
-bash-2.05b$ crontab -e
```

Edit the crontab file to include this line:

```
run at 00:01 every day 30 0 * * * $HOME/work/dobuild.sh
```

That makes your build run every night at 12:01 A.M. Easy enough.

4.4.2. Windows

The Windows at command schedules commands to run in Windows at specific times. For example, say y
a batch file, *dobuild.bat* , which runs your nightly build:

```
set  ANT_HOME=C:\ant\apache-ant-1.6.1
set JAVA_HOME=C:\jdk1.4
set PATH=%PATH%;%ANT_HOME%\bin
cd C:\work
call %ANT_HOME%\bin\ant.bat -f nightlybuild.xml
```

You can schedule that build for every night with the Windows at command:

```
C:\ant>at 00:01 /every:M,T,W,Th,F "C:\work\dobuild.bat"
Added a new job with job ID = 1
```

To list scheduled `at` jobs, enter `at` :

```
C:\ant>at
Status ID   Day                     Time          Command Line
-------------------------------------------------------------------------------
        1   Each M T W Th F         12:01 AM      C:\work\dobuild.bat
```

> Want to get the results of your nightly build emailed to you? Use the Ant mail logger, covered earlier in this chapter.

The `crontab` and `at` commands are basic ways to get your builds to run automatically, but they're still ba There are more advanced and powerful tools available.

4.4.3. Anthill

In my opinion, Anthill is the easist of the automatic build tools to use as well as the easiest to install. It's software build management server that can handle most of your build needs, from individual up to the corporate. The web site is http://www.urbancode.com/default.jsp, and this is how Anthill describes itsel

> Anthill ensures a controlled build process and promotes the sharing of knowledge within an organiz Anthill performs a checkout from the source repository of the latest version of a project before eve and tags the repository with a unique build number after every build. It supports many repository adapters including: Concurrent Version System (CVS), Visual Source Safe, Perforce, Clearcase, PV(StarTeam, MKSIntegrity and FileSystem. Anthill automatically updates a project intranet site with a from the latest build.

Anthill comes in two versions: Anthill Pro (fairly expensive) and Anthill OS (free). To install Anthill, dowr the binary distribution you want and expand it. Copy *anthill.war* from the expanded *dist* directory to a We server's application deployment directory, such as the *webapps* directory of a Tomcat server installation.

Anthill is designed to be used with a Web server that can execute Java code, like Tomcat, and you can g Tomcat free from http://jakarta.apache.org/tomcat/ . (Anthill was developed and has only been tested u the Tomcat server, though it's supposed to work with any servlet container.)

Anthill gives you a servlet-based console, hosted by Tomcat or similar server, that lets you configure yo automatic build process. Anthill is designed to check source code out of a code repository automatically build that code.

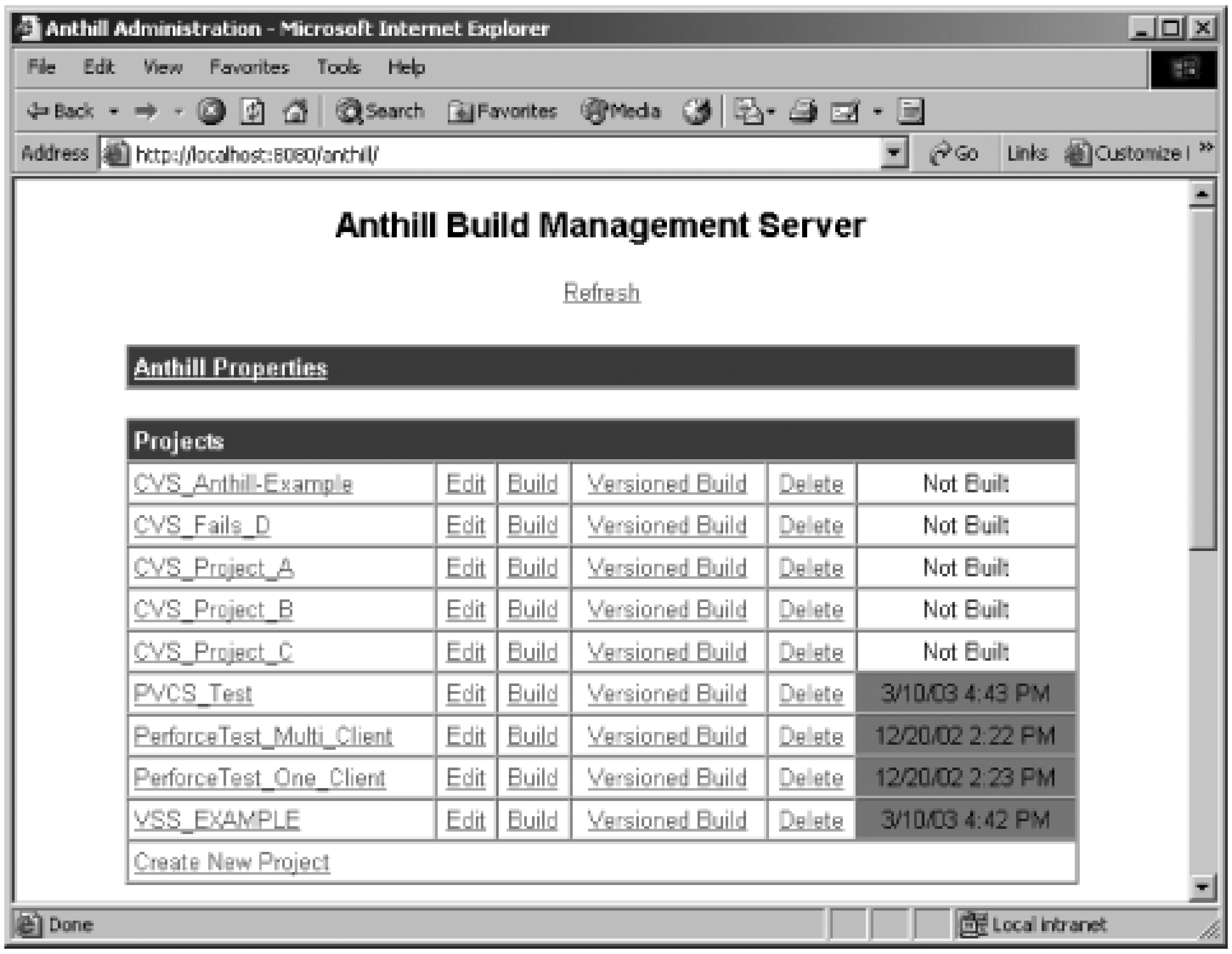
For example, you can test your Anthill installation by logging into the Anthill CVS server to retrieve the c a project named anthill-test, using the password "anthill-example":

```
%cvs -d :pserver:anthill-example@cvs2.urbancode.com:/usr/local/anthill-test login
Logging in to :pserver:anthill-example@cvs2.urbancode.com:2401:/usr/local/anthill-test
```

```
CVS password: ***************
```

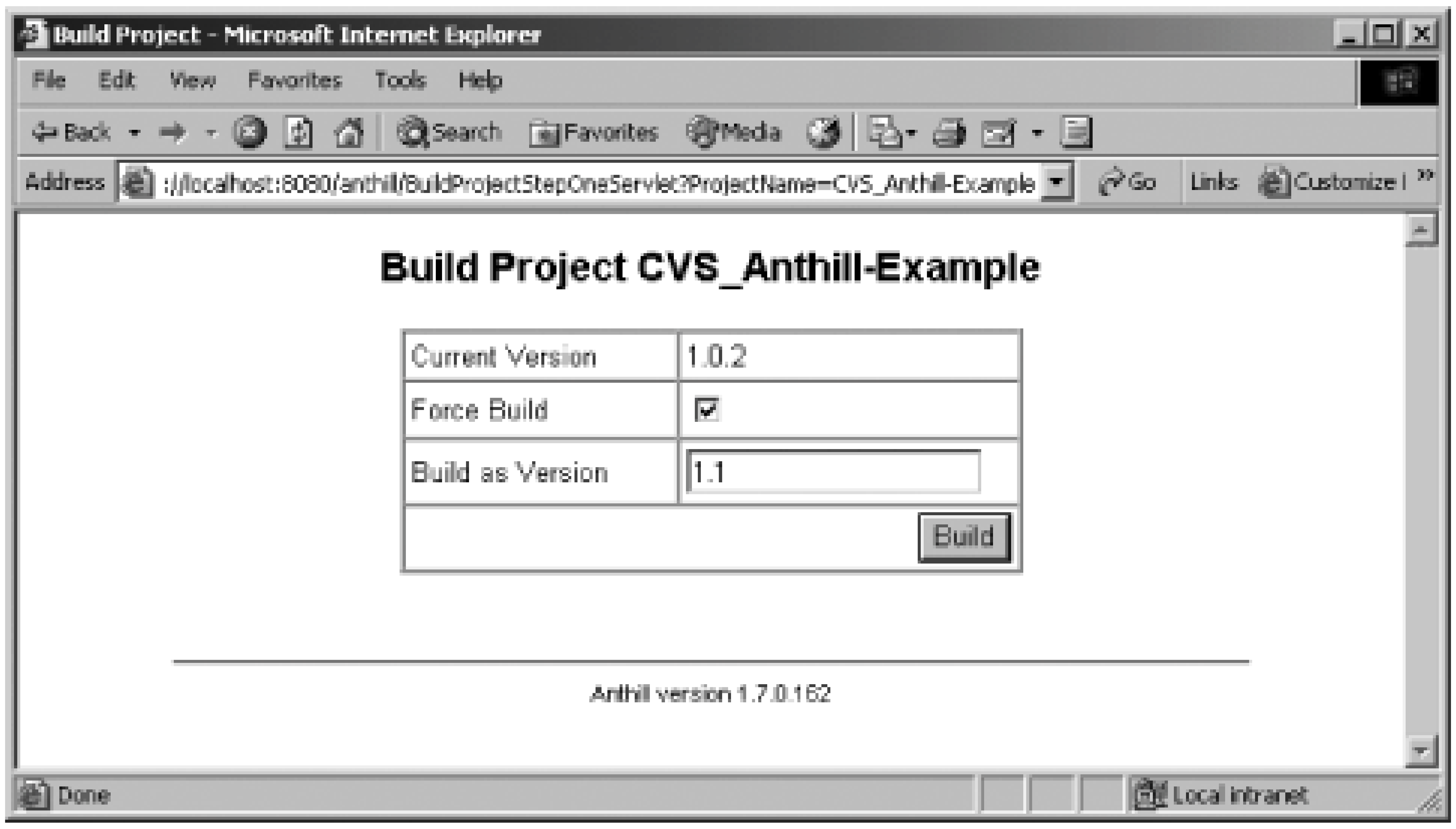
In the same command-prompt session, start Tomcat and navigate to *http://localhost:8080/anthill* to ope Anthill console, as shown in Figure 4-1. This is the console that lets you schedule and configure your bui Successfully built projects are marked with a green box in the right column of the console.

Figure 4-1. The Anthill build management server



Having logged into the Anthill CVS server, click the Buildhyperlink in the top line of the table shown in Fig 1 , which will build the `CVS_Anthill` example. This opens the Build Project page shown in Figure 4-2. Clicl Force Build checkbox, enter a build version such as 1.1, and click the Build button.

Figure 4-2. Forcing a build

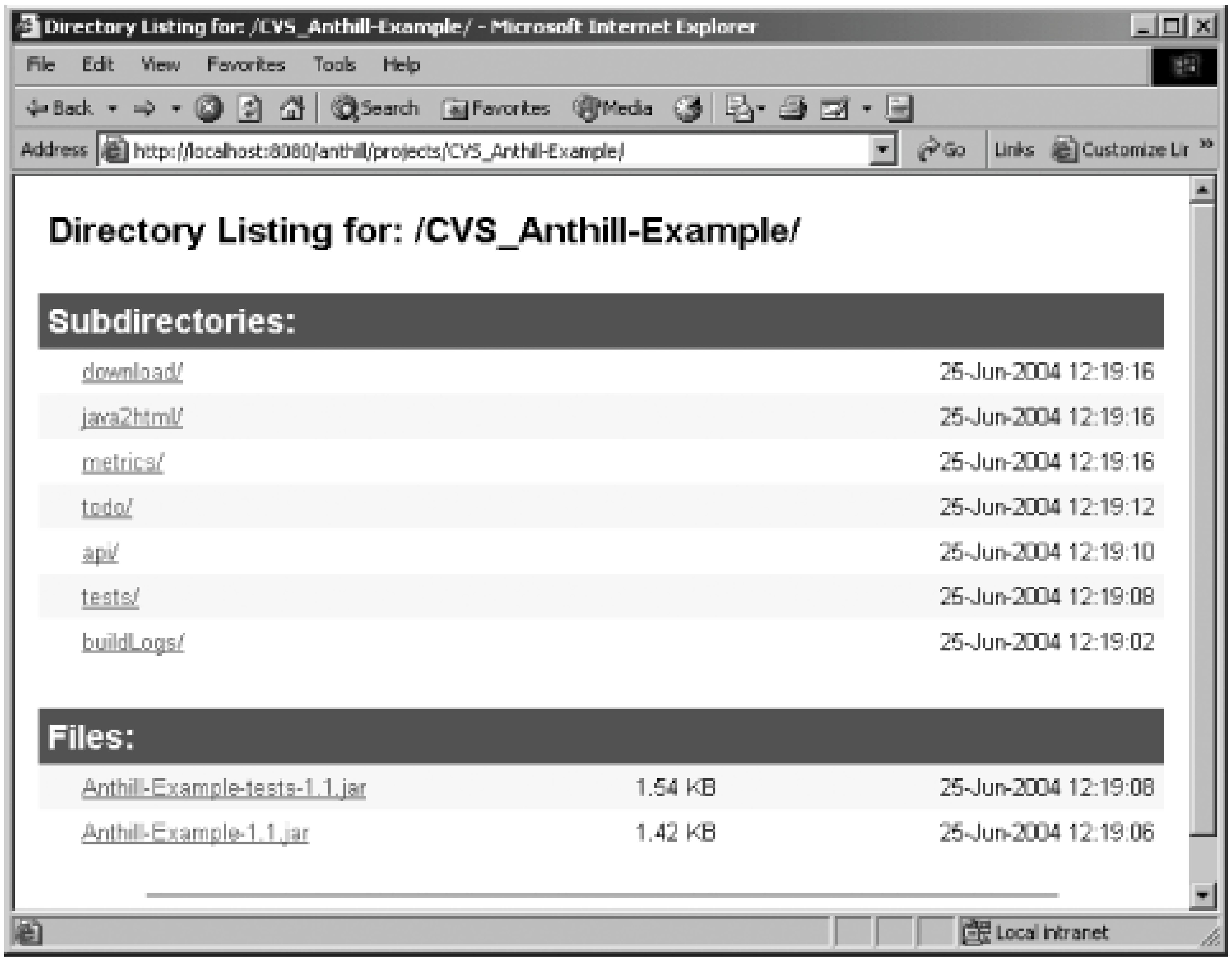


Anthill will download the code for this project from the Anthill CVS server and build it. The Anthill consol will reappear; click Refresh to verify that the project has been built. A green box should appear at right CVS Anthill-Example line in the console table, as shown in Figure 4-3 , if the build was successful.

Figure 4-3. Running a new build

If you click the CVS_Anthill-Example hyperlink in the console now, you'll get access to the results of the as shown in Figure 4-4.

Figure 4-4. Build artifacts



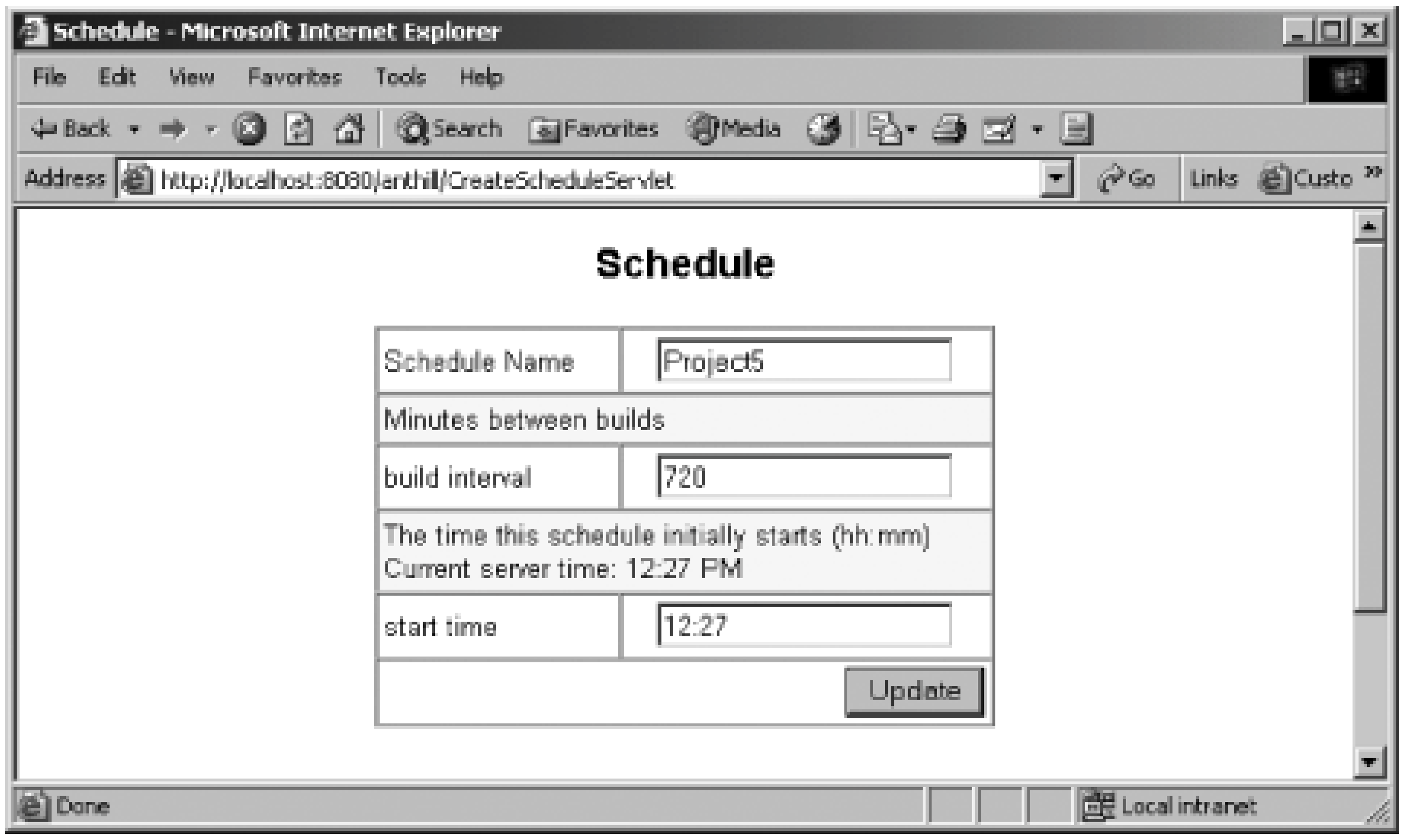
The tests hyperlink links to the results of JUnit tests, and the buildLogs hyperlink links to the build log. H what the build log looks like:

```
all:

compile:
    [mkdir] Created dir: D:\anthill\work\Anthill-Example\build\temp
    [mkdir] Created dir: D:\anthill\work\Anthill-Example\build\temp\classes
     [javac] Compiling 1 source file to D:\anthill\work\Anthill-Example\build\temp\cla
      [copy] Copying 1 file to D:\anthill\work\Anthill-Example\build\temp\classes

jars:
       [jar] Building jar: D:\anthill\publishDir\CVS_Anthill-Example\Anthill-Example-1

compile:

compile-tests:
    [mkdir] Created dir: D:\anthill\work\Anthill-Example\build\temp\tests\classes
     [javac] Compiling 1 source file to D:\anthill\work\Anthill-Example\build\temp\
tests\classes
```

```
      [jar] Building jar: D:\anthill\publishDir\CVS_Anthill-Example\
Anthill-Example-tests-1.1.jar

run-tests:
    [mkdir] Created dir: D:\anthill\work\Anthill-Example\build\temp\tests\data
    [mkdir] Created dir: D:\anthill\publishDir\CVS_Anthill-Example\tests
    [junit] Running example.WidgetTestCase
    [junit] Tests run: 2, Failures: 0, Errors: 0, Time elapsed: 0.651 sec
    [junit] Testsuite: example.WidgetTestCase
    [junit] Tests run: 2, Failures: 0, Errors: 0, Time elapsed: 0.651 sec

[junitreport] Using Xalan version: Xalan Java 2.2.D11
[junitreport] Transform time: 1051ms

doc:

javadoc:
    [mkdir] Created dir: D:\anthill\publishDir\CVS_Anthill-Example\api
  [javadoc] Generating Javadoc
  [javadoc] Javadoc execution
  [javadoc] Loading source files for package example...
  [javadoc] Constructing Javadoc information...
  [javadoc] Standard Doclet version 1.4.0

  [javadoc] Building tree for all the packages and classes...
  [javadoc] Building index for all the packages and classes...
  [javadoc]  D:\anthill\work\Anthill-Example\source\java\example\Widget.java:12:
warning - @author tag has no arguments.
  [javadoc] Building index for all classes...
  [javadoc] Generating D:\anthill\publishDir\CVS_Anthill-Example\api\stylesheet.css...
  [javadoc] 1 warning
        .
        .
        .
clean:
   [delete] Deleting directory D:\anthill\work\Anthill-Example\build\temp

BUILD SUCCESSFUL
Total time: 15 seconds
```

You schedule builds from the console page, *http://localhost:8080/anthill/* , if you're using Tomcat. Click New Schedule in the Schedule box, configure the new schedule as shown in Figure 4-5 and click Update update the scheduler.

Figure 4-5. Setting up a schedule



All in all, Anthill is a great automated build tooleasy to set up, easy to use.

4.4.4. Cruise Control and Gump

Cruise Control and Gump are two other Ant automated build tools for use with Ant. You can get Cruise C at http://cruisecontrol.sourceforge.net/ . It's an extensive build management tool, but it takes some effo install. To configure a build, you work with a *modification set* . Cruise Control supports an Ant task name `modificationset` that contains nested tasks you can use to configure your build.

After setting up the build as you want it, you start the Cruise Control runner using *.sh* and *.bat* scripts, depending on your operating system, and Cruise Control takes it from there.

An alternative automated build tool is Gump. You can get Gump from the Jakarta CVS repository, using password `anoncvs` :

```
%cvs -d :pserver:anoncvs@cvs.apache.org:home/cvspublic login
Logging in to pserver:anoncvs@cvs.apache.org:home/cvspublic
CVS password: *******

%cvs -d :pserver:anoncvs@cvs.apache.org:home/cvspublic checkuot jakarta-alexandria
```

You can read all about Gump and how it works at http://gump.apache.org/. Using Gump, project definit are converted from XML to scripts native to the platform on which you are running. These scripts execut or SVN update commands for every module which contains a project being built, and then builds each o projects.

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Chapter 5. Testing Builds with JUnit

This chapter is about a crucial aspect of the build processtesting build results before deploying them. It doesn't make sense to deploy a build that has been broken, and using the JUnit framework with Ant, you can run tests on your code and deploy a build only if it satisfies those tests. This is a great way to make sure changes to your code haven't broken anything.

To test the results of a build automatically, you'll need to use one of Ant's most powerful optional tasks: `junit`. This task is part of the repertoire of every serious Ant developer, especially those working in teams. If someone else on your project has broken your code, you should know about it before you deploy or upload to a shared code repository, and `junit` will let you know about these problems automatically.

To demonstrate how JUnit works with Ant in this chapter, we're going to use *Project.java*, shown in Example 5-1, as a guinea pig.

Example 5-1. A simple Project file

```
package org.antbook;

public class Project
{
    public Project (String name)
    {

    }

    public boolean returnTrue( )
    {
        return true;
    }

    public int return4( )
    {
        return 2 + 2;
    }

    public Object returnObject( )
    {
        return new Integer(1);
    }

    public static void main(String args[])
    {
        Project project = new Project("project");
```

```
        System.out.println(project.returnTrue( ));
         System.out.println(project.return4( ));
        System.out.println(project.returnObject( ));
    }
}
```

This application, *Project.java*, has three simple methods, each of which returns a value:

returnTrue( )

returns a boolean value of `TRue`.

return4( )

returns an integer value of `4`.

returnObject( )

returns an Integer object containing a value of `1`.

When you compile *Project.java* and run it, each of these methods are executed. Now you can use the `junit` task to make sure that alterations to this application's code doesn't break the expected operation of these methods.

You can see the original build file that builds and deploys the *Project.java* application in Example 5-2: Note the section where the JUnit tests will be added. Break the build if those tests don't pass.

Example 5-2. Using Junit ch05/junit/build.xml

```
<?xml version="1.0" ?>
<project default="main">

    <property name="message" value="Building the project...." />
    <property name="testsOK" value="Tested OK...." />
    <property name="src" location="source" />
    <property name="output" location="." />
    <property name="results" location="results" />
    <property name="jars" location="jars" />
    <property name="dist" location="user" />
    <property name="junit.fork" value="true"/>

    <target name="main" depends="init, compile, test, compress, deploy">
        <echo>
          ${message}
```

```
        </echo>
    </target>

    <target name="init">
        <mkdir dir="${output}" />
        <mkdir dir="${results}" />
        <mkdir dir="${jars}" />
    </target>

    <target name="compile">
        <javac srcdir="${src}" destdir="${output}" />
    </target>

     <target name="test" depends="test1, test2, test3, test4, test5">
        <echo>
          ${testsOK}
        </echo>
    </target>
        .
        .
        .
    <!-- [TESTS GO HERE] -->
        .
        .
        .
    <target name="compress">
        <jar destfile="${jars}/Project.jar" basedir="${output}">
          <include name="**/*.class"/>
        </jar>
    </target>

    <target name="deploy">
        <delete dir="${dist}" />
        <mkdir dir="${dist}" />
        <copy todir="${dist}">
          <fileset dir="${jars}">
              <include name="*.jar"/>
          </fileset>
        </copy>
    </target>

</project>
```

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5.1. Using JUnit

JUnit is an open source testing framework housed online athttp://www.junit.org/, where you'll find downloads and documentation. Using JUnit, you can construct a set of standard tests for everyone working on an application, and if they change the application's code, all they'll need is to run the buil file to verify that the application still passes the standard set of tests.

JUnit is primarily made up of a set of assertion methods that can test various conditions. Here they are:

`assertEquals(a, b)`

Tests if `a` is equal to `b` (`a` and `b` are primitive values or must have an `equals` method for comparison purposes)

`assertFalse(a)`

Tests if `a` is false, where `a` is a boolean value

`assertNotNull(a)`

Tests if `a` is not null, where `a` is an object or `null`

`assertNotSame(a, b)`

Tests if `a` and `b` do not refer to the identical object

`assertNull(a)`

Tests if `a` is null, where `a` is an object or null

`assertSame(a, b)`

Tests if `a` and `b` refer to the identical object `assertTrue(a)`

Tests if `a` is frue, where `a` is a boolean value

To work with JUnit, you modify your code to extend the `junit.framework.TestCase` class, which in turn extends the `junit.framework.Assert` class. After subclassing the `TestCase` class, you can use the various `assertXXX( )` methods to test the results from your newly compiled code. Each of these methods, along with their various versions, are listed in Table 5-1.

> Though your code extends the `TestCase` class, these methods are part of `TestCase`'s base class, the `Assert` class.

Table 5-1. The junit.framework.Assert methods

Method	Does this
`static void assertEquals(boolean expected, boolean actual)`	Tests if two booleans are equal
`static void assertEquals(byte expected, byte actual)`	Tests if two bytes are equal
`static void assertEquals(char expected, char actual)`	Tests if two chars are equal
`static void assertEquals(double expected, double actual, double delta)`	Tests if two doubles are equal within a value named delta
`static void assertEquals(float expected, float actual, float delta)`	Tests if two floats are equal within a value named delta
`static void assertEquals(int expected, int actual)`	Tests if two ints are equal
`static void assertEquals(long expected, long actual)`	Tests if two longs are equal
`static void assertEquals(java.lang.Object expected, java.lang.Object actual)`	Tests if two objects are equal
`static void assertEquals(short expected, short actual)`	Tests if two shorts are equal
`static void assertEquals(java.lang.String message, boolean expected, boolean actual)`	Tests if two booleans are equal
`static void assertEquals(java.lang.String message, byte expected, byte actual)`	Tests if two bytes are equal
`static void assertEquals(java.lang.String message, char expected, char actual)`	Tests if two chars are equal
`static void assertEquals(java.lang.String message, double expected, double actual, double delta)`	Tests if two doubles are equal within a value given by delta
`static void assertEquals(java.lang.String message, float expected, float actual, float delta)`	Tests if two floats are equal within a value given by delta

Method	Does this
`static void assertEquals(java.lang.String message, int expected, int actual)`	Tests if two ints are equal
`static void assertEquals(java.lang.String message, long expected, long actual)`	Tests if two longs are equal
`static void assertEquals(java.lang.String message, java.lang.Object expected, java.lang.Object actual)`	Tests if two objects are equal
`static void assertEquals(java.lang.String message, short expected, short actual)`	Tests if two shorts are equal
`static void assertEquals(java.lang.String expected, java.lang.String actual)`	Tests if two Strings are equal
`static void assertEquals(java.lang.String message, java.lang.String expected, java.lang.String actual)`	Tests if two Strings are equal
`static void assertFalse(boolean condition)`	Tests if a condition is false
`static void assertFalse(java.lang.String message, boolean condition)`	Tests if a condition is false
`static void assertNotNull(java.lang.Object object)`	Tests if an object isn't null
`static void assertNotNull(java.lang.String message, java.lang.Object object)`	Tests if an object isn't null
`static void assertNotSame(java.lang.Object expected, java.lang.Object actual)`	Tests if two objects do not refer to the same object
`static void assertNotSame(java.lang.String message, java.lang.Object expected, java.lang.Object actual)`	Tests if two objects do not refer to the same object
`static void assertNull(java.lang.Object object)`	Tests if an object is null
`static void assertNull(java.lang.String message, java.lang.Object object)`	Tests if an object is null
`static void assertSame(java.lang.Object expected, java.lang.Object actual)`	Tests if two objects refer to the same object
`static void assertSame(java.lang.String message, java.lang.Object expected, java.lang.Object actual)`	Tests if two objects refer to the same object
`static void assertTrue(boolean condition)`	Tests if a condition is true
`static void assertTrue(java.lang.String message, boolean condition)`	Tests if a condition is true
`static void fail( )`	Makes a test fail
`static void fail(java.lang.String message)`	Makes a test fail with the specified message

Table 5-2 lists the methods specific to the JUnit TestCase method.

Table 5-2. The junit.framework.TestCase methods

Method	Does this
`int countTestCases( )`	Counts how many test cases are executed
`protected TestResult createResult( )`	Creates a default `TestResult` object
`java.lang.String getName( )`	Gets the name of a `TestCase` and returns it
`TestResult run( )`	Runs a test, storing results in a `TestResult` object
`void run(TestResult result)`	Runs a test case and stores the results in `TestResult`
`void runBare( )`	Executes a bare test
`void setName(java.lang.String name)`	Specifies the name of a test case
`protected void setUp( )`	Lets you perform initialization operations
`protected void tearDown( )`	Lets you clean up after your tests, such as closing a network connection
`java.lang.String toString( )`	Returns a string representation of a case

5.1.1. Writing the Tests

To add JUnit test cases to your code, you import `junit.framework.TestCase`, base your application's class on it, and write *test cases*. Test cases are methods whose name begins with "test", which means JUnit will call them automatically. In this example, there are three test cases: `testTrue( )` to test the return value of the `returnTrue( )` method, `testEquals( )` to test the results of the `return4( )` method, and `testNotNull( )` to test the results of the `returnObject( )` method. All three of these test cases will be called automatically by the JUnit framework. Inside test cases, you can use the JUnit methods like `assertTrue( )`, `assertEquals( )`, and so on, to make sure the build didn't break your application.

To make this work, import `junit.framework.TestCase`, extend that class, and add three test cases to test the three methods in your codehe JUnit framework will call all three test cases automatically because their names start with "test":

```
package org.antbook;

import junit.framework.TestCase;

public class Project extends TestCase
{
    public Project (String name)
    {
```

```
    }

    public void testTrue( )
    {
        .
        .
        .
    }

    public void testEquals( )
    {
        .
        .
        .
    }

    public void testNotNull( )
    {
        .
        .
        .
    }

    public boolean returnTrue( )
    {
        return true;
    }

    public int return4( )
    {
        return 2 + 2;
    }

    public Object returnObject( )
    {
        return new Integer(1);
    }

    public static void main(String args[])
    {
        Project project = new Project("project");
        System.out.println(project.returnTrue( ));
         System.out.println(project.return4( ));
        System.out.println(project.returnObject( ));
    }
}
```

Use the JUnit methods `assertTrue( )`, `assertEquals( )`, and `assertNotNull( )` to test the results from the three methods in *Project.java*for example, testing if the return value of `return4` really is 4, as it should be. If any of these assertions don't work, an exception is thrown, and that exception causes the build to fail:

```java
package org.antbook;

import junit.framework.TestCase;

public class Project extends TestCase
{
    public Project (String name)
    {

    }

    public void testTrue( )
    {
        assertTrue("assertTrue test", returnTrue( ));
    }

    public void testEquals( )
    {
        assertEquals("assertEquals test", 4, return4( ));
    }

    public void testNotNull( )
    {
        assertNotNull("assertNotNull test", returnObject( ));
    }

    public boolean returnTrue( )
    {
        return true;
    }

    public int return4( )
    {
        return 2 + 2;
    }

    public Object returnObject( )
    {
        return new Integer(1);
    }

    public static void main(String args[])
    {
        Project project = new Project("project");
        System.out.println(project.returnTrue( ));
         System.out.println(project.return4( ));
        System.out.println(project.returnObject( ));
    }
}
```

Besides writing test cases like these, you can add two additional methods,`setUp( )` and `tearDown( )`, to your code. These methods act much like constructors and destructors for your tests:

`protected void setUp( )`

Lets you perform initialization, for example, opening a network connection

`protected void tearDown( )`

Lets you clean up after the tests are completefor example, closing a network connection

> For further details on how JUnit works, see the JUnit site at http://www.junit.org/index.htm.

5.1.2. Performing Tests with the junit Task

The Ant `junit` task lets you run JUnit tests from Ant. It's an optional task, so you'll need need to install *junit.jar*which you get from http://www.junit.org/æin the Ant *lib* directory. Using `junit`, you can tell Ant which *.class* files you want tested, and JUnit will run the test cases in those files. The attributes of the `junit` task appear in Table 5-3.

Table 5-3. The junit attributes

Attribute	Description	Required	Default
`dir`	Specifies the directory where you want to run the JVM. Ignored if fork is disabled.	No	
`errorproperty`	Specifies the name of a property you want set in case there was an error.	No	
`failureproperty`	Specifies the name of a property in case the task failed.	No	
`filtertrace`	Removes Junit and Ant stack frames from error stack traces.	No	on
`fork`	Specifies that you want to run tests in a new JVM.	No	off
`haltonerror`	Specifies you want to stop the build if there are errors.	No	`off`

Attribute	Description	Required	Default
haltonfailure	Specifies you want to stop the build if the test fails.	No	off
includeantruntime	Specifies you want to add the Ant classes and JUnit to the classpath in a forked JVM.	No	true
jvm	Specifies the command used to start the Java Virtual Machine. Ignored if fork is disabled.	No	"java"
maxmemory	Specifies the maximum amount of memory to give to the forked JVM. Ignored if fork is disabled.	No	
newenvironment	Specifies you don't want to copy the old environment when new environment variables are specified. Ignored if fork is disabled.	No	false
printsummary	Specifies you want statistics for each test case. Possible values: on, off, and withOutAndErr (which is the same as on but also writes output of the test as written to System.out and System.err).	No	off
reloading	Specifies whether you want a new classloader to be started for each test case. Since Ant 1.6.	No	TRue
showoutput	Sends any output to Ant's logging system and to the formatters you specify.	No	Only the formatters receive the output.
tempdir	Specifies where you want this task to place temporary files. Since Ant 1.6.	No	The project's base directory.
timeout	Specifies you want to stop a test if it doesn't finish in time. Time is measured in milliseconds. Ignored if fork is disabled.	No	

The junit task supports a nested classpath element that represents a path-like structure, and which you can use to set the classpath used while the tests are running.

A number of other elements may be nested inside the junit element. If you're using fork, you can pass additional parameters to the new JVM with nested jvmarg elements:

```
<junit fork="yes">
    <jvmarg value="-Djava.compiler=NONE"/>
        .
        .
        .
</junit>
```

> You can specify environment variables to pass to a forked JVM with nested `env` elements. I'll look at this element, including its attributes, in Chapter 7.

Nested `sysproperty` elements can specify system properties required by the class you're testing. These properties will be made available to the JVM during the execution of the test. You can use the same attributes as the `env` task here; for example, you can use the `key` and `value` attributes to specifies properties and property values, as in this example:

```
<junit>
    <sysproperty key="basedir" value="${basedir}"/>
        .
        .
        .
</junit>
```

5.1.2.1 Formatting test results

Test results can be printed in various formats, and you use the `formatter` nested element to specify which format to use (by default, the output of the tests will be sent to a file unless you set the `usefile` attribute to false). There are three predefined formatters:

- The `XML` formatter prints the test results in XML format.
- The `plain` formatter prints plain text.
- The `brief` formatter will give only brief details, only printing in-depth information for test cases that failed.

I'll look at formatting the results of JUnit tests using these formatters in this chapter. The attributes of the `formatter` element appear in Table 5-4.

Table 5-4. The formatter task's Attributes

Attribute	Description	Required	Default
`classname`	Specifies the name of the custom formatter class you want to use.	Exactly one of `type` or `classname`.	
`extension`	Specifies the extension for the output filename.	Yes, if `classname` has been used.	
`if`	Specifies JUnit will only use this formatter if a specified property is set.	No	`TRue`

Attribute	Description	Required	Default
`type`	Specifies a predefined formatter you want to use. Possible values: `xml`, `plain`, or `brief`.	Exactly one of `type` or `classname`.	
`unless`	Specifies JUnit should use the formatter if a specified property is not set.	No	`true`
`usefile`	Specifies if you want to send output to a file.	No	`true`

5.1.2.2 Specifying the test class

You use the `test` nested element to specify a class to test. The attributes of this element appear in Table 5-5.

Table 5-5. The test task's Attributes

Attribute	Description	Required	Default
`errorproperty`	Specifies the the name of a property you want to have set if there is an error	No	
`failureproperty`	Specifies the name of a property in case the task fails	No	
`filtertrace`	Removes Junit and Ant stack frames from error stack traces	No	`on`
`fork`	Specifies you want to run tests in a new JVM	No	
`haltonerror`	Specifies you want to stop the build if there are errors	No	
`haltonfailure`	Specifies you want to stop the build if the test fails	No	
`If`	Specifies this test should run only if a specified property is set	No	
`name`	Specifies the name of the test class you want to use	Yes	
`outfile`	Sets the filename where the test results should go	No	`TEST-`*`name`*, where *`name`* is the name of the test specified in the name attribute

Attribute	Description	Required	Default
todir	Specifies the directory you want the reports written to	No	The current directory
unless	Specifies this test should run only if a specified property is not set	No	

5.1.2.3 Running tests in batches

Another nested element, batchtest, lets you set up a number of tests at once. The batchtest element collects the included files from any number of nested filesets, and generates a test class name for each file that ends in *.java* or *.class*. You'll use this element later in this chapter. The attributes for batchtest appear in Table 5-6.

Table 5-6. The batchtest element's attributes

Attribute	Description	Required	Default
errorproperty	Specifies the name of a property you want set in case there is an error	No	
failureproperty	Specifies the name of a property in case the task fails	No	
filtertrace	Removes Junit and Ant stack frames from error stack traces	No	on
fork	Specifies you want to run tests in a new JVM	No	
haltonerror	Specifies you want to stop the build if there are errors	No	
haltonfailure	Specifies you want to stop the build if the test fails	No	
if	Specifies this test should run only if a specified property is set	No	
todir	Specifies the directory where you want reports written to	No	The current directory
unless	Specifies this test should run only if a specified property is not set	No	

Other nested elements are available since Ant 1.6. You can specify a set of properties to be used as system properties with syspropertysets. If you're forking a new JVM, you can specify the location of bootstrap class files using the bootclasspath path-like structure inside the junit task. You can revoke or grant security permissions during the execution of a class with a nested permissions element. And you can even control Java 1.4 assertions with an assertions subelement.

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5.2. Running Test Cases

To run the JUnit test cases, add a `test` target to the build file introduced at the beginning of the chapter, and make the `main` target depend on the `test` target as part of the build process:

```
<target name="main" depends="init, compile, test, compress, deploy">
    <echo>
        ${message}
    </echo>
</target>
```

The `test` target will run the six targets you're going to create in this chapter:

```
<property name="testsOK" value="Tested OK...." />
    .
    .
    .
<target name="test" depends="test1, test2, test3, test4, test5, test6">
    <echo>
        ${testsOK}
    </echo>
</target>
```

If you're not using Ant or a Java IDE, you usually run JUnit tests from the command line and use the `junit.textui.TestRunner` class like this, testing the example class created earlier in the chapter, `org.antbook.Project` :

```
%java junit.textui.TestRunner org.antbook.Project
```

You can do essentially the same thing in Ant using the `java` task, and that looks like this in the build file for the first test task, `test1` . Note that I'm adding *junit.jar* to the classpath:

```
 <target name="test1" depends="compile">
    <java fork="true"
        classname="junit.textui.TestRunner"
        classpath="${ant.home}/lib/junit.jar;.">
        <arg value="org.antbook.Project"/>
    </java>
</target>
```

Here's what this task looks like when it's running:

```
test1:
```

```
[java] ...
[java] Time: 0.01

[java] OK (3 tests)
```

Each dot (.) indicates a test case that's running, and three test cases are in the example. As you can see from the last line, the tests all passed OK, but this isn't exciting and it doesn't stop a build if there's a problem.

5.2.1. Using the Plain Formatter for Reports

The second test, `test2` , will use `junit` to run the test. No results are printed out by successful JUnit tests unless you use a formatter, so the plain formatter is used here, set by a`formatter` element. `classpath` is used to specify where `junit` should search for the class to test, and the `test` nested element sets up the test, giving the name of the class to test and the directory in which to store the formatted results of the test:

```
<target name="test2" depends="compile">
    <junit
        printsummary="yes"
        errorProperty="test.failed"
        failureProperty="test.failed"
        haltonfailure="yes">
        <formatter type="plain"/>
        <classpath path="."/>
        <test todir="${results}" name="org.antbook.Project"/>
    </junit>
    <fail message="Tests failed!" if="test.failed"/>
</target>
```

Note that if you set `haltonfailure` to true, the build will halt if the test failswhat to do if you want to avoid deploying a defective build.

> You can use attributes like `errorProperty` instead of `haltonfailure` to set properties indicating the build had problems. That's useful if you want to clean up after the partial build with other tasks instead of failing immediately in the `junit` task.

Here's the output you see when this task runs:

```
test2:
    [junit] Running org.antbook.Project
    [junit] Tests run: 3, Failures: 0, Errors: 0, Time elapsed: 0.011 sec
```

The plain formatter creates the output file *TEST-org.antbook.Project.txt* , which holds these contents:

```
Testsuite: org.antbook.Project
Tests run: 3, Failures: 0, Errors: 0, Time elapsed: 0.01 sec

Testcase: testTrue took 0 sec
Testcase: testEquals took 0 sec
Testcase: testNotNull took 0 sec
```

All the tests succeeded, and the results look good. But what if you changed a test so the `return4` method is supposed to return `5` , rather than `4` :

```
    public void testEquals( )
    {
        assertEquals("assertEquals test", 5, return4( ));
    }
```

In that case, you'd see this in the build:

```
test2:
    [junit] Running org.antbook.Project
    [junit] Tests run: 2, Failures: 1, Errors: 0, Time elapsed: 0.02 sec
```

You could read all about the problems in the output file *TEST-org.antbook.Project.txt* , which indicates the problem:

```
Testsuite: org.antbook.Project
Tests run: 2, Failures: 1, Errors: 0, Time elapsed: 0.02 sec

Testcase: testTrue took 0.01 sec
Testcase: testEquals took 0 sec
        FAILED
assertEquals test expected:<5> but was:<4>
junit.framework.AssertionFailedError: assertEquals test expected:<5> but was:<4>
        at org.antbook.Project.testEquals(Unknown Source)
        at sun.reflect.NativeMethodAccessorImpl.invoke0(Native Method)
        at sun.reflect.NativeMethodAccessorImpl.invoke(Unknown Source)
        at sun.reflect.DelegatingMethodAccessorImpl.invoke(Unknown Source)
```

If there's a problem, you can use the formatter's output to track it down.

5.2.2. Using the Brief Formatter for Reports

The brief formatter prints little unless there's been an error. Here's how to use it in a new test, `test3` :

```
    <target name="test3" depends="compile">
        <junit printsummary="yes" fork="yes" haltonfailure="yes">
            <formatter type="brief" usefile="true"/>
            <classpath path="."/>
```

```
            <test todir="${results}" name="org.antbook.Project"/>
        </junit>
    </target>
```

If everything goes well, this formatter displays a brief message during the build:

```
test3:
    [junit] Running org.antbook.Project
    [junit] Tests run: 2, Failures: 1, Errors: 0, Time elapsed: 0.01 sec
```

And it puts a brief message in *TEST-org.antbook.Project.txt* :

```
Testsuite: org.antbook.Project
Tests run: 3, Failures: 0, Errors: 0, Time elapsed: 0.01 sec
TEST-org.antbook.Project.txt:
```

On the other hand, if you reproduce an error as in `test2` (changing the expected value from 4 to 5), you'll see more information in *TEST-org.antbook.Project.txt* :

```
Testsuite: org.antbook.Project
Tests run: 2, Failures: 1, Errors: 0, Time elapsed: 0.01 sec

Testcase: testEquals(org.antbook.Project):        FAILED
assertEquals test expected:<5> but was:<4>
junit.framework.AssertionFailedError: assertEquals test expected:<5> but was:<4>
        at org.antbook.Project.testEquals(Unknown Source)
        at sun.reflect.NativeMethodAccessorImpl.invoke0(Native Method)
        at sun.reflect.NativeMethodAccessorImpl.invoke(Unknown Source)
        at sun.reflect.DelegatingMethodAccessorImpl.invoke(Unknown Source)
```

5.2.3. Using the XML Formatter for Reports

The XML formatter gives you the most information of all formatters. Here's how you use it in a new task, `test4` :

```
    <target name="test4" depends="compile">
        <junit printsummary="yes" fork="yes" haltonfailure="yes">
            <formatter type="xml"/>
            <classpath path="."/>
            <test todir="${results}" name="org.antbook.Project"/>
        </junit>
    </target>
```

This task creates a new file, *TEST-org.antbook.Project.xml* , which contains a tremendous amount of information, including the names and values of all properties, as well as the results of the tests:

```
<?xml version="1.0" encoding="UTF-8" ?>
<testsuite name="org.antbook.Project" tests="3" failures="0" errors="0" time="0.04">
  <properties>
     <property name="java.runtime.name" value="Java(TM) 2 Runtime Environment,
        Standard Edition"></property>
     <property name="ant.java.version" value="1.4"></property>
    <property name="java.vm.vendor" value="Sun Microsystems Inc."></property>
    <property name="java.vendor.url" value="http://java.sun.com/"></property>
    <property name="path.separator" value=";"></property>
    <property name="java.vm.name" value="Java HotSpot(TM) Client VM"></property>
    <property name="file.encoding.pkg" value="sun.io"></property>
    <property name="user.country" value="US"></property>
     <property name="sun.os.patch.level" value="Service Pack 3"></property>
        .
        .
        .
  </properties>
   <testcase name="testTrue" classname="org.antbook.Project" time="0.0"></testcase>
  <testcase name="testEquals" classname="org.antbook.Project"
       time="0.0"></testcase>
  <testcase name="testNotNull" classname="org.antbook.Project"
       time="0.0"></testcase>
  <system-out><![CDATA[]]></system-out>
  <system-err><![CDATA[]]></system-err>
</testsuite>
```

This kind of output is primarily designed to be used with the`junitreport` task.

5.2.4. Creating Reports with the junitreport Task

You can use the `junitreport` task to merge XML files generated by the JUnit task's XML formatter and apply a stylesheet on the resulting merged document to create a browseable report of results. This is an optional Ant task, and you need *xalan.jar* , version 2+, in the Ant *lib* directory to run it. You can get *xalan.jar* from http://xml.apache.org/xalan-j/ .

The attributes for this task appear in Table 5-7.

Table 5-7. The junitreport task's attributes

Attribute	Description	Required	Default
`todir`	Specifies the directory where you want XML-formatted reports to be written	No	The current directory
`tofile`	Specifies the name of the report file	No	*TESTS-TestSuites.xml*

The `junitreport` task can contain nested `fileset` elements. `junitreport` collects XML files generated by the JUnit task as specified in the nested `fileset` elements.

The `junitreport` task can contain nested `report` elements. These elements are the ones that generate the browseable report based on the merged XML documents. The attributes of the `report` element appear in Table 5-8 .

Table 5-8. The report task's attributes

Attribute	Description	Required	Default
`format`	Specifies the format you want to use in the report. Must be `noframes` or `frames` .	No	`frames`
`styledir`	Specifies the directory where the task should look for stylesheets. If you're using frames format, the stylesheet must be named *junit-frames.xsl* . If you're using noframes format, the stylesheet must be named *junit-noframes.xsl* .	No	Embedded stylesheets.
`todir`	Specifies the directory where output should be written.	No	The current directory.

In the build file's `test5` target, create an XML-formatted report for the JUnit tests:

```
<target name="test5" depends="compile">
   <junit printsummary="yes" fork="yes" haltonfailure="yes">
       <formatter type="xml"/>
       <classpath path="."/>
       <test todir="${results}" name="org.antbook.Project"/>
   </junit>
   .
   .
   .
```

Then use `junitreport` to merge and translate any XML reports into something you can look at in a browser. Here's what it looks like in the build file:

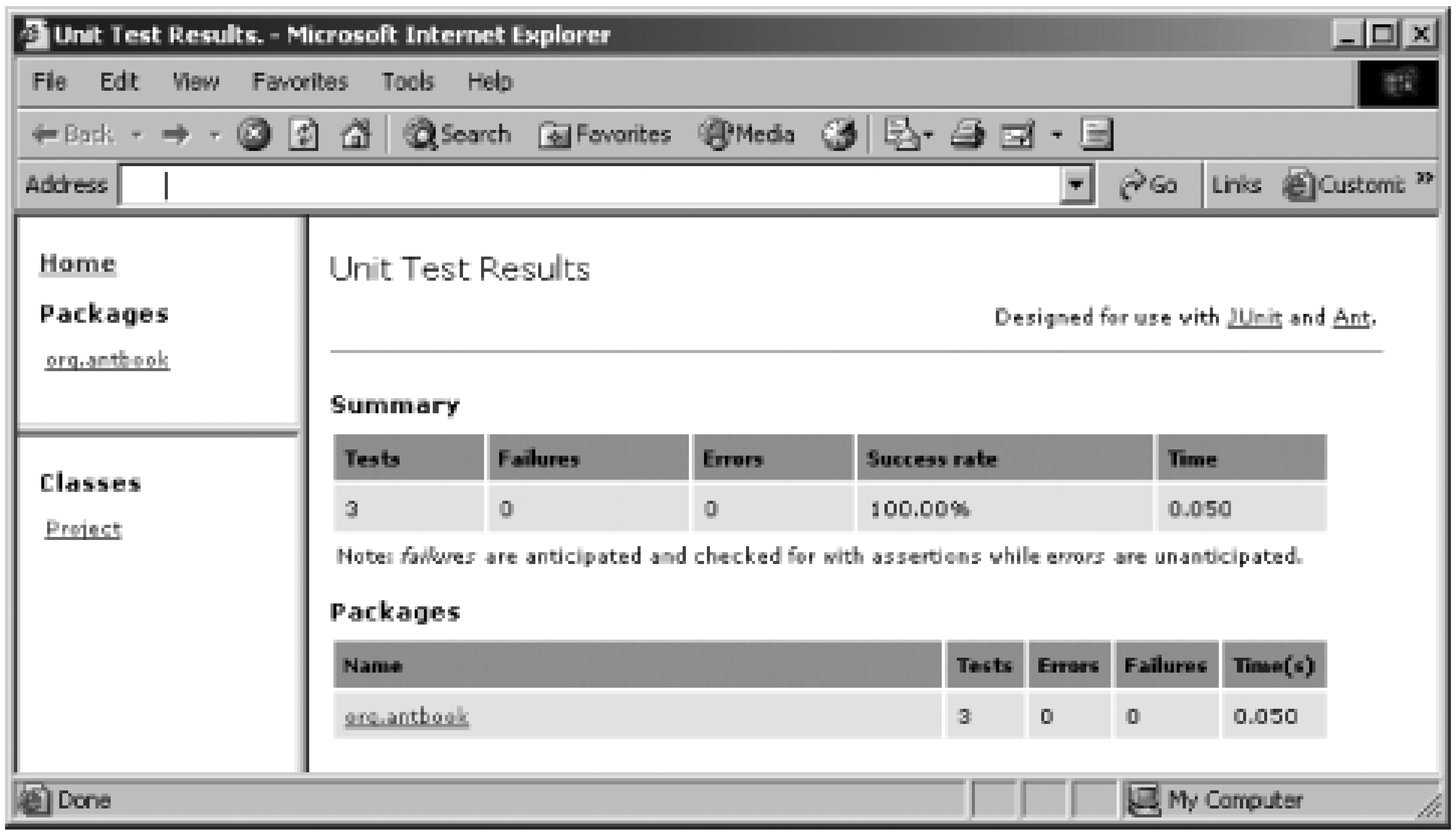
```
<target name="test5" depends="compile">
   <junit printsummary="yes" fork="yes" haltonfailure="yes">
       <formatter type="xml"/>
       <classpath path="."/>
       <test todir="${results}" name="org.antbook.Project"/>
   </junit>

   <junitreport todir="${results}">
       <fileset dir="${results}">
           <include name="TEST-*.xml"/>
       </fileset>
       <report format="frames" todir="${results}"/>
   </junitreport>
```

```
    </target>
```

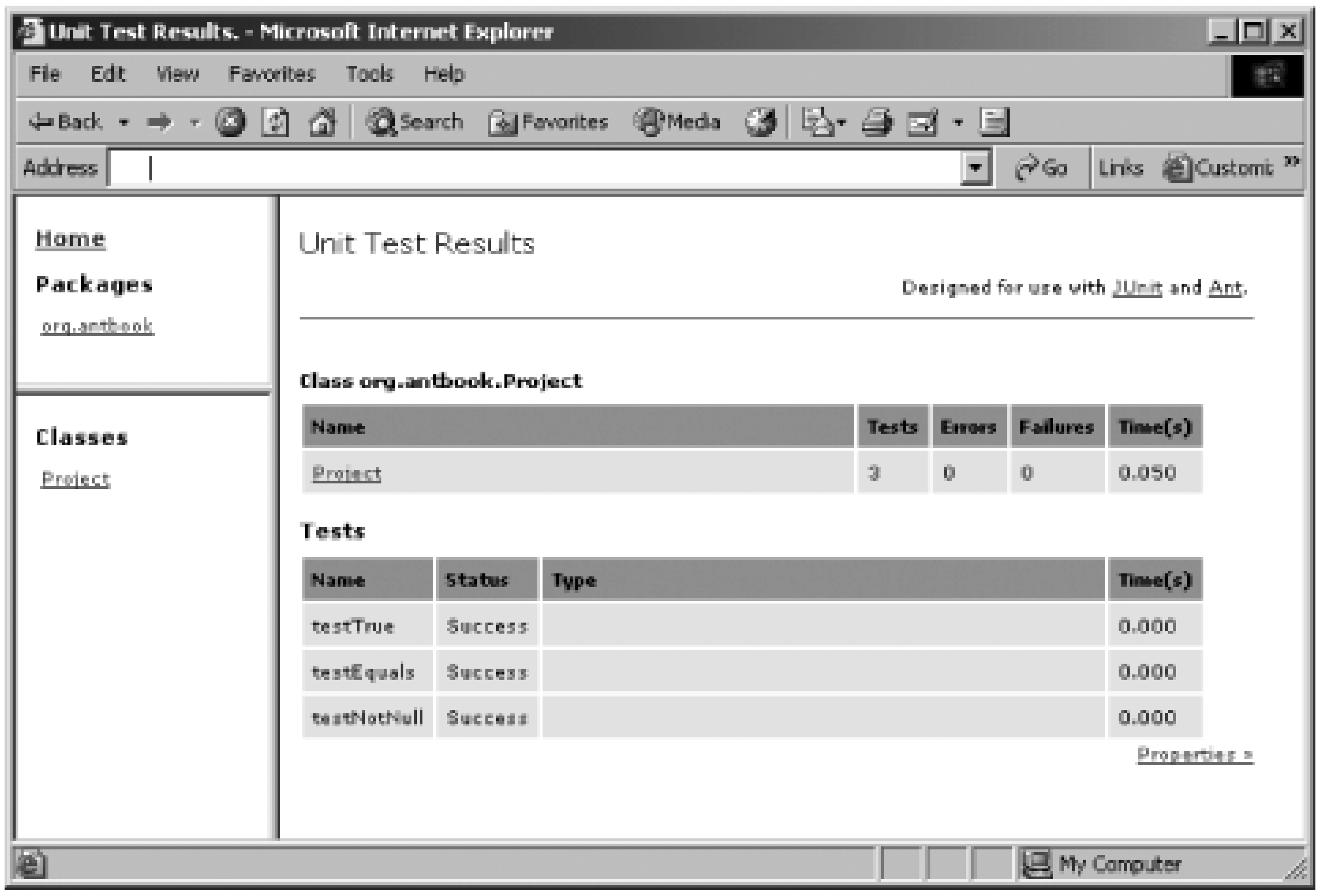
The `junit` task creates *TEST-org.antbook.Project.xml* , and the `junitreport` task creates *TESTS-TestSuites.xml* and the browseable report. To see the report, open the created *index.html* , shown in Figure 5-1 .

Figure 5-1. A JUnit report



You can browse through the results of your tests by clicking the Project link in the frame labeled Classes, opening the page you see in Figure 5-2, which reports on each test case.

Figure 5-2. Browsing test case results



Clicking the Properties link displays a page showing all property names and values.

5.3. Testing in Batches

When you're working with JUnit, you can set up *test suites*, which run multiple tests, by extending the `TestSuite` class:

```
import junit.framework.TestCase;
import junit.framework.TestSuite;
        .
        .
        .
public class NewSuite extends TestSuite
{
    static public Test testSuite( )
    {
        TestSuite suite = new TestSuite( );
        suite.addTestSuite(Project.class);
        suite.addTestSuite(Connector.class);
        suite.addTestSuite(DataHandler.class);
        return suite;
    }
}
```

When you're using JUnit from Ant, it's easier to use *batch testing* with the nested `batchtest` task. This task lets you specify whole filesets to test using the `fileset` type, and the results will be merged into a report. Here's how to use `batchtest`:

```
    <target name="test6" depends="compile">
        <junit printsummary="yes" haltonfailure="yes">
            <formatter type="brief" usefile="true"/>
            <classpath path="."/>
            <batchtest todir="${results}">
                <fileset dir="." includes="**/Project.class"/>
            </batchtest>
        </junit>
    </target>
```

In this case, the fileset only contains a single file (there's only one file to test in this chapter's example), but you can include as multiple files in your nested `fileset` element:

```
    <target name="test6" depends="compile">
        <junit printsummary="yes" haltonfailure="yes">
            <formatter type="brief" usefile="true"/>
            <classpath path="."/>
            <batchtest todir="${results}">
                <fileset dir="${build}">
```

```
                <include name="**/*Test.class"/>
                <include name="**/*Gold.class"/>
                <exclude name="**/*Beta.class"/>
             </fileset>
         </batchtest>
     </junit>
 </target>
```

Team LiB

5.4. Running the Build File

That completes the build file that runs the JUnit tests in*Project.java*. You can see the final version of this file, *build.xml* in Example 5-1Example 5-1.

Example 5-3. Using Junit ch05/junit/build.xml

```
<?xml version="1.0" ?>
<project default="main">

    <property name="message" value="Building the project...." />
    <property name="testsOK" value="Tested OK...." />
    <property name="src" location="source" />
    <property name="output" location="." />
    <property name="results" location="results" />
    <property name="jars" location="jars" />
    <property name="dist" location="user" />
    <property name="junit.fork" value="true"/>

    <target name="main" depends="init, compile, test, compress, deploy">
        <echo>
            ${message}
        </echo>
    </target>

    <target name="init">
        <mkdir dir="${output}" />
        <mkdir dir="${results}" />
        <mkdir dir="${jars}" />
    </target>

    <target name="compile">
        <javac srcdir="${src}" destdir="${output}" />
    </target>

     <target name="test" depends="test1, test2, test3, test4, test5, test6">
        <echo>
            ${testsOK}
        </echo>
    </target>

     <target name="test1" depends="compile">
        <java fork="true"
            classname="junit.textui.TestRunner"
            classpath="${ant.home}/lib/junit.jar;.">
```

```
            <arg value="org.antbook.Project"/>
        </java>
    </target>

    <target name="test2" depends="compile">
        <junit
            printsummary="yes"
            errorProperty="test.failed"
            failureProperty="test.failed"
            fork="${junit.fork}"
            haltonfailure="yes">
            <formatter type="plain"/>
            <classpath path="."/>
            <test todir="${results}" name="org.antbook.Project"/>
        </junit>
        <fail message="Tests failed!" if="test.failed"/>
    </target>

    <target name="test3" depends="compile">
        <junit printsummary="yes" fork="yes" haltonfailure="yes">
            <formatter type="brief" usefile="true"/>
            <classpath path="."/>
            <test todir="${results}" name="org.antbook.Project"/>
        </junit>
    </target>

    <target name="test4" depends="compile">
        <junit printsummary="yes" fork="yes" haltonfailure="yes">
            <formatter type="xml"/>
            <classpath path="."/>
            <test todir="${results}" name="org.antbook.Project"/>
        </junit>
    </target>

    <target name="test5" depends="compile">
        <junit printsummary="yes" fork="yes" haltonfailure="yes">
            <formatter type="xml"/>
            <classpath path="."/>
            <test todir="${results}" name="org.antbook.Project"/>
        </junit>

        <junitreport todir="${results}">
            <fileset dir="${results}">
                <include name="TEST-*.xml"/>
            </fileset>
            <report format="frames" todir="${results}"/>
        </junitreport>
    </target>

    <target name="test6" depends="compile">
        <junit printsummary="yes" haltonfailure="yes">
            <formatter type="brief" usefile="true"/>
```

```
            <classpath path="."/>
            <batchtest todir="${results}">
                <fileset dir="." includes="**/Project.class"/>
            </batchtest>
        </junit>
    </target>

    <target name="compress">
        <jar destfile="${jars}/Project.jar" basedir="${output}">
            <include name="**/*.class"/>
        </jar>
    </target>

    <target name="deploy">
        <delete dir="${dist}" />
        <mkdir dir="${dist}" />
        <copy todir="${dist}">
            <fileset dir="${jars}">
                <include name="*.jar"/>
            </fileset>
        </copy>
    </target>

</project>
```

Here's what you see when you run the build file:

```
%ant
Buildfile: build.xml

init:
     [mkdir] Created dir: /home/ant/ch05/junit/results
     [mkdir] Created dir: /home/ant/ch05/junit/jars

compile:
    [javac] Compiling 1 source file to /home/ant/ch05/junit

test1:
     [java] ...
     [java] Time: 0

     [java] OK (3 tests)




test2:
    [junit] Running org.antbook.Project
    [junit] Tests run: 3, Failures: 0, Errors: 0, Time elapsed: 0.01 sec
```

```
test3:
    [junit] Running org.antbook.Project
    [junit] Tests run: 3, Failures: 0, Errors: 0, Time elapsed: 0.01 sec



test4:
    [junit] Running org.antbook.Project
    [junit] Tests run: 3, Failures: 0, Errors: 0, Time elapsed: 0.04 sec



test5:
    [junit] Running org.antbook.Project
    [junit] Tests run: 3, Failures: 0, Errors: 0, Time elapsed: 0.04 sec



test6:
    [junit] Running org.antbook.Project
    [junit] Tests run: 3, Failures: 0, Errors: 0, Time elapsed: 0.01 sec


[junitreport] Using Xalan version: Xalan Java 2.4.1
[junitreport] Transform time: 1191ms

test:
     [echo]
     [echo]           Tested OK....
     [echo]

compress:
       [jar] Building jar: /home/ant/ch05/junit/jars\Project.jar

deploy:
     [mkdir] Created dir: /home/ant/ch05/junit/user
      [copy] Copying 1 file to /home/ant/ch05/junit/user

main:
     [echo]
     [echo]           Building the project....
     [echo]

BUILD SUCCESSFUL
Total time: 7 seconds
```

Because all tests ran successfully, the build was allowed to continue on to deployment.

5.5. Extending JUnit

There are many extensions for JUnit designed to help test specific types of builds, such as web applications. You can find many extensions on the JUnit site, at http://www.junit.org/news/extension/index.htm. Here's a starter list of JUnit extensions:

- Abbot is a scripted Java GUI testing framework.
- dbUnit is a database testing framework, which sets up your database before executing your tests.
- HtmlUnit is a Java unit testing framework for testing Web-based applications.
- HttpUnit is a framework for accessing websites from a Java program, with support for following links, submitting forms, handling cookies, and so on.
- JavaBean Tester is a tool to automate the testing of JavaBeans.
- Jemmy is a Java library that is used to create automated tests for Java GUI applications.
- Jenerator generates Unit Tests for all types of EJB for JUnit and Cactus.
- JFCUnit enables you to execute unit tests against Swing-based code.
- JUnit JNDI DataSource helper package can simulate JNDI lookups for database connections.
- JUnitDoclet generates TestSuites, TestCase skeletons, and default tests from Java sources.
- JUnitPerf is a collection of JUnit test decorators to test scalability.
- JUnitX provides access to private and protected classes, methods, and variables between different packages for testing purposes.
- jWebUnit provides a high-level API for navigating a web application combined with a set of assertions to verify the application's correctness.
- Log4Unit is a JUnit extension combining JUnit with Log4J.
- Schema Unit Test (SUT) is a framework for testing XML Schema.
- SQLUnit is a regression and unit testing harness for testing procedures stored in a database.

Chapter 6. Getting Source Code from CVS Repositories

Up to this point, you've been working solo with Ant, butas with any major build toolAnt can be used in team environments. There's a lot of support built in for the Concurrent Version System (CVS) in Ant, and this chapter is all about making code sharing in teams with CVS happen.

Team LiB

6.1. Source Control and Ant

When you work in teams, you have to coordinate your efforts. That means discussing and planning, but even with the best of intentions, you can still end up with unintentional conflicts. You may have made some brilliant changes to the code, only to find them wiped out by mistake when another programmer uploads his own version of the same file.

Source control helps prevent these problems by controlling access to code and by maintaining a history of the changes made so things aren't destroyed unintentionally. Storing a history of your code is powerful; you can compare a new (buggy) file against an older one, and you can revert to a previous version in case things have gone bad.

Ant has several source control tasks, shown in Table 6-1.

Table 6-1. Source control tasks

Task name	Description
`clearcase`	Tasks for `ClearCase cleartool checkin`, `checkout`, `uncheckout`, `update`, `lock`, `unlock`, `mklbtype`, `rmtype`, `mklabel`, `mkattr`, `mkdir`, `mkelem`, and `mkbl` commands
`Continuus/Synergy tasks`	Tasks for `Continuus ccmcheckin`, `ccmcheckout`, `ccmcheckintask`, `ccmreconfigure`, and `ccmcreateTask` commands
`cvs`	Specifies how to work with packages and modules retrieved from a CVS repository
`cvschangelog`	Creates change reports from a CVS repository
`cvspass`	Adds entries to a *.cvspass* file
`cvstagdiff`	Creates an XML-formatted report of the changes between two tags or dates recorded in a CVS repository
`Microsoft Visual Sourcesafe tasks`	Tasks for Visual `SourceSafe vssget`, `vsslabel`, `vsshistory`, `vsscheckin`, `vsscheckout`, `vssadd`, `vsscp`, and `vsscreate` commands
`perforce`	Tasks for `Perforce p4sync`, `p4change`, `p4edit`, `p4submit`, `p4have`, `p4label`, `p4counter`, `p4reopen`, `p4revert`, and `p4add` commands
`pvcs`	Retrieves and handles source code from a PVCS repository
`sourceoffsite`	Tasks for `SourceOffSite sosget`, `soslabel`, `soscheckin`, and `soscheckout` commands
`starteam`	Tasks for `StarTeam stcheckout`, `stcheckin`, `stlabel`, and `stlist` commands

Though Ant lets you work with various source control systems, most of its support revolves around CVS, which is used throughout this chapter. CVS is an open source project that started as a set of Unix shell scripts in 1986 and came into its own with dedicated software in 1989. Support for CVS is available on many operating systems: Unix, Linux, Windows, Mac, and others. For the full CVS story, look at http://www.cvshome.org.

> To work with CVS using Ant, you need access to a CVS server. Most Linux and Unix installations come with a built-in CVS server. To test if you have a working CVS installation, type **`cvs --help`** at the prompt; you should see a list of help items. If you can't find a CVS server, you can download what you need from http://www.cvshome.org. Many CVS servers are available for Windows, such as CVSNT, available for free from http://www.cvsnt.org. To install CVSNT, download the executable file and run it.

The idea behind CVS, as with any repository software, is to manage and record changes to source code. What corresponds to a project for Ant is a *module* in CVS. Modules are represented by directories in CVS; the files you share are stored in the CVS *repository*. When you retrieve a file from the repository, you *check the file out*. After you've modified the file, you *commit* the file, checking it back in and sending those changes to the repository. If you want to refresh your own copy of a file, you *update* it from the repository.

Because each file must be independently tracked, CVS gives the individual files a version number automatically. Each time a file is committed, its version number is incremented. When you commit files to the repository, they'll get a new version number as well.

Using the `cvs` task, you communicate with the CVS server using CVS commands, which appear in Table 6-2.

Read more about these commands in the CVS guide at https://www.cvshome.org/docs/manual/cvs-1.11.7/cvs_16.html.

Table 6-2. CVS commands

CVS command	Does this
`add`	Specifies you want to add a new file or directory to the CVS repository
`admin`	Lets you work with administrative commands
`annotate`	Specifies the revision where each line was modified
`authserver`	Specifies authentication mode for the server

CVS command	Does this
chacl	Specifies the access list for a directory
checkout	Checks out source code from the repository
chown	Changes the owner of a directory in the repository
commit	Checks source code files into the repository
diff	Displays the differences between source code revisions
edit	Specifies you want to edit a file
editors	Specifies you want to watch who has been editing a particular file
export	Exports source code from a CVS repository (similar to checkout)
history	Displays the CVS repository access history
import	Imports source code into a CVS repository
info	Displays information about the CVS repository and its supported protocols
init	Creates a CVS repository and initializes it
log	Displays information on file history
login	Asks for a password, if needed
logout	Logs out of a server
ls	Lists the files in the CVS repository
lsacl	Lists the CVS directories access control list
passwd	Sets a user's CVS password
rannotate	Displays the revision in which source lines were modified
rdiff	Creates patch files by comparing two files and outputting a file that be used to update one into the other
release	Specifies that a module will not be used anymore
remove	Removes an item from a CVS repository
rlog	Displays CVS history information for a module
rtag	Adds a tag to a CVS module
server	Lets you set server modes for access
status	Displays checked-out file information
tag	Adds a tag to checked-out files
unedit	Undoes an edit command that's been executed
update	Updates local copies of a file with those in the CVS repository

CVS command	Does this
version	Shows the CVS version
watch	Watches a file or files
watchers	Displays which users are watching a file or files

The first step in working with CVS is to log into the CVS server, typically done with the cvspass task.

Team LiB

6.2. Logging In

You use the `cvspass` task to log into a CVS server to get access to the code stored in the CVS repository. This task adds entries to a *.cvspass* file, which has the same affect as a CVS `login` command. When a *.cvspass* file has been created, subsequent logins will get the needed data from this file, and you won't have to supply a password again.

The values you assign to the attribute named `cvsroot` use the same format of strings that appear in a CVS *.cvspass* file, which specifies the protocol type, username, server, and repository location. For example, using the `pserver` protocol with a user named Steven, a server named STEVE, and a repository location of */home/steven/repository*, `cvspass` would look like:

```
<?xml  version="1.0"?>

<project default="main" basedir=".">

    <property name="cvs.dir" value="project" />

    <target name="main" >
        <cvspass cvsroot=":pserver:steven@STEVE:/home/steven/repository"
            password="opensesame" />
        .
        .
        .
    </target>

</project>
```

The CVS-related tasks can read the CVS root value from the `cvsroot` attribute, if they support that attribute, or from the `CVSROOT` environment variable.

> In Windows, when your username includes a space or spaces, you might run into problems with the `cvsroot` attribute. In that case, assign a value to the `CVSROOT` environment variable instead (e.g., `C:\ant\ch06>set CVSROOT=:pserver:Steven Holzner@STEVE:/home/steven/repository`) and then use `cvspass` or other CVS-related tasks in your build file normally.

The attributes of the `cvspass` task appear in Table 6-3.

Table 6-3. Attributes for the cvspass task

Attribute	Description	Required	Default
cvsroot	Specifies the CVS repository you want to add an entry for	Yes	
passfile	Specifies the password file you want to add the entry to	No	~/.cvspass
password	Specifies the password you want to be added to the password file	Yes	

Team LiB

Team LiB

6.3. Working with the Server

The cvs task lets you interact with the CVS server after you've logged in. The attributes of this task appear in Table 6-4 ; to use this task, the cvs command must work on the command line (ie., the cvs binary must be in your path).

Table 6-4. The cvs attributes

Attribute	Description	Required	Default
append	Specifies whether you want to append output when redirecting text to a file.	No	false
command	Specifies the CVS command you want to execute.	No	"checkout "
compression	The same as compressionlevel="3 ".	No	false
compressionlevel	Specifies the compression level you want to use, via a number between 1 and 9. Any other value sets compression="false ".	No	false
cvsRoot	Specifies the CVSROOT variable.	No	
cvsRsh	Specifies the CVS_RSH variable.	No	
date	Specifies that you want to use the most recent revision, as long as it is no later than the given date.	No	
dest	Specifies the directory where you want checked-out files to be placed.	No	The project's basedir.
error	Specifies the file where you want error messages stored.	No	Sends errors to the Ant Log as MSG_WARN.
failonerror	Stops the build if the task encounters an error.	No	false
noexec	Specifies that CVS actions should report only, without changing any files.	No	false
output	Specifies the file to which standard output should be directed.	No	Sends output to the Ant Log as MSG_INFO.
package	Specifies the module you want to check out.	No	

Attribute	Description	Required	Default
`passfile`	Specifies a password file you want to have the task read passwords from.	No	~/.cvspass.
`port`	Specifies the port used by the task to communicate with the CVS server.	No	Port 2401
`quiet`	Suppresses messages. This is the same as using `-q` on the command line.	No	`false`
`reallyquiet`	Suppresses all messages. This is the same as using `-Q` on the command line. Since Ant 1.6.	No	`false`
`tag`	Specifies the module to check out by tag name.	No	

This task is designed to pass commands on to CVS verbatim. For example, here's how you'd pass a CVS `diff` command to the CVS server:

```
<cvs command="diff -u -N" output="diff.txt"/>
```

You can nest `commandline` elements and use the `value` attribute of `argument` elements to pass arguments to the CVS server; you can pass the `diff` command this way:

```
<cvs output="patch">
    <commandline>
        <argument value="diff"/>
        <argument value="-u"/>
        <argument value="-N"/>
    </commandline>
</cvs>
```

or this way, using the `argument` element's `line` attribute:

```
<cvs output="patch">
    <commandline>
        <argument line="-q diff -u -N"/>
    </commandline>
</cvs>
```

6.3.1. Checking Out Modules

To check out a module from the CVS server, you can use the `cvs` task without specifying a CVS command; the default for the `command` attribute is "checkout." In Example 6-1, a module named `GreetingApp` is checked out and stored in a directory named *project* .

In this and the following CVS-related build files, you can omit the `cvspass` task if you've stored your password in the *.cvspass* file (which is what `cvspass` does). If you omit `cvspass` , set the `cvsroot` attribute in the `cvs` task, or set the `CVSROOT` environment variable.

Example 6-1. Checking out a CVS module (ch06/checkout/build.xml)

```
<?xml version="1.0"?>

<project default="checkout" basedir=".">

    <property name="cvs.dir" value="project" />

    <target name="checkout" >
        <cvspass cvsroot=":pserver:steven@STEVE:/home/steven/repository"
            password="opensesame" />
        <cvs package="GreetingApp" dest="${cvs.dir}" />
    </target>

</project>
```

Here's what this build file looks like in action:

```
%ant
Buildfile: build.xml

checkout:
      [cvs] Using cvs passfile: /home/.cvspasss
      [cvs] cvs server: Updating GreetingApp
      [cvs] U GreetingApp/.classpath
      [cvs] U GreetingApp/.project
      [cvs] cvs server: Updating GreetingApp/org
      [cvs] cvs server: Updating GreetingApp/org/antbook
      [cvs] cvs server: Updating GreetingApp/org/antbook/ch06
      [cvs] U GreetingApp/org/antbook/ch06/GreetingClass.java


BUILD SUCCESSFUL
Total time: 2 seconds
```

Before using the build files for this chapter in the downloadable code, make sure you replace the `cvsroot` attribute value or the `CVSROOT` environment variable with an appropriate value for your CVS server.

After running this build file, the project directory will hold the checked-out module, including a CVS

.project file and a *CVS* directory, which holds logging and tracking information. You're free to work with the code that's been downloaded, and when you want to commit the project back to the CVS server, specify the same directory you downloaded the project to.

6.3.2. Updating Shared Code

When you want to update your local copy of a module from the CVS repository, you can use the `update` command. You can see how that works in Example 6-2; as before, you can omit the `cvspass` task if your password is in the *.cvspass* file though it causes no harm to leave it in.

Example 6-2. Updating a CVS module ch06/update/build.xml

```
<?xml version="1.0"?>

<project default="main" basedir=".">

    <property name="cvs.dir" value="project" />

    <target name="main" depends="login, update">
        <echo>
            Updating....
        </echo>
    </target>

    <target name="login">
        <cvspass cvsroot=":pserver:steven@STEVE:/home/steven/repository"
            password="opensesame" />
    </target>

    <target name="update" depends="login">
        <cvs dest="${cvs.dir}" command="update"/>
    </target>

</project>
```

Here's what you see when running this build file:

```
%ant
Buildfile: build.xml

login:
      [cvs] Using cvs passfile: /home/.cvspass


update:
      [cvs] Using cvs passfile: /home/.cvspass
      [cvs] cvs server: Updating GreetingApp
      [cvs] cvs server: Updating GreetingApp/org
      [cvs] cvs server: Updating GreetingApp/org/antbook
      [cvs] cvs server: Updating GreetingApp/org/antbook/ch06
```

```
main:
     [echo]
     [echo]             Updating....
     [echo]

BUILD SUCCESSFUL
Total time: 3 seconds
```

This updates your local copy of a module with what's currently in the CVS repository.

6.3.3. Committing Source Code

After you've made changes to the code in a checked-out module, you can send the revised module back to the CVS repository by setting the `command` attribute to "commit", as shown in Example 6-3. In this example, the build file commits a new version of a checked-out module, adding the comment "New Version."

Example 6-3. Committing a CVS module ch06/commit/build.xml

```
<?xml version="1.0"?>

<project default="main" basedir=".">

    <property name="cvs.dir" value="project" />

    <target name="main" depends="login, commit">
        <echo>
            Committing....
        </echo>
    </target>

    <target name="login">
        <cvspass cvsroot=":pserver:steven@STEVE:/home/steven/repository"
            password="opensesame" />
    </target>

    <target name="commit" depends="login">
        <cvs dest="${cvs.dir}/GreetingApp" command="commit -m 'New Version'"/>
    </target>

</project>
```

Here's what this build file gives you when you run it and the CVS server commits the new code:

```
%ant
Buildfile: build.xml
```

```
login:

commit:
      [cvs] Using cvs passfile: /home/.cvspass
      [cvs] cvs commit: Examining .
      [cvs] cvs commit: Examining org
      [cvs] cvs commit: Examining org/antbook
       [cvs] cvs commit: Examining org/antbook/ch06
       [cvs] Checking in org/antbook/ch06/GreetingClass.java;
      [cvs] /home/steven/repository/GreetingApp/org
       /antbook/ch06/GreetingClass.java,v
      <--  GreetingClass.java
       [cvs] new revision: 1.5; previous revision: 1.4
      [cvs] done


main:
     [echo]
     [echo]             Committing....
     [echo]

BUILD SUCCESSFUL
Total time: 1 second
```

6.3.4. Comparing Files

You can compare local files to those in the CVS repository with the CVS `diff` command. For example, say that the module you've been working with, `GreetingApp` , contains *GreetingClass.java* , which holds these contents (presumably committed earlier by you or another developer):

```
package  org.antbook.ch06;

public class GreetingClass
{
    public static void main(String[] args)
    {
        System.out.println("No problems here.");
    }
}
```

Then suppose you change the displayed message from "No problems here." to "No problems at all." in the local version of the file:

```
package  org.antbook.ch06;

public class GreetingClass
{
    public static void main(String[] args)
```

```
    {
        System.out.println("No problems at all.");
    }
}
```

The CVS `diff` command finds the difference between your local copy and the server's version. You can see a build file using this command in Example 6-4; in this case, the differences are written to a file named *patch.txt* .

Example 6-4. Finding differences in a CVS module ch06/diff/build.xml

```
<?xml version="1.0"?>

<project default="main" basedir=".">

    <property name="cvs.dir" value="project" />

    <target name="main" >
        <cvspass cvsroot=":pserver:steven@STEVE:/home/steven/repository"
            password="opensesame" />
        <cvs command="diff" dest="${cvs.dir}/GreetingApp" output="patch.txt"/>
    </target>

</project>
```

Here's what the build process looks like at work:

```
%ant
Buildfile: build.xml

main:
      [cvs] Using cvs passfile: /home/.cvspass
      [cvs] cvs server: Diffing .
      [cvs] cvs server: Diffing org
      [cvs] cvs server: Diffing org/antbook
      [cvs] cvs server: Diffing org/antbook/ch06


BUILD SUCCESSFUL
Total time: 1 second
```

In *patch.txt* , the `diff` command caught the difference between the local copy of the file and the version in the CVS repository:

```
Index:  org/antbook/ch06/GreetingClass.java
===================================================================
RCS  file:  /home/steven/repository/GreetingApp/org/antbook/ch06/GreetingClass.java,v
retrieving  revision  1.6
```

```
diff -r1.6 GreetingClass.java
20c20
<         System.out.println("No problems at all.");
---
>         System.out.println("No problems here.");
```

> If you want to create a patch file that you can, with the `patch` utility, update code files with, use the CVS `rdiff` command, not `diff` .

That's how the `cvs` task works; you pass the CVS command, along with any command-line options, in the `command` attribute or a `commandline` element. You can extrapolate from the CVS examples given here to other CVS commands easily.

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6.4. Getting Version Data

The `cvsversion` task retrieves the version of the CVS client and server. For example, this `cvsversion` element stores the server's version number in the property `cvsServerVersion`, and the client's version in `cvsClientVersion`:

```
<cvsversion cvsroot=":pserver:steven@STEVE:/home/steven/repository"
    password="opensesame"
    cvsserverproperty="cvsServerVersion"
    cvsclientproperty="cvsClientVersion"
/>
```

The attributes for this task appear in Table 6-5.

Table 6-5. The cvsversion task's attributes

Attribute	Description	Required	Default
`cvsclientproperty`	Specifies the name of the property in which you want the version of the cvsclient to be placed	No	
`cvsroot`	Specifies the `CVSROOT` variable you want to use	No	
`cvsrsh`	Specifies the `CVS_RSH` variable you want to use	No	
`cvsserverproperty`	Specifies the name of a property where you want the CVS server version to be placed	No	
`dest`	Specifies the directory which holds, or will hold, a checked-out project	No	Project's basedir
`failonerror`	Makes the build fail if this task encounters an error	No	`false`
`package`	Specifies the module you want to check out	No	

Attribute	Description	Required	Default
passfile	Specifies the password file you want the task to read passwords from	No	~/.cvspass
port	Specifies the port used to communicate with the CVS server	No	Port 2401

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6.5. Creating Change Logs

This task creates an XML-formatted report file of the change logs in a CVS repository. If you want to track what's been happening with a module, this is the way to do it. For example, take a look at the build file in Example 6-5, which creates a change log, *changelog.xml*, for the `GreetingApp` module:

Example 6-5. Getting a CVS change log (ch06/changelog/build.xml)

```
<?xml version="1.0"?>

<project default="main" basedir=".">

    <property name="cvs.dir" value="project" />

    <target name="main" >
        <cvspass cvsroot=":pserver:steven@STEVE:/home/steven/repository"
            password="opensesame" />
        <cvschangelog dir="${cvs.dir}/GreetingApp" destfile="changelog.xml" />
    </target>

</project>
```

Here's the resulting change log, *changelog.xml*:

```
<?xml version="1.0" encoding="UTF-8"?>
<changelog>
    <entry>
        <date>2005-02-24</date>
        <time>16:18</time>
        <author><![CDATA[steven]]></author>
        <file>
             <name>org/antbook/ch06/GreetingClass.java</name>
            <revision>1.1</revision>
        </file>
        <msg><![CDATA[The Greeting App]]></msg>
    </entry>
    <entry>
        <date>2005-06-22</date>
        <time>16:25</time>
        <author><![CDATA[steven]]></author>
        <file>
             <name>org/antbook/ch06/GreetingClass.java</name>
            <revision>1.3</revision>
            <prevrevision>1.2</prevrevision>
```

```
            </file>
            <msg><![CDATA[*** empty log message ***]]></msg>
        </entry>
        <entry>
            <date>2005-02-25</date>
            <time>16:24</time>
            <author><![CDATA[steven]]></author>
            <file>
                <name>.classpath</name>
                <revision>1.1</revision>
            </file>
            <file>
                <name>.project</name>
                <revision>1.1</revision>
            </file>
            <msg><![CDATA[The Greeting App]]></msg>
        </entry>
        <entry>
            <date>2005-02-25</date>
            <time>16:34</time>
            <author><![CDATA[steven]]></author>
            <file>
                  <name>org/antbook/ch06/GreetingClass.java</name>
                <revision>1.2</revision>
                <prevrevision>1.1</prevrevision>
            </file>
            <msg><![CDATA[*** empty log message ***]]></msg>
        </entry>
        <entry>
            <date>2005-06-22</date>
            <time>16:27</time>
            <author><![CDATA[steven]]></author>
            <file>
                  <name>org/antbook/ch06/GreetingClass.java</name>
                <revision>1.4</revision>
                <prevrevision>1.3</prevrevision>
            </file>
            <msg><![CDATA[OK]]></msg>
        </entry>
        <entry>
            <date>2005-06-22</date>
            <time>16:29</time>
            <author><![CDATA[steven]]></author>
            <file>
                  <name>org/antbook/ch06/GreetingClass.java</name>
                <revision>1.5</revision>
                <prevrevision>1.4</prevrevision>
            </file>
            <msg><![CDATA[New Version]]></msg>
        </entry>
    </changelog>
```

The attributes for this task appear in Table 6-6.

Table 6-6. The cvschangelog task's attributes

Attribute	Description	Required	Default
`cvsroot`	Specifies the `CVSROOT` variable you want to use	No	
`cvsrsh`	Specifies the `CVS_RSH` variable you want to use	No	
`daysinpast`	Specifies for how many days in the past you want change log information	No	
`destfile`	Specifies the file in which you want the change log report written	Yes	
`dir`	Specifies the directory from which to run the CVS log command	No	`${basedir}`
`end`	Specifies the latest date for which you want to include change logs	No	
`failonerror`	Specifies that you want the task to fail if it encounters an error	No	false
`package`	Specifies the module you want to check out	No	
`passfile`	Specifies the password file you want the task to read passwords from	No	~/.cvspass
`port`	Specifies the port the task should use to communicate with the CVS server	No	port 2401
`start`	Specifies the earliest date for which you want to include change logs	No	
`tag`	Lets you access change logs by tag	No	
`usersfile`	Specifies a property file holding name/value pairs connecting user IDs and names, allowing the task to report names inctead of IDs	No	

The nested user element allows you to specify a mapping between a user ID (as it appears to the CVS server) and a name to include in the formatted report. The attributes of theuser element appear in Table 6-7.

Table 6-7. The user element's attributes

Attribute	Description	Required	Default
displayname	Specifies the name you want used in the CVS change log report	Yes	
userid	Specifies the user ID of the person as far as the CVS server is concerned	Yes	

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6.6. Finding Changes Between Versions

The `cvstagdiff` task generates an XML-formatted report file of the changes between two tags or dates recorded in a CVS repository. Here's an example that creates a report, *datediff.xml*, for all the changes that have been made in the `GreetingApp` module in January 2005:

```
<cvstagdiff
    destfile="datediff.xml"
    package="GreetingApp"
     startDate="2005-01-01"
     endDate="2005-31-01"
/>
```

You can see the attributes of this task in Table 6-8.

Table 6-8. The cvstagdiff task's attributes

Attribute	Description	Required	Default
`compression`	Specifies the compression you want to use. Set to true, false, or a number (1-9) for compression level.	No	No compression
`cvsroot`	Specifies the `CVSROOT` variable you want to use.	No	
`cvsrsh`	Specifies the `CVS_RSH` variable you want to use.	No	
`destfile`	Specifies the file where the report should be stored.	Yes	
`enddate`	Sets the latest date for differences to still be included in the report.	One of the endtag or enddate	
`endtag`	Sets the latest tag for differences to still be included in the report.	One of the endtag or enddate	

Attribute	Description	Required	Default
`failonerror`	Makes the build fail if this task encounters an error.	No	`false`
`package`	Specifies the module you want to analyze. Since Ant 1.6, multiple modules can be separated by spaces.	Yes	
`passfile`	Specifies the password file you want the task to read passwords from.	No	~/.cvspass
`port`	Specifies the port used to communicate with the CVS server.	No	port 2401
`quiet`	Specifies that you want to suppress displayed messages.	No	`false`
`startdate`	Sets the earliest date for differences to still be included in the report.	One of starttag or startdate	
`starttag`	Sets the earliest tag for differences to still be included in the report.	One of starttag or startdate	

Here's something useful to know: Ant comes with an XSLT stylesheet, *${ant.home}/etc/tagdiff.xsl*, that you can use to generate a HTML report based on this task's XML output. Here's an example:

```
<style in="datediff.xml"
    out="datediff.html"
    style="${ant.home}/etc/tagdiff.xsl">
  <param name="title" expression="Date Differences"/>
  <param name="module" expression="GreetingApp"/>
</style>
```

6.7. Creating Patches

This task applies a patch file to local source code, updating the local code. You can create a patch file with the CVS `rdiff` command, which lets you compare two files. Here's an example, which applies *patch.txt* to the module in the current directory:

```
<patch patchfile="patch.txt"/>
```

The attributes for this task appear in Table 6-9.

> To use this task, the `patch` utility must be in your path.

Table 6-9. The patch task's attributes

Attribute	Description	Required	Default
`backups`	Specifies you want to keep backups of unpatched files	No	
`destfile`	Specifies the file you want to send the output to. Since Ant 1.6	No	
`dir`	Specifies the directory where you want to run the patch command	No	The project's basedir.
`ignorewhitespace`	Specifies that you want to ignore whitespace differences	No	
`originalfile`	Specifies the file you want to patch	No	
`patchfile`	Specifies the file that contains the patch	Yes	
`quiet`	Specifies you want to supress messages unless an error occurs	No	
`reverse`	Specifies you want to create the patch with old and new files in reverse order (swapped)	No	

Chapter 7. Executing External Programs

Part of the build process involves testing what you've built, and an obvious way of doing that is to ru the results of a build. Doing so from Ant involves using the tasks detailed in this chapter:`java`, `exec`, and `apply`. You can check the return code from your build to ensure things worked out; if not, you can halt the build before you deploy faulty build results.

Executing code to test it is a fundamental part of the build process, and this chapter covers that aspect of Ant. Besides running your code, you can start and stop external programs needed to test your code, such as when you want to run a JUnit test on a Web application and need to start a web server. The tasks in this chapter do more than the usual internal Ant tasks, and because they're designed to deal with the external run-time environment, so they're a little more involved than usual

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7.1. Executing Java Code

The `java` task is part of Ant's core functionality; it executes a Java class in the current JVM, or forks another JVM and runs the class in the new JVM. You can recover the exit code of the Java class and stop the build if the build results you're testing create an error.

Here's an example using this task. Say you have this code, *Project.java*, which reads what the user enters on the command line and displays it:

```
public class Project
{
    public static void main(String args[])
    {
        System.out.println("You said: " + args[0]);
        System.exit(0);
    }
}
```

After compiling this code you can run it with the `java` task by setting up the classpath with a `classpath` element and passing a command-line argument, "OK", in a nested `arg` element. The build file appears in Example 7-1.

Example 7-1. Using the java task (ch07/java/build.xml)

```
<?xml version="1.0" ?>
<project default="main">

    <property name="src" location="source" />
    <property name="output" location="bin" />
    <property environment="env" />

    <target name="main" depends="init, compile, run">
        <echo>
            Building and running....
        </echo>
    </target>

    <target name="init">
        <mkdir dir="${output}" />
    </target>

    <target name="compile">
        <javac srcdir="${src}" destdir="${output}" />
    </target>
```

```
    <target name="run" failonerror="true">
        <java classname="Project"
            fork="true" >
            <classpath>
               <pathelement location="${output}"/>
            </classpath>
            <arg value="OK" />
        </java>
    </target>
</project>
```

Here's what you see when you run this build file; the code ran without problem and recovered the command-line argument passed to it:

```
%ant
Buildfile: build.xml

init:
    [mkdir] Created dir: /home/steven/ch07/bin

compile:
    [javac] Compiling 1 source file to /home/steven/ch07/bin

run:
     [java] You said: OK



main:
     [echo]
     [echo]             Building and running....
     [echo]

BUILD SUCCESSFUL
Total time: 4 seconds
```

The many attributes for this task appear in Table 7-1.

> If things go wrong when you run this task, there may be a conflict with the current JVM, which is running Ant. In that case, set `fork="true"` to use a new JVM.

Table 7-1. The java task's attributes

Attribute	Description	Required	Default
Append	Specifies whether you want to append to output and error files.	No	false
args	Deprecated. Use nested arg elements. Specifies the arguments for the class that you want to run.	No	
classname	Specifies the Java class you want to run.	One of either jar or classname	
classpath	Specifies the classpath you want to use when the class is run.	No	
classpathref	Specifies the classpath you want to use, as a reference, when the class is run.	No	
dir	Specifies the directory where you want to run Java.	No	
error	Specifies the file where standard error output should be stored.	No	
errorproperty	Specifies the name of a property where you want to store errors.	No	
failonerror	Specifies the build should be stopped if the task encounters errors.	No	false
fork	Specifies you want to run the class in a forked JVM.	No	false
input	Specifies the file where the task should take input to run the class with.	No	
inputstring	Specifies a string holding the input stream for the class to run.	No	
jar	Specifies the location of the .jar file to run. The .jar file must have a Main-Class entry in the manifest.	jar or classname	
jvm	Specifies the command used to start Java.	No	"java"
jvmargs	Deprecated. Use nested jvmarg elements. Specifies arguments to pass to the forked Java Virtual Machine.	No	
logError	Specifies you want to send error output to Ant's log.	No	
maxmemory	Specifies the maximum amount of memory you want to give a forked JVM.	No	
newenvironment	Specifies old environment variables should not be passed as new environment variables to a forked JVM.	No	false
output	Specifies the name of a file in which to store the output.	No	
outputproperty	Specifies the name of a property in which you want the output of the task to be placed.	No	

Attribute	Description	Required	Default
resultproperty	Specifies the name of the property that you want to hold the return code. Use this only if failonerror is false and if fork is true.	No	
spawn	Specifies you want to spawn a new process in which to run the class. To use this attribute, set fork to true.	No	
timeout	Specifies you want the task to quit if it doesn't finish in the given time. Set the time in milliseconds. You should only use this if fork is true.	No	

The java task supports a number of nested elements, many of which are the same as the javac task. You can use arg elements to pass arguments to Java and jvmarg elements to specify arguments to a forked JVM. Nested sysproperty elements specify system properties required by the class you're running. As of Ant 1.6, you can use syspropertyset elements, which specify a set of properties to be used as system properties.

The java task supports nested classpath elements, which you can use to specify a classpath to use when Java runs, and supports as bootclasspath elements (since Ant 1.6) to set the location of bootstrap class files. You can use env elements (see Table 7-3) to specify environment variables to pass to the forked JVM and nested permissions elements. As with the javac task, permissions represents a set of security permissions granted to the code in the JVM where Ant is running. Since Ant 1.6, you can use nested assertions elements to support Java 1.4 assertions.

7.1.1. Handling Errors and Return Codes

By default, the return code of the java task is ignored. If you want to check the return code, you can set the resultproperty attribute to the name of a property and have the result code assigned to it. For example, say your code returned a non-zero value:

```
public class Project
{
    public static void main(String args[])
    {
        System.out.println("You said: " + args[0]);
        System.exit(1);
    }
}
```

You can test the return code from a forked JVM and explicitly fail unless it's 0 this way:

```
    <target name="run">
        <java classname="Project"
            fork="true" resultproperty="return.code">
            <classpath>
               <pathelement location="${output}"/>
            </classpath>
```

```
            <arg value="OK" />
        </java>
        <condition property="problem">
            <not>
                <equals arg1="${return.code}" arg2="0"/>
            </not>
        </condition>
        <fail if="problem" message="Failed: ${return.code}" />
    </target>
```

Here's the result. The `java` task indicates a nonzero return code and the build was terminated by the `fail` task:

```
%ant build.xml
Buildfile: build.xml

init:
    [mkdir] Created dir: /home/steven/ch07/bin

compile:
    [javac] Compiling 1 source file to /home/steven/ch07/bin

run:
     [java] You said: OK


     [java] Java Result: 1

BUILD FAILED
/home/steven/ch07/build2.xml:35:  Failed:  1

Total time:  4 seconds
```

You can set `failonerror="true"` in the `java` task, in which case the only possible value for `resultproperty` is `0`, or the build will terminate. That's how the example in the previous topic was written:

```
    <target name="run" failonerror="true">
        <java classname="Project"
            fork="true" >
            <classpath>
               <pathelement location="${output}"/>
            </classpath>
            <arg value="OK" />
        </java>
    </target>
```

> If `failonerror="false"` and `fork="false"`, the `java` task *must* return a value of `0` or the build will exit because the code was run by the build JVM.

Making a build fail if there's an error when you run the build's output is a perfect way to test the results of a build; if the output doesn't run as it should, there's no sense in deploying it. Setting `failonerror` to `true` in the `java` task ensures your build will halt before deployment if the results don't work.

Here's another example using the `java` task, which forks a JVM and runs a *.jar* file in 512 Megabytes of memory, using the entry point indicated by the manifest:

```
<java jar="${bin}/connect.jar"
    fork="true"
    failonerror="true"
     maxmemory="512m"
    >
    <arg value="-q"/>
    <classpath>
        <pathelement location="${bin}/connect.jar"/>
        <pathelement path="${java.class.path}"/>
    </classpath>
</java>
```

This example passes on a system property and an argument to the JVM:

```
<java classname="Project.main" fork="true" >
    <sysproperty key="DEBUG" value="true"/>
    <arg value="-z"/>
    <jvmarg value="-enableassertions"/>
    <classpath>
        <pathelement location="${bin}/**"/>
    </classpath>
</java>
```

As you can see, there are a great many options when running Java code.

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7.2. Executing External Programs

The exec task executes a system command or external program. The attributes for this task appear in Table 7-2.

Table 7-2. The exec task's attributes

Attribute	Description	Required	Default
append	Specifies whether you want to append to output and error files.	No	false
command	Deprecated. Use executable and nested arg elements. Specifies the command you want to run.	Exactly one of command or executable.	
dir	Specifies the directory where you want to run the command.	No	
error	Specifies the file where standard error output should be stored.	No	
errorproperty	Specifies the name of a property where you want to store errors.	No	
executable	Specifies the command you want to run (without any command-line arguments).	Exactly one of command or executable.	
failifexecutionfails	Specifies the build should be stopped if the executable can't start.	No	true
failonerror	Specifies the build should be stopped if the task encounters errors.	No	false
input	Specifies the file where the task should take input to run the executable with.	No	
inputstring	Specifies a string holding the input stream for the executable to run.	No	
logError	Specifies you want to send error output to Ant's log.	No	
newenvironment	Specifies old environment variables should not be passed as new environment variables to a forked JVM.	No	false

Attribute	Description	Required	Default
os	Specifies the operating systems in which the executable can be run.	No	
output	Specifies the name of a file in which to store the output.	No	
outputproperty	Specifies the name of a property in which you want the output of the task to be placed.	No	
resolveExecutable	Specifies the name of the executable should be resolved using the project's base directory, then using the execution directory if that doesn't work. Available since Ant 1.6.	No	false
resultproperty	Specifies the name of the property that you want to hold the return code. Use this only if failonerror is false and if fork is TRue.	No	
spawn	Specifies you want to spawn a new process in which to run the command. To use this attribute, set fork to true.	No	false
timeout	Specifies you want the task to quit if it doesn't finish in the given time. Set the time in milliseconds.	No	
vmlauncher	Specifies you want to run the executable using the JVM's execution facilities.	No	false

If you're running a mixed Unix/Windows environment, such as Cygwin, exec task will not understand paths like */bin/release* for the executable attribute because the JVM in which Ant is running is a Windows executable, which means it's unaware of the conventions used in Cygwin.

How you execute general code like this varies by operating system, so you can specify the operating system with the os attribute; operating system names are strings like "Linux", "Windows 2000", and so on. When you specify a target operating system, the command or program is only executed when the OS matches one of the operating systems you specify.

If you want to check the OS name for a target platform, use Java to display the value of the os.name system property.

You can nest arg elements in the exec task to pass command-line arguments. And you can set the values of environment variables using nested env elements. The attributes of this element appear in Table 7-3.

You can send input to a program using the `input` and `inputstring` attributes.

Table 7-3. The env element's attributes

Attribute	Description	Required
`file`	Specifies an environment variable that you want to replace with the absolute name of the file.	Exactly one of `value`, `path`, or `file`.
`key`	Specifies the name of the environment variable you want to work with.	Yes
`path`	Specifies the value for a path-like environment variable. Use ; or : as path separators.	Exactly one of `value`, `path`, or `file`.
`value`	Specifies the value of the environment variable.	Exactly one of `value`, `path`, or `file`.

7.2.1. Handling Return Codes

By default the return code of an `exec` is ignored. However, if you set `failonerror` to `TRue`, then any OS-specific return code that indicates failure means the build will fail. If you start an external program and the program fails to execute, the build halts unless `failifexecutionfails` is set to `false`. You can set the `resultproperty` to the name of a property that will be assigned the return code for testing. Any of these attributes can test if the results of your build functions as they should.

Example 7-2 shows how to execute a C++ compiler, *cpp.exe*, passing it a command line to execute and watching for errors by setting `failonerror` to `TRue`, which means the build will quit if there is an error.

Example 7-2. Running a JVM (ch07/exec/build.xml)

```
<?xml version="1.0" ?>
<project default="main">

    <property name="src" location="source" />
    <property name="output" location="bin" />

    <target name="main" depends="init, compile">
        <echo>
            Building and running....
        </echo>
    </target>
```

```
    <target name="init">
        <mkdir dir="${output}" />
    </target>

    <target name="compile">
        <exec dir="." executable="/bin/cpp.exe"
        failonerror="true">
            <arg line="-c ${src}/*.cpp ${output}"/>
        </exec>
    </target>
</project>
```

You can use this task to run any general program. Here's an example that will launch the Internet Explorer in Windows, assuming a default installation of that browser, and open the exec task's documentation page:

```
<?xml version="1.0" ?>
<project default="main">

    <property name="browser" location=
        "C:/Program Files/Internet Explorer/iexplore.exe"/>
    <property name="file" location="${ant.home}/docs/manual/coretasks/exec.html"/>

    <target name="main">
        <exec executable="${browser}" spawn="true">
            <arg value="${file}"/>
        </exec>
    </target>

</project>
```

This example starts emacs on X Window's display 1:

```
<?xml version="1.0" ?>
<project default="main">

    <target name="main">
        <exec executable="/usr/bin/emacs">
            <env key="DISPLAY" value=":1.0"/>
        </exec>
    </target>

</project>
```

7.2.2. Targeting Operating Systems

The exec task depends on a specific operating system. If you want your build file to work on multiple platforms, use the os attribute to specify which exec task is intended to run on which platform.

In Example 7-3, two platforms are targeted. The build file executes the `ls` command on Linux, sending the output to *ls.txt*, and works on Windows via the `dir` command, sending output to *dir.txt*.

Example 7-3. Targeting operationg systems (ch07/targeting/build.xml)

```
<?xml version="1.0" ?>
<project default="main">

    <target name="main">
        <exec dir="." executable="ls" os="Linux" output="ls.txt" />
         <exec dir="." executable="cmd.exe" os="Windows 2000" output="dir.txt">
            <arg line="/c dir"/>
        </exec>
    </target>

</project>
```

Here's what you might see in Linux:

```
-bash-2.05b$ ant
Buildfile: build.xml

main:

BUILD SUCCESSFUL
Total time: 0 seconds

-bash-2.05b$ cat ls.txt
build.xml
ls.txt
```

Here's what you might see in Windows:

```
C:\ant\ch07\exec>ant
Buildfile: build.xml

main:

BUILD SUCCESSFUL
Total time: 0 seconds

C:\ant\ch07\exec>type dir.txt
 Volume in drive C has no label.
 Volume Serial Number is 1512-1722

 Directory of C:\ant\ch07\exec

06/25/2004  01:06p      <DIR>          .
```

```
06/25/2004  01:06p      <DIR>          ..
06/25/2004  02:02p                 311 build.xml
06/25/2004  02:02p                 104 dir.txt
               2 File(s)            455 bytes
               2 Dir(s)  29,627,777,024 bytes free
```

7.2.3. Handling Timeouts

You can limit the amount of time you want to wait for an external program to execute by setting the `timeout` attribute to a millisecond value. If the timeout is reached and the program hasn't returned, it's killed and the `java` tasks's return value will be `1`. In that case, the build will halt if `failonerror` is `true`. Here's an example:

```
<?xml version="1.0" ?>
<project default="main">

    <target name="main">
        <exec dir="." executable="databaseConnect" timeout="100 "
              failonerror="true" />
    </target>

</project>
```

7.2.4. Executing Shell Commands

How about shell and batch scripts? In Unix, executing shell scripts is no problem. Assign the `executable` attribute the name of the script. In Windows, it's a different story. To execute a batch (*.bat*) file, execute the command-line processor, *cmd.exe*, and pass the name of the batch file using an `arg` nested element and the `/c` switch:

```
<exec dir="." executable="cmd" os="Windows 2000">
    <arg line="/c backup.bat"/>
</exec>
```

If you're running a Unix-like shell in Windows, execute the command shell, `sh`, and use the `-c` switch, which sends the output to a file:

```
<exec executable="/bin/sh">
    <arg value="-c" />
    <arg value="run.sh &gt; results" />
</exec>
```

7.2.5. Checking for External Programs Before Executing Them

When you start launching external programs, ensure the desired programs are available before launching them. Example 7-4 shows how you can do that with the `available` task, where the existence of *cc* is verified before compiling C code. If *cc* is found, the build file sets a property named `cc.ok`, which is checked by the `compile` target before the compilation is attempted.

Example 7-4. Checking for external programs (ch07/checkfirst/build.xml)

```
<?xml version="1.0" ?>
<project default="main">

    <property name="src" location="source" />

    <target name="main" depends="check, compile">
        <echo>
            Compiling....
        </echo>
    </target>

    <target name="check">
        <condition property="cc.ok">
            <or>
                <available file="cc" filepath="/usr" />
                <available file="cc" filepath="/usr/bin" />
                <available file="cc" filepath="/usr/local/bin" />
            </or>
        </condition>
    </target>

    <target name="compile" depends="check" if="cc.ok">
        <exec dir="." executable="cc">
            <arg line="${src}/Project.cc"/>
        </exec>
    </target>

</project>
```

7.3. Performing Batch Execution

What if you want to execute a command on multiple files? If you want to pass a set of files to an external command, use the `apply` task, a version of `exec` that takes filesets. The files in the fileset are passed as arguments to the command or external program.

This task is a powerful one, letting you batch your executions and work with external programs as if they supported filesets. In Example 7-5, the build file is running the C compiler `gcc` on a fileset. In this case, the `apply` task executes the command line `gcc -c -o` ***`target source`*** for each *.c* file in `${src}`, where ***`source`*** with the name of each matching *.c* file in turn, and ***`target`*** is replaced with the name of the corresponding *.o* output file you want created.

Example 7-5. Using the apply task (ch07/apply/build.xml)

```
<?xml version="1.0" ?>
<project default="main">

    <property name="src" location="source" />

    <target name="main">
        <apply executable="gcc">
            <arg value="-c"/>
            <arg value="-o"/>
            <targetfile/>
            <srcfile/>
            <fileset dir="${src}" includes="*.c" />
            <mapper from="*.c" to="*.o" type="glob" />
        </apply>
    </target>
</project>
```

You can see this task's attributes Table 7-4.

Table 7-4. The apply task's attributes

Attribute	Description	Required	Default
`addsourcefile`	Specifies if you want source filenames to be added to the command automatically. Since Ant 1.6.	No	`TRue`

Attribute	Description	Required	Default
append	Specifies whether you want to append to output and error files.	No	false
dest	Specifies the directory in which files will be stored by the task.	Yes, if you specify a nested mapper.	
dir	Specifies the directory where the command should be executed.	No	
error	Specifies the file where standard error output should be stored.	No	
errorproperty	Specifies the name of a property where you want to store errors.	No	
executable	Specifies the command to execute (without any command-line arguments).	Yes	
failifexecutionfails	Specifies the build should be stopped if the program doesn't start.	No	true
failonerror	Specifies the build should be stopped if the task encounters errors.	No	
forwardslash	Specifies you want filenames to be passed with forward slashes as directory separators.	No	false
input	Specifies the file where the task should take input to run the class with.	No	
inputstring	Specifies a string holding the input stream for the class to run.	No	
logError	Specifies you want to send error output to Ant's log.	No	
maxparallel	Specifies the maximum number of source files to use at once. Set to a value less than or equal to 0 for unlimited parallelism. Available since Ant 1.6.	No	unlimited
newenvironment	Indicates you do not want to pass to the old environment when new environment variables are specified.	No	false
os	Specifies the operating systems in which the executable can be run.	No	
output	Specifies the name of a file in which to store the output.	No	
outputproperty	Specifies the name of a property in which you want the output of the task to be placed.	No	

Attribute	Description	Required	Default
parallel	Specifies you want to run the command one time only on multiple files.	No	false
relative	Specifies if filenames should be absolute or relative when passed to the command to execute.	No	false
resolveExecutable	Specifies the name of the executable should be resolved using the project's base directory, then using the execution directory if that doesn't work. Since Ant 1.6.	No	false
resultproperty	Specifies the name of the property that you want to hold the return code. Use this one only if failonerror is false and if fork is true.	No	
skipemptyfilesets	Specifies you don't want to run the command if no source files found or are newer than their corresponding target files.	No	false
spawn	Specifies you want to spawn a new process in which to run the command. To use this attribute, set fork to true.	No	false
timeout	Specifies you want the task to quit if it doesn't finish in the given time. Set the time in milliseconds.	No	
type	Specifies whether you're working with files or directories. Set to dir, file, or both.	No	"file"
verbose	Specifies whether you want the task to display its progress. Since Ant 1.6.	No	false
Vmlauncher	Specifies you want to run the executable using the JVM's execution facilities.	No	true

You can use any number of nested fileset elements to specify the files you want to use with this task. Since Ant 1.6, you can use any number of nestedfilelist and/or dirset elements as well. At least one fileset or filelist is required.

You can use one mapper element to specify the target files relative to the dest attribute for dependency checking, as I'll do below. Command-line arguments can be passed witharg elements, as with the exec task, and you can use nested env elements.

How does Ant pass the names of files to the external program? By default, the file-names of the source files are added to the end of the command line. If you want to insert the names of files in a different place, use a nested srcfile element between nested arg elements. Nested targetfile elements are similar to srcfile elements, except they mark the position of the target filename on the command line. You can only use a targetfile element if you define a nested mapper and the dest attribute.

7.4. Multithreading Tasks

The parallel task can contain other Ant tasks and execute each nested task in its own thread. While the tasks within the parallel task are being run, the main thread will be blocked waiting for all the child threads to complete.

This task is useful to speed up build-file processing and to launch external tasks that may depend on each other; you may want to launch a server and run tests on build output, for example. The attributes of this task appear in Table 7-5.

Table 7-5. The parallel task's attributes

Attribute	Description	Required	Default
failonany	Specifies you want the task to fail if any nested task fails.	No	
pollInterval	Polls tasks; not implemented at this point.	No	1000
threadCount	Specifies the maximum numbers of threads you want to use.	No	
tHReadsPerProcessor	Specifies the maximum number of threads you want to use for each processor. Requires JDK 1.4 or later.	No	
timeout	Specifies a timeout, in miiliseconds, before the task fails.	No	

Be careful when using this task as you would with any parallel task. For example, if you're compiling and two files have the same dependency, you could have file access conflicts.

The parallel task supports a daemons nested element, which is a list of tasks which are to be run in parallel daemon threads. The parallel task will not wait for these tasks to complete. Because they are daemon threads, however, they will not prevent Ant from completing the task.

The parallel task may be combined with the sequential task to define sequences of tasks to be executed on each thread inside the parallel task; for an example usingparallel and sequential, see the next topic.

7.5. Setting Execution Order

Like `parallel`, `sequential` is a container task which can contain other Ant tasks. In this task, the nested tasks are executed in sequence. You use this task primarily to ensure the sequential executio of a subset of tasks in the `parallel` task.

The `sequential` task has no attributes and has no nested elements besides the Ant tasks you want to run. Here's an example which uses the `wlrun` task to start the Weblogic Web server, waits for it to start, runs a JUnit test, and then stops Weblogic:

```
<parallel>
    <wlrun taskname="server"
           classpath="${weblogic.boot.classpath}"
           wlclasspath="${weblogic.classes}:${code.jars}"
           name="antserver"
           home="${weblogic.home}"
           properties="antserver/antserver.properties"/>
    <sequential>
        <sleep seconds="60"/>
        <junit printsummary="yes" haltonfailure="yes">
            <formatter type="plain"/>
            <batchtest fork="true" todir="${reports.tests}">
                .
                .
                .
            </batchtest>
        </junit>
        <wlstop/>
    </sequential>
</parallel>
```

Chapter 8. Developing for the Web

Developing for the Web is bread and butter for Ant developers. There is a wide spectrum of tasks at your disposal: Chapter 4 introduced packaging and deploying applicationsincluding Web applicationsï£§with the `move`, `copy`, `ftp`, `telnet`, `sshexec`, and `mail` tasks, but Ant offers more. This chapter covers the tasks specifically designed for packaging Web applications, such as `war`, `cab`, `ear`, and `jspc`, and for deploying them, such as `get`, `serverdeploy`, and `scp`. I'll cover the custom Ant tasks targeted to specific servers such as `deploy`, `reload`, and `undeploy`. And there's more to come: Chapter 9 covers the many optional Enterprise JavaBeans (EJB) tasks Ant supports.

Team LiB

8.1. Creating WAR Archives

The `war` task is an extension of the `jar` task, and it compresses Web applications into *.war* files, with special handling for files that should end up in the *WEB-INF/lib*, *WEB-INF/classes* or *WEB-INF* directories on the server. For example, say you have this directory layout after you build your project:

```
war
|____output
|        login.class
|        logout.class
|
|____source
     |    login.xml
     |
     |____html
              welcome.xml
```

The build file in Example 8-1 will create the *.war* file you need to deploy this application, placing the *.class* files in the *WEB-INF/classes* directory, renaming *login.xml web.xml* and placing it in *WEB-INF*, and so on.

Example 8-1. Creating a war file (ch08/war/build.xml)

```
<?xml version="1.0" encoding="UTF-8" ?>

<project default="main" basedir=".">

    <property name="bin" value="output" />
    <property name="src" value="source" />

    <target name="main" >
        <war destfile="login.war" webxml="${src}/login.xml">
            <fileset dir="${src}/html"/>
            <classes dir="${bin}"/>
        </war>
    </target>

</project>
```

Here's what this build file looks like at work:

```
%ant
```

```
Buildfile: build.xml

main:
      [war] Building war: /home/steven/ant/ch08/war/login.war

BUILD SUCCESSFUL
Total time: 2 seconds
```

That creates the *.war* file. Besides packaging the files specified, Ant supplies a default manifest file, *Manifest.mf*, in the resulting *.war* file, which contains these contents:

```
Manifest-Version: 1.0
Ant-Version: Apache Ant 1.6.1
Created-By: 1.4.2_03-b02 (Sun Microsystems Inc.)
```

After you create your *.war* file, you can deploy it by copying it to your web server's deployment directory, such as to the *webapps* directory in Tomcat.

The attributes of the `war` task appear in Table 8-1.

> The `war` task is a shortcut for specifying the particular layout of a *.war* file. The same thing can be accomplished using the `prefix` and `fullpath` attributes of zipfilesets in a `zip` or `jar` task.

Table 8-1. The war task's attributes

Attribute	Description	Required	Default
`basedir`	Specifies the source directory for files to include in the compressed file.	No	
`compress`	Specifies you want to not only store data but compress it.	No	`TRue`
`defaultexcludes`	Specifies if you want to use default excludes or not. Set to `yes`/`no`.	No	Default excludes are used.
`destfile`	Specifies the WAR file you want to create.	Exactly one of `destfile` or `warfile`.	
`duplicate`	Specifies what to do if a duplicate file is found. Valid values are `add`, `preserve`, and `fail`.	No	`add`
`encoding`	Specifies the character encoding to use for filenames in the WAR file.	No	`UTF8`

Attribute	Description	Required	Default
`excludes`	Specifes the patterns matching files to exclude, as a comma- or space-separated list.	No	
`excludesfile`	Specifes the name of a file where each line is a pattern matching files to exclude.	No	
`filesonly`	Specifies you want to store only file entries.	No	`false`
`includes`	Specifes the patterns matching files to include, as a comma- or space-separated list.	No	
`includesfile`	Specifes the name of a file where each line is a pattern matching files to include.	No	
`keepcompression`	Preserves the compression as it has been in archives you're compressing instead of using the compress attribute. Available since Ant 1.6.	No	`false`
`manifest`	Specifies the manifest file to use in the compressed file.	No	
`update`	Specifies whether you want to update or overwrite the target file if it exists.	No	`false`
`warfile`	Deprecated. Use `destfile`. Specifies the WAR file you want to create.	Exactly one of `destfile` or `warfile`.	
`webxml`	Specifies the deployment descriptor you want to use. Will be deployed to WEB-INF/web.xml.	Yes, unless `update` is set to true.	

The `war` task can contain elements like `fileset` and `zipfileset` to specify what files to include in the *.war* file. This task can contain these elements to specify where you want various files to go:

- Files contained in the `webinf` element end up in *WEB-INF*
- Files contained in the `classes` element end up in *WEB-INF/classes*
- Files contained in the `lib` element end up in *WEB-INF/lib*
- Files contained in the `metainf` files end up in *META-INF*

Team LiB

8.2. Creating CAB Files

The cab task creates Microsoft *.cab* archive files, and you use this task as you would the jar or zip tasks. The *.cab* files are the .NET equivalent of *.war* files, packaging .NET applications for server deployment. This task works in Windows using the external cabarc tool (this tool comes from Microsoft), which must be in your executable path.

I'm not going to spend much time on this task because the Microsoft Visual Studio IDE has many powerful integrated build tools and wizards that create *.cab* files; most Microsoft developers do not need Ant to solve their build problems. Here's a quick example using the Ant cab task:

```
<cab cabfile="${deploy}/app.cab"
    basedir="${output}"
/>
```

> You can get a free copy of the Microsoft C# command-line compiler, csc, if your version of Windows doesn't have it. Install the .NET Framework's Software Development Kit (SDK), which you can find at http://msdn.microsoft.com/downloads. The csc compiler is included.

The attributes of the cab task appear in Table 8-2.

> It's possible to use this task on other platforms besides Windows, but you need to get and compile the libcabinet tool from http://trill.cis.fordham.edu/~barbacha/cabinet_library/.

Table 8-2. The cab task's attributes

Attribute	Description	Required	Default
basedir	Specifies the directory to archive files from.	No	
cabfile	Specifies the name of the cab file you want to create.	Yes	
compress	Specifies you want to not only store data but compress it.	No	yes
defaultexcludes	Specifies if you want to use default excludes or not. Set to yes/no.	No	Default excludes are used.

Attribute	Description	Required	Default
excludes	Specifes the patterns matching files to exclude, as a comma- or space-separated list.	No	
excludesfile	Specifes the name of a file where each line is a pattern matching files to exclude.	No	
includes	Specifes the patterns matching files to include, as a comma- or space-separated list.	No	
includesfile	Specifes the name of a file where each line is a pattern matching files to include.	No	
options	Specifies any additional command-line options you want to pass to the cabarc tool.	No	
verbose	Specifies you want full (verbose) output. Set to yes or no.	No	no

You can use nested fileset elements to specify the files to be included in the archive. As with other Ant tasks, this task forms an implicit FileSet and supports all attributes of thefileset element (dir becomes basedir) as well as the nested include, exclude and patternset elements.

8.3. Creating Simple Web Deployment

With a WAR file (or CAB file), it's time to turn to the deployment side of the Web development equation. If you're working on the same machine as a Web server, deployment can be as easy as copying a *.war* file to the application base directory for the server. Example 8-2 illustrates the point; this build file creates and copies a *.war* file over to the Tomcat *webapps* directory. When you (re)start Tomcat, the *.war* file will expand automatically into a directory of the same name (minus the *.war* extension), and the Web application will become available, in this case, at *http://localhost:8080/app*. (If you're deploying a servlet, the URL will reflect the servlet's package, as in *http://localhost:8080/org/antbook/ch08/app* for the servlet class `org.antbook.ch08.app`.)

Example 8-2. Build file for Tomcat deployment (ch08/simple/build.xml)

```
<?xml version="1.0" encoding = "UTF-8"?>
<project default="main" basedir=".">

        <property name="src" location="source" />
        <property name="wardir" location=
         "c:/tomcat/jakarta-tomcat-5.0.19/webapps"/>
        <property name="warfile" location="${wardir}/app.war"/>

        <target name="main" depends="war">
                <echo message="Deploying the Web app...."/>
        </target>

        <target name="war" >
        <war destfile="${warfile}" webxml="${src}/app.xml" basedir="${bin}" />
        </target>

</project>
```

You can use Ant's `ftp` task (see Chapter 4) for remote deployment to a Web server's base directories.

Team LiB

8.4. Deploying with SCP

Another deployment task, available since Ant 1.6, is the scp task, which copies a file or FileSet to or from a remote machine running the SSH daemon. This task is an optional one, and you need *jsch.jar* in the Ant *lib* directory to use it (you can get *jsch.jar* at http://www.jcraft.com/jsch/index.html).

This task is handy for deployment. For example, here's how to deploy a single file to a remote host (any host you connect to must be listed in your *knownhosts* file unless you specifically set the TRust attribute to yes or true):

```
<scp file="Project.jar"
    todir="user:password@antmegacorp.com:/home/steven/cgi-bin"/>
```

You can use the password attribute explicitly to set the password:

```
<scp file="Project.jar"
    todir="user@antmegacorp.com:/home/steven/cgi-bin""
    password="password"/>
```

Here's how to copy a remote file to a local machine:

```
<scp file="user:password@antmegacorp.com:/home/steven/cgi-bin/Project.jar"
    todir="${archive}"/>
```

Here's how to copy a set of files using a fileset:

```
<scp todir="user:password@antmegacorp.com:/home/steven/source">
    <fileset dir="${src}">
        <include name="**/*.java"/>
    </fileset>
</scp>
```

Example 8-3 gives a complete example build file using the scp task for deployment. (It uses the remote machine's IP address instead of naming the remote server.)

Example 8-3. Using scp (ch08/scp/build.xml)

```
<?xml version="1.0" ?>
<project default="main">

    <property name="message" value="Deploying the .jar file." />
    <property name="src" location="source" />
```

```
    <property name="output" location="bin" />

    <target name="main" depends="init, compile, compress, deploy">
        <echo>
            ${message}
        </echo>
    </target>

    <target name="init">
        <mkdir dir="${output}" />
    </target>

    <target name="compile">
        <javac srcdir="${src}" destdir="${output}" />
    </target>

    <target name="compress">
        <jar destfile="${output}/Project.jar" basedir="${output}">
            <include name="*.class"/>
            <include name="*.txt"/>
        </jar>
    </target>

    <target name="deploy">
        <scp trust="true"
            file="${output}/Project.jar"
              todir="user:password@000.000.000.000:cgi-bin"/>
    </target>

</project>
```

Here's what that build file output looks like when run on a Windows machine:

```
%ant
Buildfile: build.xml

init:
     [mkdir] Created dir: C:\ant\ch08\scp\bin

compile:
    [javac] Compiling 1 source file to C:\ant\ch08\scp\bin

compress:
       [jar] Building jar: C:\ant\ch08\scp\bin\Project.jar

deploy:
      [scp] Connecting to 000.000.000.000
      [scp] Sending: Project.jar : 664
      [scp] File transfer time: 1.32 Average Rate: 9502.27 B/s
      [scp] done.
```

```
main:
     [echo]
     [echo]             Deploying the .jar file.
     [echo]

BUILD SUCCESSFUL
Total time: 12 seconds
```

> As discussed in Chapter 4, hardcoding passwords and/or usernames in a build file is a bad idea. It's better to use properties like this:
>
> ```
> <scp todir="${username}:${password}@antmegacorp.com:/home/steven/source" ...>
> ```
>
> Pass the username and password to Ant like this:
>
> ```
> ant -Dusername=steven -Dpassword=opensesame
> ```
>
> Unix file permissions are not retained when files are copied with the`scp` task (they get `UMASK` permissions). If you want to retain Unix permissions, execute the Unix`scp` command instead (i.e., <exec executable="scp" ... >).

The attributes of this task appear in Table 8-3.

Table 8-3. The scp task's attributes

Attribute	Description	Required	Default
`failonerror`	Specifies whether you want to stop the build if the task encounters an error.	No	`true`
`file`	Specifies the file you want to transfer. You can give a local path or a remote path of the form *user[:password]@host:/directory/path* .	Yes, unless a nested `fileset` element is used.	
`keyfile`	Specifies the location of a file holding the private key you want to use.	Yes, if you are using key-based authentication.	
`knownhosts`	Specifies the known hosts file, which can be used to validate remote hosts.	No	*${user.home}/.ssh/known_hosts* .

Attribute	Description	Required	Default
`passphrase`	Specifies the passphrase for your private key.	Yes, if you are using key-based authentication.	
`password`	Specifies the password you want to use for logging in.	No if you are using key-based authentication or the password has been given in the file or todir attribute.	
`port`	Specifies the port you want to connect to on the remote host.	No	`22`
`todir`	Specifies the directory you want to copy to. This can be a local path or a remote path of the form *user[:password]@host:/directory/path*.	Yes	
`TRust`	Specifies you want to trust all unknown hosts if set to yes/true. If set to false (the default), the host you connect to must be listed in your *knownhosts* file.	No	`no`

You can use `fileset` elements to select sets of files to copy; if you use a fileset, you must assign a value to the `todir` attribute. (The `fileset` element works only when you're copying files from the local machine to a remote machine.)

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8.5. Deploying to Tomcat

Tomcat (available from http://jakarta.apache.org/tomcat/), the reference Web server for servlets and JSP, has become more attractive to Ant developers since it comes with custom Ant tasks for deployment. Copy the file *server/lib/catalina-ant.jar* from your Tomcat 5 installation into the *lib* directory of your Ant installation to use these tasks.

The Tomcat deployment tasks are `deploy`, `reload`, and `undeploy`; to use them, add these `taskdef` elements (discussed in Chapter 11) to your build file:

```
<taskdef name="deploy" classname="org.apache.catalina.ant.DeployTask"/>
<taskdef name="reload" classname="org.apache.catalina.ant.ReloadTask"/>
<taskdef name="undeploy" classname="org.apache.catalina.ant.UndeployTask"/>
```

To use these tasks, you'll need manager privileges with Tomcat; edit *conf/tomcat-users.xml* to add manager privileges for a username (`admin` here) and password like this:

```
<?xml version='1.0' encoding='utf-8'?>
<tomcat-users>
  <role rolename="manager"/>
  <role rolename="role1"/>
  <role rolename="tomcat"/>
  <user username="admin" password="password" roles="manager"/>
  <user username="role1" password="tomcat" roles="role1"/>
  <user username="tomcat" password="tomcat" roles="tomcat"/>
  <user username="both" password="tomcat" roles="tomcat,role1"/>
</tomcat-users>
```

You can use the `deploy` task to deploy a web application to Tomcat from Ant like this:

```
<target name="install">

    <deploy url="${manager.url}"
        username="${manager.username}"
        password="${manager.password}"
        path="${app.path}"
        localWar="file://${build}"/>

</target>
```

Here, `manager.url` is the URL of the Tomcat manager servlet. The default name for this servlet is "manager", so this is something like *http://localhost:8080/manager*. The `app.path` property holds the context path at which this application should be deployed (usually `/` plus the name of the application as you want to use it in the URL to access the application online). The `build` property holds the location at which you build the Web application as it should be installed in the Tomcat `webapps` directory.

If you have installed an application and want Tomcat to recognize you have updated Java classes, use the `reload` task instead:

```
<target name="reload">

    <reload url="${manager.url}"
         username="${manager.username}"
         password="${manager.password}"
         path="${app.path}"/>

 </target>
```

To remove a Web application, use the `undeploy` task:

```
<target name="remove">

    <undeploy url="${manager.url}"
        username="${manager.username}"
        password="${manager.password}"
        path="${app.path}"/>

</target>
```

8.6. Deploying to Tomcat

More often than not, you won't be developing your applications on the same server you want to deploy t You can deploy to a Tomcat installation running on a remote server by contacting the Tomcat manager servlet via URL in a browser. To do that in Ant you use the `get` task, which gets a file when you pass it a If you're using Java 1.4 or later, this task supports any URL schema, including http, *ftp* :, *jar* :, and http This task is great if you want to download online content, or, as in this case, issue commands via URLs t online code.

Before getting to deployment, here's an example that uses `get` to retrieve the Ant home page and stores in *ant.html* :

```
<get src="http://ant.apache.org/" dest="ant.html"/>
```

You can upload Web applications to Tomcat using the manager servlet, passing the local location of the application to upload. For example, to upload a Web application from *C:/ant/ch08/app* in Windows, you'd this location:

```
file:////C:\ant\ch08\app/
```

To upload a *.war* file, you add an `!` at the end of the location to indicate you're uploading a file, not the contents of a directory, like this in Unix:

```
jar:file://///ant/ch08/app.war!/
```

Example 8-3 shows how this works in practice. In this case, the build file deploys a Web application fron *C:\ant\deploy\app* that consists of a servlet (`org.antbook.ch08.Deploy`) that displays the message "Proje Deployment!" to Tomcat. Here's the URL you pass to the `get` task to tell the Tomcat manager servlet wh you want to do:

```
http://localhost:8080/manager/deploy?path=/deployment&amp;war=file:////c:\ant\deploy\a
```

You can see this at work in Example 8-4.

Example 8-4. Deploying with get (ch08/get/build.xml)

```
<?xml version="1.0" encoding="UTF-8" ?>

<project default="main" basedir=".">

   <property name="tomcat.port" value="8080" />
  <property name="tomcat.username" value="admin" />
```

```
  <property name="tomcat.password" value="password" />

  <target name="main" >
      <get  src="http://localhost:8080/manager/deploy?path=/deployment&amp;war=file:////c
\ant\deploy\app/"
      dest="deploy.txt"
      username="${tomcat.username}"
      password="${tomcat.password}" />

  </target>

</project>
```

Here's what the build file looks like in action:

```
%ant
Buildfile: build.xml

main:
       [get] Getting: http://localhost:8080/manager/deploy?path=/deployment&war=
file:////c:\ant\ch08\get\app/

BUILD SUCCESSFUL
Total time: 1 second
```

Here's what Tomcat wrote to the output file, *deploy.txt* :

```
OK - Deployed application at context path /deployment
```

After deployment, navigating to *http://localhost:8080/deployment/org.antbook.ch08.Deploy* shows the deployed servlet, as seen in Figure 8-1 .

Figure 8-1. Deploying to Tomcat

> For more information on using the Tomcat manager servlet, look at *manager/html-manager-howto.html* in your Tomcat installation.

The attributes of the `get` task appear in Table 8-4 .

Table 8-4. The get task's attributes

Attribute	Description	Required	Defa
`dest`	Specifies the file where you want to store the retrieved data.	Yes	
`ignoreerrors`	Specifies you want to only log errors instead of treating them as fatal.	No	`fals`
`password`	Specifies the password to use when connecting.	If `username` is set.	
`src`	Specifies the URL where the data you want is.	Yes	
`username`	Specifies the username for BASIC http authentication.	If `password` is set.	
`usetimestamp`	Specifies you want to download a file only after checking the timestamp of the local copy to ensure you don't overwrite a more recent version.	No	`fals`
`verbose`	Specifies you want to see full information as this task executes. Set to `true` /`false` .	No	`fals`

> When the `verbose` option is on, this task will display a dot (.) for every 100 KB received.

8.7. Compiling JSPs

When deploying to servers, the `jspc` task can be useful. This task runs the JavaServer Pages compiler and turns JSP pages into Java source, which you can compile with the `javac` task. Compiling JSP pages supports fast invocation of JSP pages, deployment on servers without the complete JDK, o lets you check the syntax of pages without deploying them. By default, this task uses the Jasper JSP compiler, which comes with Tomcat. Copy Tomcat's *jasper-compiler.jar* and *jasper-runtime.jar* files into the Ant *lib* directory to use this task. You'll need *servlet.jar*, which comes with Tomcat, in the Ant *lib* directory.

For example, say you have this JSP page, *greeting.jsp*:

```
<HTML>
  <HEAD>
    <TITLE>Creating a Greeting</TITLE>
  </HEAD>

  <BODY>
     <H1>Creating a Greeting</H1>
    <%
        out.println("Hello from JSP!");    //Display the greeting
     %>
  </BODY>
</HTML>
```

Example 8-5 shows how to compile this JSP into *greeting.java*.

Example 8-5. Compiling JSP pages (ch08/jspc/build.xml)

```
<?xml version="1.0" ?>
<project default="main">

    <property name="message" value="Compiling the JSP...." />
    <property name="src" location="source" />
    <property name="output" location="bin" />

    <target name="main" depends="init, compile">
        <echo>
            ${message}
        </echo>
    </target>

    <target name="init">
        <mkdir dir="${output}" />
```

```
    </target>

    <target name="compile">
        <jspc srcdir="${src}"
            destdir="${output}"
            package="org.antbook.jsp"
            verbose="9">
            <include name="**/*.jsp" />
        </jspc>
    </target>

</project>
```

Here's what you see when you run the build file:

```
%ant
Buildfile: build.xml

init:

compile:
     [jspc] Compiling 1 source file to
      /home/steven/ant/ch08/jspc/bin/org/antbook/jsp
  [jasperc] 2004-06-30 02:20:09 - Class name is: greeting
  [jasperc] 2004-06-30 02:20:09 - Java filename is:
      /home/steven/ant/ch08/jspc/bin/org/antbook/jsp/greeting.java
  [jasperc] 2004-06-30 02:20:09 - Accepted
     org.apache.jasper.compiler.Parser$Scriptlet at /greeting.jsp(7,4)
  [jasperc] 2004-06-30 02:20:09 - Compiling with: -encoding UTF8

main:
     [echo]
     [echo]            Compiling the JSP....
     [echo]

BUILD SUCCESSFUL
Total time: 3 seconds
```

And this is what the resulting Java code, *greeting.java*, looks like:

```
package org.antbook.jsp.;

import javax.servlet.*;
import javax.servlet.http.*;
import javax.servlet.jsp.*;
import org.apache.jasper.runtime.*;


public class greeting extends HttpJspBase {
```

```
    static {
    }
    public greeting( ) {
    }

    private static boolean _jspx_inited = false;

    public final void _jspx_init( ) throws org.apache.jasper.runtime.JspException {
    }

    public void _jspService(HttpServletRequest request, HttpServletResponse
        response)
        throws java.io.IOException, ServletException {

        JspFactory _jspxFactory = null;
        PageContext pageContext = null;
        HttpSession session = null;
        .
        .
        .
        out.println("Hello from JSP!");    //Display the greeting
        .
        .
        .
    }
}
```

Here's another example, which compiles JSP pages, checks the dependencies, and uses the `javac` task to create the actual bytecode for this JSP:

```
<jspc
    destdir="temp"
    srcdir="${src}"
     package="org.antbook.ch08">
    <include name="**/*.jsp" />
</jspc>

<depend
    srcdir="temp"
    destdir="${bin}"
    classpath="lib/app.jar"/>

<javac
    srcdir="temp"
    destdir="${bin}"
    classpath="lib/app.jar" />
```

You can see the attributes of the `jspc` task in Table 8-5.

Table 8-5. The jspc task's attributes

Attribute	Description	Required	Default
classpath	Specifies the classpath to use when you're running the JSP compiler. You can specify this by nested classpath elements.	No	
classpathref	Specifies the classpath to use when you're running the JSP compiler, by reference.	No	
compiler	Specifies the classname of a JSP compiler, such as jasper or jasper42.	No	jasper
compilerclasspath	Specifies the classpath that should be used to find the compiler specified by the compiler attribute.	No	
destdir	Specifies where you want to place the compiled files.	Yes	
failonerror	Specifies if the task to fail if it encounters an error.	No	yes
ieplugin	Specifies the Java Plugin class ID for Internet Explorer.	No	
mapped	Specifies you want to generate separate write statements for each HTML line in the JSP. Set to true/false.	No	
package	Specifies the name of the destination package for the generated compiled classes.	No	
srcdir	Specifies where you want the task to look for source JSP files.	Yes	
uribase	Specifies the base URI for relative URI references in JSP pages.	No	
uriroot	Sets the root directory from which URIs should be resolved.	No	
verbose	Specifies you want full (verbose) output. Set to an integer value (0-9).	No	0
webinc	Specifies the filename for the section of web.xml that details any servlets.	No	
webxml	Specifies the filename for the generated web.xml-type file.	No	

The jspc task is a directory-based task, so the JSP files to be compiled are located the same way as the javac task locates files, which means you can use nested elements, such as includes and excludes. You can use nested classpath and classpathref elements, as well as nested webapp elements. The webapp element, unique to the jspc task, instructs the JSP compiler to build an entire Web application. The one attribute of the webapp element is the basedir attribute, which sets the base directory of the application. The base directory must have a *WEB-INF* subdirectory beneath it. If you use this element, the task uses the compiler for all dependency checking. Here's an example using webapp:

```
<jspc
     package="org.antbook.ch08">
    <include name="**/*.jsp" />
    <webapp basedir="${ch08}" />
</jspc>
```

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8.8. Deploying to EJB Containers

Fundamentally, deploying to Enterprise JavaBean (EJB) application servers is similar to other Ant deployment projects you've seen. You can use the tasks covered to package and deploy EJB applications. For example, you can see a build file developed for the JBoss server in Example 8-6; this build file first creates a *.war* file and then packages it into an *.ear* file for deployment.

Example 8-6. A Jboss EJB build (ch08/ejb/build.xml)

```
<?xml version="1.0" ?>
<project default="main" basedir=".">

    <target name="main" depends="init, compile, war, ear"/>

    <target name="init">
        <property name="src" value="${basedir}/src"/>
        <property name="bin" value="${basedir}/output"/>
        <property name="web" value="${basedir}/web"/>
        <property name="descriptors"
            value="${basedir}/output/deploymentdescriptors"/>
        <property name="eardir" value="${basedir}/output/ear"/>
        <property name="wardir" value="${basedir}/output/war"/>
        <property name="warfile" value="app.war"/>
        <property name="earfile" value="app.ear"/>

        <mkdir dir="${wardir}/WEB-INF"/>
        <mkdir dir="${wardir}/WEB-INF/classes"/>
        <mkdir dir="${eardir}/META-INF"/>
    </target>

    <target name="compile">
        <javac destdir="${bin}" srcdir="${src}" includes="**/*.java" />
    </target>

    <target name="war">
        <copy todir="${wardir}">
            <fileset dir="${web}" includes="**/*.*" />
        </copy>

        <copy file="${descriptors}/web.xml" todir="${wardir}/WEB-INF" />

        <copy todir="${wardir}/WEB-INF/classes">
            <fileset dir="${bin}" includes="**/*.class" />
        </copy>
```

```
        <jar jarfile="${eardir}/${warfile}" basedir="${wardir}" />
    </target>

    <target name="ear">
        <copy file="${descriptors}/application.xml" todir="${eardir}/META-INF" />

        <jar jarfile="${basedir}/${earfile}" basedir="${eardir}" />
    </target>

</project>
```

That's all it takes. Though this build file gets the job done using standard Ant tasks, tasks built into Ant make it easier to work with EJB applications, starting with the `ear` task.

8.8.1. Creating EAR Files

The `ear` task is handy for creating *.ear* files and makes special provisions for the *application.xml* file needed in most EARs. It's not mandatory to use this task to create a *.ear* file, but it can make life easier. You can see the attributes of this task in Table 8-6.

> The `ear` task is an extension of the Jar task with special treatment for application.xml. You can perform the same operation by using the `prefix` and `fullpath` attributes of zipfilesets in a `zip` or `jar` task.

Table 8-6. The ear task's attributes

Attribute	Description	Required	Default
`appxml`	Specifies the deployment descriptor you want to use, such as *application.xml*.	Yes, unless `update` is set to `TRue`.	
`basedir`	Specifies the directory from which to get the files.	No	
`compress`	Indicates you want to not only store data but compress it.	No	`true`
`defaultexcludes`	Specifies if you want to use default excludes or not. Set to `yes`/`no`.	No	Default excludes are used.
`destfile`	Specifies the EAR file you want to create.	Yes	
`duplicate`	Specifies what to do if a duplicate file is found. Valid values are `add`, `preserve`, and `fail`.	No	`add`

Attribute	Description	Required	Default
encoding	Specifies the character encoding to use for filenames in the EAR file.	No	UTF8
excludes	Specifies the patterns matching files to exclude, as a comma- or space-separated list.	No	
excludesfile	Specifies the name of a file where each line is a pattern matching files to exclude.	No	
filesonly	Specifies you want to store only file entries.	No	false
includes	Specifies the patterns matching files to include, as a comma- or space-separated list.	No	
includesfile	Specifies the name of a file where each line is a pattern matching files to include.	No	
keepcompression	Preserves the compression as it has been in archives you're compressing instead of using the compress attribute. Available since Ant 1.6.	No	
manifest	Specifies the manifest file to use in the compressed file.	No	
update	Specifies whether you want to update or overwrite the target file if it exists.	No	false

The extended zipfileset element from the zip task, which supports the attributes prefix, fullpath, and src, is available in the ear task. The nested metainf element specifies a fileset; all files included in this fileset will end up in the META-INF directory of the *.ear* file.

This task lets you specify where to get *application.xml* from, using the appxml attribute. Here's an example that creates an *.ear* file:

```
<ear destfile="${output}/app.ear" appxml="${src}/application.xml">
    <fileset dir="${wardir}" includes="*.war"/>
</ear>
```

8.8.2. Supporting Hot Deployment

The serverdeploy task is designed to support hot deployment (where you don't have to take the server down before deploying) to EJB-aware servers. You set the action attribute to values you've seen, like those used for the Tomcat manager servlet: "deploy", "delete", and "undeploy".

> You'll need vendor-specific deployment software to make this one work. Ant provides the build-end, but your server will need to provide a deployment facility that Ant can connect and interact with.

As of this writing, this task only supports Weblogic servers and the JOnAS 2.4 Open Source EJB server, but support for other EJB containers should be added soon. This task has only two attributes, which appear in Table 8-7, and requires some nested elements.

Table 8-7. The serverdeploy task's attributes

Attribute	Description	Required
`action`	Specifies the action you want to perform, such as `deploy`, `delete`, `list`, `undeploy`, or `update`.	Yes
`source`	Specifies the path and filename of the component you want to deploy. This may be an *.ear*, *.jar*, *.war*, or other file type supported by the server.	Depends on the server.

The `serverdeploy` task supports a nested `classpath` element to set the classpath. It supports the vendor-specific `generic`, `jonas`, and `weblogic` nested elements.

8.8.2.1 The generic element

This is the element you use for generic Java-based deployment if you've got deployment codea Java classsupplied by the server's vendor. If there's a vendor-specific element for `serverdeploy`, use that, of course, but if not, try the `generic` element. The attributes of this element appear in Table 8-8.

Table 8-8. The generic element's attributes

Attribute	Description	Required
`classname`	Specifies the classname of the deployment tool you want to run.	Yes
`classpath`	Specifies the classpath you want the JVM running the tool to use. May be supplied as a nested element.	Depends on the server.
`password`	Specifies the password you want to use on the server.	Depends on the server.
`server`	Specifies the URL of the server to use.	Depends on the server.
`username`	Specifies the username to log in with.	Depends on the server.

The `generic` element supports nested `arg` and `jvmarg` elements. Here's an example using the `generic` element for deployment that assumes the deployment tool for the target Web server is `org.steven.j2ee.config.Deploy`:

```
<serverdeploy action="deploy" source="${eardir}/app.ear">
     <generic classname="org.steven.j2ee.config.Deploy"
        classpath="${classpath}"
        username="${user.name}"
        password="${user.password}">
        <arg value="-install"/>
        <jvmarg value="-mx512m"/>
    </generic>
</serverdeploy>
```

8.8.2.2 The weblogic element

The `weblogic` element is designed to run the `weblogic.deploy` deployment tool; legal actions for this tool are `deploy`, `undeploy`, `list`, `update`, and `delete`. The attributes for this element appear in Table 8-9.

Table 8-9. The weblogic element's attributes

Attribute	Description	Required	Default
`application`	Specifies the name of the application you want to deploy.	Yes	
`classpath`	Specifies the classname of the deployment tool you want to run.	No	
`component`	Specifies the string for deployment targets, of the form: `<component>:<target1>,<target2>....`. In this case, `component` is the archive name (without a file extension).	No	
`debug`	Specifies if you want debug information to be displayed during deployment.	No	
`password`	Specifies the password you want to use on the server.	Yes	
`server`	Specifies the URL of the server to use.	No	
`username`	Specifies the username to log in with.	No	`system`

Here's an example using this element inside a `serverdeploy` element to deploy to a WebLogic server:

```
<serverdeploy action="deploy"
    source="${eardir}/app.ear">
    <weblogic application="app"
         server="ff19://server:7001"
        classpath="${weblogic.home}/lib/weblogic.jar"
        username="${user.name}"
        password="${user.password}"
        component="appserver,productionserver" />
</serverdeploy>
```

8.8.2.3 The jonas element

The `jonas` element supports deployment to JOnAS (Java Open Applicaton Server) servers. Valid actions for the JOnAS deployment tool (`org.objectweb.jonas.adm.JonasAdmin`

`)`

are `deploy`, `undeploy`, `list` and `update`. The attributes of this element appear in Table 8-10.

Table 8-10. The jonas element's attributes

Attribute	Description	Required	Default
`jonasroot`	Specifies the root directory for the server.	Yes	
`orb`	Specifies the orb, such as RMI, JEREMIE, DAVID, and so on. If the orb is DAVID (RMI/IIOP), specifies the `davidhost` and `davidport` attributes.	No	The ORB present in the classpath.
`davidhost`	Specifies the value for the property `david.CosNaming.default_host`.	No	
`davidport`	Specifies the value for the property `david.CosNaming.default_port`.	No	
`classname`	Specifies the classname of the deployment tool you want to run.	No	`org.objectweb.jonas.adm.JonasAdmin`
`classpath`	Specifies the classpath you want the JVM running the tool to use. May be supplied as a nested element.	No	
`server`	Specifies the URL of the server to use.	Yes	

If you want to build in delay times to take into account delays in getting responses from a server, use the Ant `waitfor` task. You can use the `sleep` task for this purpose.

The `jonas` element supports nested `classpath`, `arg`, and `jvmarg` elements. Here's an example using `serverdeploy` to deploy to a JOnAS server:

```
<serverdeploy action="deploy" source="${eardir}/app.jar">
     <jonas server="JOnAS5" jonasroot="${jonas.root}">
        <classpath>
            <pathelement path="${jonas.root}/lib/RMI_jonas.jar"/>
        </classpath>
    </jonas>
</serverdeploy>
```

Chapter 9. XML and XDoclet

XML support is built into Ant, and not only as far as build files go. You can validate XML documents using XML DTDs and schemas using the `xmlvalidate` task. You can read properties from an XML document using `xmlproperty`. You can use the `xslt/style` task to transform XML documents using XSLT. And you can use the `antstructure` task to generate an XML DTD for all the tasks Ant knows about.

Besides covering these and other XML tasks, I'm going to discuss XDoclet in this chapter. XDoclet is an open source code generation engine that is designed to run in Ant. Using codes that you embed in Java source code, XDoclet can generate code, deployment descriptors such as *web.xml*, and other artifacts for Web and EJB applications.

I'll also round out the discussion of EJB from the previous chapter by discussing the Ant EJB tasks, a specially designed set of optional tasks for developing Enterprise JavaBeans (EJBs).

Team LiB

9.1. Validating XML Documents

You use the xmlvalidate task to validate XML documents with Document Type Definitions (DTDs) or XML schema. Your build process may involve generating XML documents, and it can be worthwhile to test those documents for validity before deploying them (for example, see the section on XDoclet in this chapter. You typically use XDoclet to generate XML documents for deploying web applications, such as *web.xml* , *application.xml* , and so on). By default, this task uses the SAX2 parser implementation provided by Sun's JAXP (http://java.sun.com/xml/jaxp/index.jsp). The attributes of this task appear in Table 9-1 .

Table 9-1. The xmlvalidate task's attributes

Attribute	Description	Required	Default
classname	Specifies the XML parser you want to use.	No	
classpathref	Specifies where to find the XML parser class. Note that you can also use a nested classpath element.	No	
failonerror	Specifies you want this task to fail if it encounters an error.	No	true
file	Specifies the file or files you want to validate. You can use a nested fileset.	No	
lenient	Check only if the XML document is well-formed if true.	No	
warn	Specifies the parser should log warn messages.	No	

This task can contain nested dtd elements, which specify locations for DTD resolution. The attributes of the dtd element appear in Table 9-2.

Table 9-2. The dtd element's attributes

Attribute	Description	Required
location	Specifies the location of the DTD you want to use. Set this to a file, a resource, or a URL.	Yes
publicId	Specifies the public ID of the DTD to resolve.	Yes

You can use nested xmlcatalog elements; an XMLCatalog is a catalog of public resources, such as DTDs or entities, that are referenced in an XML document. The attributes of this element appear in Table 9-3

Table 9-3. The xmlcatalog element's attributes

Attribute	Description	Required
`id`	Specifies a unique ID for an XMLCatalog. This ID can be used to reference the XMLCatalog from another XMLCatalog.	No
`refid`	Specifies the ID of another XMLCatalog whose contents are used in this XMLCatalog.	No

The `xmlcatalog` element can contain nested `dtd` , `classpath` , and `catalogpath` elements; the `catalogpath` element is an Ant path-like element, which, as you know, means it can contain nested `fileset` elements, `pathelement` elements, and so on.

The `xmlvalidate` element can contain nested `attribute` elements, which set SAX Parser features as defined at http://xml.org/sax/features/ . The attributes of this element appear in Table 9-4.

Table 9-4. The attribute element's attributes

Attribute	Description	Required
`name`	Specifies the name of the feature to set	Yes
`value`	Specifies the boolean setting of the feature	Yes

9.1.1. Validating with XML Schema

It's easy enough to use the `xmlvalidate` task to validate XML documents with schema, as shown in Example 9-1 , which validates *document.xml* . This example turns on schema validation by setting the parser attribute identified by the URI http://apache.org/xml/features/validation/schemato true.

Example 9-1. Valiating with a schema (ch09/schemat/build.xml)

```
<?xml version="1.0" encoding="UTF-8" ?>

<project default="main" >

    <target name="main">
        <xmlvalidate
            lenient="no"
            warn="yes"
            file="document.xml"
            classname="org.apache.xerces.parsers.SAXParser">
            <attribute name="http://apache.org/xml/features/validation/schema"
                value="true" />
        </xmlvalidate>
```

```
    </target>

</project>
```

Here's *document.xml* , the document to validate, which uses the `xsi:noNamespace SchemaLocation` attribute to specify the name of the schema document, *document.xsd* :

```
<?xml version="1.0" encoding="UTF-8" ?>
<document xsi:noNamespaceSchemaLocation="document.xsd"
     xmlns="" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" >
    <hello />
</document>
```

Here's the schema, *document.xsd* :

```
<?xml version="1.0" encoding="UTF-8" ?>
<xs:schema  xmlns:xs="http://www.w3.org/2001/XMLSchema"
    xmlns="" elementFormDefault="qualified" >
    <xs:element name="document">
        <xs:complexType mixed="false">
            <xs:sequence>
                <xs:element name="hello" type="xs:string" />
            </xs:sequence>
        </xs:complexType>
    </xs:element>
</xs:schema>
```

Finally, here's what you see when you execute this build file, showing that the document was successfully validated:

```
%ant
Buildfile: build.xml

main:
[xmlvalidate] 1 file(s) have been successfully validated.

BUILD SUCCESSFUL
Total time: 1 second
```

Here's what you'd see if there was an error; for example, if "document" had been mispelled "documnt" in the schema:

```
%ant
Buildfile: build.xml

main:
[xmlvalidate] document.xml:4:60: cvc-elt.1 Cannot find the declaration of 'document'.
```

```
BUILD FAILED
document.xml is not a valid XML document.
Total time: 1 second
```

9.1.2. Validating with DTDs

Validating documents using DTDs is as easy, as you can see in Example 9-2, which validates a document, *document.xml* , with a DTD.

Example 9-2. Valiating with a DTD ch09/DTD/build.xml

```
<?xml version="1.0" encoding="UTF-8" ?>

<project default="main" >

    <target name="main">
        <xmlvalidate
            lenient="no"
            warn="yes"
            file="document.xml"
            classname="org.apache.xerces.parsers.SAXParser">
        </xmlvalidate>
    </target>

</project>
```

Here's the document with a DTD, *document.xml* , to validate:

```
<?xml version = "1.0" standalone="yes"?>
<!DOCTYPE document [
<!ELEMENT document (employee)*>
<!ELEMENT employee (name, hiredate, projects)>
<!ELEMENT name (lastname, firstname)>
<!ELEMENT lastname (#PCDATA)>
<!ELEMENT firstname (#PCDATA)>
<!ELEMENT hiredate (#PCDATA)>
<!ELEMENT projects (project)*>
<!ELEMENT project (product,id,price)>
<!ELEMENT product (#PCDATA)>
<!ELEMENT id (#PCDATA)>
<!ELEMENT price (#PCDATA)>
]>
<document>
    <employee>
        <name>
            <lastname>Kelly</lastname>
            <firstname>Grace</firstname>
        </name>
```

```
         <hiredate>October 15, 2005</hiredate>
        <projects>
            <project>
                <product>Printer</product>
                <id>111</id>
                <price>$111.00</price>
            </project>
            <project>
                <product>Laptop</product>
                <id>222</id>
                <price>$989.00</price>
            </project>
        </projects>
    </employee>
    <employee>
        <name>
            <lastname>Grant</lastname>
            <firstname>Cary</firstname>
        </name>
         <hiredate>October 20, 2005</hiredate>
        <projects>
            <project>
                <product>Desktop</product>
                <id>333</id>
                <price>$2995.00</price>
            </project>
            <project>
                <product>Scanner</product>
                <id>444</id>
                <price>$200.00</price>
            </project>
        </projects>
    </employee>
    <employee>
        <name>
            <lastname>Gable</lastname>
            <firstname>Clark</firstname>
        </name>
         <hiredate>October 25, 2005</hiredate>
        <projects>
            <project>
                <product>Keyboard</product>
                <id>555</id>
                <price>$129.00</price>
            </project>
            <project>
                <product>Mouse</product>
                <id>666</id>
                <price>$25.00</price>
            </project>
        </projects>
    </employee>
```

downloaded from: lib.ommolketab.ir

```
</document>
```

And here are the results:

```
%ant
Buildfile: build.xml

main:
[xmlvalidate] 1 file(s) have been successfully validated.

BUILD SUCCESSFUL
Total time: 0 seconds
```

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9.2. Loading Properties from XML Files

The `xmlproperty` task loads property values from a well-formed XML file. The way you structure the XML document determines the names of the properties it creates.

Say you have this XML document, *properties.xml*, that defines a property named `name1`, and two nested properties, `firstName` and `lastName`, creating the properties `name1.firstName` and `name1.lastName`:

```
<name1  language="english">
    <firstName language="german">Stefan</firstName>
    <lastName>Edwards</lastName>
</name1>
```

You can load these properties into a build with the `xmlproperty` task, as shown in Example 9-3. This build file displays the values of the properties created by *properties.xml*, `name1.firstName`, and `name1.lastName`. This example defines attributes for the `name1` and `firstName` properties, creating an attribute named `language` which can be accessed as `name1(language)` and as `name1.firstName(language)`. The build file displays the values of these properties.

Example 9-3. Loading XML properties (ch09/xmlproperty/build.xml)

```
<?xml version="1.0" ?>
<project default="main">

   <xmlproperty file="properties.xml" />

    <target name="main">
        <echo>
            ${name1(language)}
            ${name1.firstName}
            ${name1.firstName(language)}
            ${name1.lastName}
        </echo>
    </target>

</project>
```

Here's what the build file displays when run:

```
%ant
Buildfile: build.xml
```

```
main:
     [echo]
     [echo]             english
     [echo]             Stefan
     [echo]             german
     [echo]             Edward
     [echo]

BUILD SUCCESSFUL
Total time: 0 seconds
```

The attributes of this task appear in Table 9-5.

Table 9-5. The xmlproperty task's attributes

Attribute	Description	Required	Default
`collapseAttributes`	Specifies you want to treat attributes as nested elements	No	`false`
`file`	Specifies the XML file you want to parse for properties	Yes	
`includeSemanticAttribute`	Specifies you want to include the semantic attribute name as part of the property name	No	`false`
`keepRoot`	Specifies you want to make the XML root tag the first value in the property name	No	`true`
`prefix`	Specifies the prefix to prepend to each property automatically	No	
`rootDirectory`	Specifies the root directory to search for files	No	`${basedir}`
`semanticAttributes`	Specifies you want to use semantic handling of attribute names	No	`false`
`validate`	Specifies you want to validate the input file	No	`false`

9.3. Creating Ant Task DTDs

The Ant documentation is useful but at times hard to use if you're looking for the definitions of nested tasks and elements, because they're not listed at the top level. On the other hand, if you can read a DTD and want to know how any Ant task or element is defined, use the `antstructure` task. This task will create a DTD for all Ant tasks that Ant knows about, including optional tasks, with their attributes and nested elements. This task only has one attribute, `output` , which specifies the output file to hold the DTD.

Example 9-4 shows how to use this task, storing the DTD for all Ant tasks in *project.dtd* .

Example 9-4. Using the antstructure task (ch09/antstructure/build.xml)

```
<?xml version="1.0" ?>
<project default="main">

    <target name="main">
        <antstructure output="project.dtd"/>
    </target>

</project>
```

Here's part of the DTD, *project.dtd* , generated:

```
<!ELEMENT project (target | %tasks; | %types;)*>
<!ATTLIST project
          name    CDATA #IMPLIED
          default CDATA #IMPLIED
          basedir CDATA #IMPLIED>

<!ELEMENT target (%tasks; | %types;)*>

<!ATTLIST target
          id          ID    #IMPLIED
          name        CDATA #REQUIRED
          if          CDATA #IMPLIED
          unless      CDATA #IMPLIED
          depends     CDATA #IMPLIED
          description CDATA #IMPLIED>

<!ELEMENT patternset (include | patternset | exclude | excludesfile | includesfile)*>
<!ATTLIST patternset
          id ID #IMPLIED
          includes CDATA #IMPLIED
          refid IDREF #IMPLIED
```

```
    description CDATA #IMPLIED
    excludesfile CDATA #IMPLIED
    includesfile CDATA #IMPLIED
    excludes CDATA #IMPLIED>
  .
  .
  .
```

9.4. Transforming XML Using XSLT

The `xslt` task, also called the `style` task (the two names are interchangeable in Ant), can process a set of documents via XSLT. This is handy for building nicely formatted views of XML-based documentation in other formats like HTML, or for generating code. How do you use this task to perform XSLT transformations? Example 9-5 shows a build file that puts it to work, transforming *style.xml* into *style.html*, using *style.xsl*.

Example 9-5. Using the xslt/style task ch09/xslt/build.xml

```
<?xml version="1.0" encoding="UTF-8" ?>

<project default="main" >

    <target name="main">
        <xslt basedir="." destdir="." extension=".html" includes="style.xml"
            style="style.xsl"/>
    </target>

</project>
```

Here's *style.xml*, the XML document to transform, which holds data about three U.S. states:

```
<?xml version="1.0" encoding ="UTF-8"?>
<states>

    <state>
        <name>California</name>
         <population units="people">33871648</population><!--2000 census-->
        <capital>Sacramento</capital>
        <bird>Quail</bird>
        <flower>Golden Poppy</flower>
         <area units="square miles">155959</area>
    </state>

    <state>
        <name>Massachusetts</name>
         <population units="people">6349097</population><!--2000 census-->
        <capital>Boston</capital>
        <bird>Chickadee</bird>
        <flower>Mayflower</flower>
         <area units="square miles">7840</area>
    </state>
```

```
    <state>
        <name>New York</name>
          <population units="people">18976457</population><!--2000 census-->
        <capital>Albany</capital>
        <bird>Bluebird</bird>
        <flower>Rose</flower>
         <area units="square miles">47214</area>
    </state>

</states>
```

In this example, the names of the states are extracted and used to create an HTML document with *style.xsl*:

```
<?xml version="1.0" encoding="UTF-8"?>
<xsl:stylesheet  version="1.0"  xmlns:xsl="http://www.w3.org/1999/XSL/Transform">

    <xsl:template match="states">
        <HTML>
            <BODY>
                <xsl:apply-templates/>
            </BODY>
        </HTML>
    </xsl:template>

    <xsl:template match="state">
        <P>
            <xsl:value-of select="name"/>
        </P>
    </xsl:template>

</xsl:stylesheet>
```

Here's the resulting HTML document:

```
<HTML>
    <BODY>

        <P>California</P>

        <P>Massachusetts</P>

        <P>New York</P>

    </BODY>
</HTML>
```

The attributes of this task appear in Table 9-6.

> If you are using JDK 1.4 or higher, this task doesn't require external libraries. If you're using an earlier JDK, you'll need Xalan from http://xml.apache.org/xalan-j/index.html (or another XSLT processor), and Ant's *optional.jar*.

Table 9-6. The xslt/style task's attributes

Attribute	Description	Required	Default
`basedir`	Specifies the directory to search for the source XML file.	No	`${basedir}`
`classpath`	Specifies the classpath to use when searching for the XSLT processor.	No	
`classpathref`	Specifies the classpath to use, given as a reference.	No	
`defaultexcludes`	Specifies if you want to use default excludes or not. Set to `yes`/`no`.	No	Default excludes are used.
`destdir`	Specifies the directory in which you want to store the results.	Yes, unless `in` and `out` have been specified.	
`excludes`	Specifies the patterns matching files to exclude, as a comma- or space-separated list.	No	
`excludesfile`	Specifies the name of a file where each line is a pattern matching files to exclude.	No	
`extension`	Specifies the file extension to be used for the output files.	No	`".html"`
`force`	Forces creation of the output files.	No	`false`
`in`	Specifies a single XML document to be transformed. This attribute should be used with the `out` attribute.	No	
`includes`	Specifies the patterns matching files to include, as a comma- or space-separated list.	No	
`includesfile`	Specifies the name of a file where each line is a pattern matching files to include.	No	

Attribute	Description	Required	Default
out	Specifies the output name for the transformed result (specified with the in attribute).	No	
processor	Specifies the name of the XSLT processor to use. Possible values: trax for a TraX compliant processor, xslp for the XSL:P processor (note that this value has been deprecated, however), xalan for the Apache XML Xalan processor (Version 1this value has been deprecated), or the name of an arbitrary XSLTLiaison class. The first one found in your class path is the one that is used.	No	Defaults to trax, followed by xalan and then xslp (in that order).
reloadstylesheet	Specifies if the transformer is freshly created for every transformation. Originally introduced to handle a bug in some Xalan-J versions.	No	false
scanincludeddirectories	Specifies you want to transform files found in any directories specified by the include patterns.	No	TRue
style	Specifies the name of the stylesheet to use for the transformation.	Yes	

This task forms an implicit fileset and so supports all attributes of fileset (dir becomes basedir) as well as the nested include, exclude, and patternset elements. You can use nested classpath elements to load the XSLT processor, nested xmlcatalog elements (see Table 9-3) for entity and URI resolution, and attribute elements (see Table 9-4) to specify settings of the processor factory (the attribute names and values are processor specific). The xslt/style task supports the use of nested param elements, whose attributes appear in Table 9-7, to pass values to xsl:param declarations in stylesheets.

Table 9-7. The param element's attributes

Attribute	Description	Required
name	Specifies the name of an XSLT parameter you want set	Yes
expression	Specifies the text value to be stored in the parameter	Yes
if	Specifies you want to pass the parameter only if this property is set	No
unless	Specifies you want to pass the parameter only if this property is not set	No

You can use outputproperty elements, whose attributes appear in Table 9-8, with a TraX processor to specify how the result tree should be output.

Table 9-8. The outputproperty element's attributes

Attribute	Description	Required
name	Specifies the name of the property to set	Yes
value	Specifies the new value of the property	Yes

TraX processors can accept factory elements to specify factory settings. These elements can contain one attribute, name, which specifies the fully qualified classname of the transformer factory to use.

9.5. Using XDoclet

XDoclet is an open source code generation engine designed for use with Ant, and you can pick it up for free at http://xdoclet.sourceforge.net/ . It'll write code for you, especially deployment descriptors, and is often used for Web and EJB development. XDoclet comes with a number of Ant tasks built-in, shown in Table 9-9 .

Table 9-9. The XDoclet Ant tasks

Ant task	Does this
`doclet`	Specifies the base class for all XDoclet Ant tasks
`ejbdoclet`	Specifies which EJB-specific subtasks to execute
`hibernatedoclet`	Specifies which Hibernate subtasks to execute
`jdodoclet`	Specifies which JDO-specific subtasks to execute
`jmxdoclet`	Specifies which JMX-specific subtasks to execute
`mockdoclet`	Generates mock doclet objects
`portletdoclet`	Specifies which portlet-specific subtasks to execute
`webdoclet`	Specifies which Web-specific subtasks to execute

XDoclet lets you generate code and deployment descriptors by embedding tags in your code, much like tags you'd use for Javadoc. There are entire books written about XDoclet because it's an extensive tool. Though there's not room for that level of coverage herethis is a book about Ant, not XDocletI'll take a lo at several examples creating Web and EJB applications here, giving the XDoclet story from Ant's point o view.

9.5.1. Developing Applications

You use the XDoclet `webdoclet` task to develop Web applications. The attributes of this task appear in Ta 9-10 , and the possible nested elements in Table 9-11.

Table 9-10. The webdoclet Ant tasks

Attribute	Description	Required
`addedTags`	Specifies you want to add JavaDoc tags to the generated classes	No

Attribute	Description	Required
destDir	Specifies the destination directory for the generated output	If destDir is not specified by a subtask.
excludedTags	Specifies tags that should not be automatically written to output files	No
force	Specifies you want generation of files to be forced	No
mergeDir	Specifies the directory where subtasks will look for files that they should merged with their generated files	No, but should be set if you want to use the merge feature.
verbose	Specifies you want verbose feedback	No

Table 9-11. The webdoclet Ant task's nested elements

Element	Description
configParam	Specifies configuration parameters you want to use
deploymentdescriptor	Specifies you want to generate a *web.xml* deployment descriptor
fileset	Specifies a fileset to indicate the files to parse
jbosswebxml	Specifies you want to generate a *jboss-web.xml* deployment descriptor
jonaswebxml	Specifies you want to generate a web application deployment descriptor for JOnAS
jrunwebxml	Specifies you want to generate a *jrun-web.xml* deployment descriptor
jsptaglib	Specifies you want to generate a *taglib.tld* deployment descriptor for JSP taglibs
packageSubstitution	Substitutes a new package for the package in generated files
resin-web-xml	Specifies you want to generate *web.xml* with Resin extensions
strutsconfigxml	Specifies you want to generate a *struts-config.xml* deployment descriptor
strutsvalidationxml	Specifies you want to generate a Struts Validator *validation.xml* deployment descriptor
subTask	Specifies a subtask for this task
weblogicwebxml	Specifies you want to generate a *weblogic.xml* deployment descriptor for We applications
webspherewebxml	Specifies you want to generate WebSphere specific deployment descriptors
webworkactiondocs	Specifies you want to generate HTML files containing descriptions of WebWo actions

Element	Description
webworkactionsxml	Specifies you want to generate an *actions.xml* file
webworkconfigproperties	Specifies you want to generate a *views.properties* file

You use tags prefixed with an @ to tell XDoclet what you want it to do. In Example 9-6, in this servlet's code, *ServletApp.java* , I'm telling Ant how to set up the deployment descriptor, *web.xml* .

Example 9-6. The servlet's code ch09/servlet/ServletApp.java

```
package app.web;

import java.io.*;
import javax.servlet.*;
import javax.servlet.http.*;

/**
 * @web.servlet
 *     display-name="Servlet App"
 *      load-on-startup="1"
 *     name="ServletApp"
 *
 * @web.servlet-init-param
 *     name="param1"
 *     value="value1"
 *
 * @web.servlet-init-param
 *     name="param2"
 *     value="value2"
 *
 * @web.servlet-mapping
 *     url-pattern="/app/*"
 *
 * @author Steve
 */

public class ServletApp extends HttpServlet
{
    public void doPost(HttpServletRequest request, HttpServletResponse response)
            throws IOException, ServletException
    {
        response.getWriter( ).println("No worries.");
    }
}
```

To use webdoclet from Ant, you have to use a taskdef task this way to set up the webdoclet task (See Chapter 12):

```
        <taskdef
            name="webdoclet"
            classname="xdoclet.modules.web.WebDocletTask"
            classpathref="app.class.path"/>
```

To create *web.xml* for this servlet, you use a `deploymentdescriptor` element inside the `webdoclet` elemen

```
            <deploymentdescriptor
                servletspec="2.3"
                destdir="${app.web-inf.dir}"/>
```

The complete build file appears in Example 9-7 . It compiles the code, creates *web.xml* , and is designed be used from a directory named *build* right under the XDoclet directory (*xdoclet-1.2.1* is the current version as of this writing), while the servlet's code is stored in the directory*build/src/java/app/web* .

Example 9-7. The servlet's build file ch09/servlet/build.xml

```
<?xml version="1.0"?>

<project default="main" basedir=".">

    <property name="lib.dir" value="../lib"/>
    <property name="app.dir" value="."/>
    <property name="app.dist.dir" value="${app.dir}/output"/>
    <property name="app.src.dir" value="${app.dir}/src"/>
    <property name="app.java.dir" value="${app.src.dir}/java"/>
    <property name="app.generated-src.dir" value="${app.dist.dir}/generated-src"/>
    <property name="app.web-inf.dir" value="${app.dist.dir}/web-inf"/>
    <property name="app.classes.dir" value="${app.dist.dir}/classes"/>
    <property name="app.xdoclet.force" value="false"/>

    <path id="app.class.path">
        <fileset dir="${lib.dir}">
            <include name="*.jar"/>
        </fileset>
    </path>

    <target name="init">
        <tstamp>
            <format property="TODAY" pattern="d-MM-yy"/>
        </tstamp>

        <taskdef
            name="webdoclet"
            classname="xdoclet.modules.web.WebDocletTask"
            classpathref="app.class.path"/>

        <mkdir dir="${app.classes.dir}"/>
        <mkdir dir="${app.generated-src.dir}"/>
```

```
    </target>

    <target name="webdoclet" depends="init">

        <webdoclet
            destdir="${app.generated-src.dir}"
            excludedtags="@version,@author,@todo"
            force="${app.xdoclet.force}"
            verbose="false">

            <fileset dir="${app.java.dir}">
                <include name="**/Servlet*.java"/>
            </fileset>

            <deploymentdescriptor
                servletspec="2.3"
                destdir="${app.web-inf.dir}"/>

        </webdoclet>
    </target>

    <target name="compile" depends="webdoclet">

        <javac
            destdir="${app.classes.dir}"
            classpathref="app.class.path"
            debug="on"
            deprecation="on"
            optimize="off">

            <src path="${app.java.dir}"/>
            <src path="${app.generated-src.dir}"/>

        </javac>

    </target>

    <target name="main" depends="compile">
        <echo>Using XDoclet....</echo>
    </target>

</project>
```

When you run this build file, it'll create a complete*web.xml* for this servlet; here is the crucial part:

```
<servlet>
   <servlet-name>ServletApp</servlet-name>
   <display-name>Servlet App</display-name>
  <servlet-class>app.web.ServletApp</servlet-class>

   <init-param>
```

```
            <param-name>param1</param-name>
            <param-value>value1</param-value>
        </init-param>
        <init-param>
            <param-name>param2</param-name>
            <param-value>value2</param-value>
        </init-param>

         <load-on-startup>1</load-on-startup>

    </servlet>

    <servlet-mapping>
        <servlet-name>ServletApp</servlet-name>
        <url-pattern>/app/*</url-pattern>
    </servlet-mapping>
```

In this way, XDoclet can write deployment descriptors for you if you remember to put all needed information in your source code files using XDoclet tags.

9.5.2. Working with EJB Containers

This XDoclet Ant task executes EJB-specific sub-tasks to support EJB development. You can see the attributes of this task in Table 9-12 . The legal nested elements appear in Table 9-13.

Table 9-12. The ejbdoclet Ant task's attributes

Attribute	Description	Required	Default
addedTags	Specifies you want to add JavaDoc tags to the generated classes.	No	
destDir	Specifies the destination directory to use for output files.	If destDir is not specified for a subtask.	
ejbClassNameSuffix	Specifies suffixes that should be removed from the bean classname. A comma-separated list.	No	"Bean , EJE , Ejb "
ejbSpec	Specifies the version of EJB specification ejbdoclet should use. Possible values: 1.1 and 2.0.	No. Default is 2.0 .	
excludedTags	Specifies tags that should not be written to output files.	No	
force	Specifies whether you want to force the the generation of files if needed.	No	

Attribute	Description	Required	Default
mergeDir	Specifies the directory where subtasks will look for files that they should merge with their generated files.	No, but should be set if you use the merge feature.	
verbose	Specifies you want verbose feedback.	No	

Table 9-13. The ejbdoclet Ant task's nested elements

Element	Description
apachesoap	Provides support for Apache SOAP subtasks
axisdeploy	Provides support for axis deployment
axisundeploy	Provides support for axis undeployment
borland	Provides support for Borland code
castormapping	Specifies you want to generate a mapping.xml deployment descriptor
configParam	Specifies configuration parameters that will be included as an attribute/value pa
dao	Provides support for DAO
dataobject	Provides support for data objects for Entity EJBs.
deploymentdescriptor	Creates a deployment descriptor
easerver	Provides support for configuration files for EJB JAR files in EAServer 4.1+
entitybmp	Creates entity bean classes for BMP entity EJBs
entitycmp	Creates CMP layer code
entityfacade	Provides support for entity facades
entitypk	Creates primary key classes for entity EJBs
fileset	Specifies a fileset of files to parse
homeinterface	Provides support for remote home interfaces for EJBs
hpas	Provides support for an *hp-ejb-jar.xml* deployment descriptor for HPAS
jboss	Provides support for *jboss.xml* , *jaws.xml* , and/or *jbosscmp-jdbc.xml* deployment descriptors for JBoss
jonas	Provides support for the deployment descriptor for JOnAS
jrun	Provides support for jrun.
localhomeinterface	Generates local home interfaces for EJBs

Element	Description
localinterface	Generates local interfaces for EJBs
mvcsoft	Generates MVCSoft's XML
oc4j	Generates OC4J specific deployment descriptor (*orion-ejb-jar.xml*)
openejb	Provides support for *openejb-jar.xml* deployment descriptors for OpenEJB
orion	Provides support for Orion's *orion-ejb-jar.xml*
packageSubstitution	Specifies you want to substitute a new package for the package in generated files
pramati	Provides support for Pramati deployment files
remotefacade	Provides support for stage 2 of remote facade generation
remoteinterface	Provides support for remote interfaces for EJBs
resin-ejb-xml	Provides support for Resin
session	Provides support for sessions
strutsform	Provides support for a Struts ActionForm , based on an entity EJB
subTask	Specifies a subtask for this task
sunone	Provides support for configuration files for EJB jars in iPlanet/SunONE
utilobject	Provides support for util objects
valueobject	Provides support for value objects for Entity EJBs
weblogic	Generates deployment descriptors for WLS 6.0, 6.1, and 7.0
websphere	Generates EJB-related files from one or a set of EJB bean source files that uses custom EJBDoclet JavaDoc tags

The source code for an EJB, *Appbean.java* , appears in Example 9-8 and shows how the ejbdoclet task works. The embedded XDoclet tags hold data for the ejbdoclet task, which will create a deployment descriptor and write code.

Example 9-8. The EJB bean ch09/ejb/Appbean.java

```
package app.web;

import javax.ejb.*;

/**
 *
 * @ejb.bean name="App"
 *    description="App example bean"
 *    jndi-name="ejb/App"
 *    type="Stateless"
```

```
 *
 * @ejb.security-role-ref role-link="Administrator"
 *    role-name="admin"
 *
 * @ejb.permission   role-name="App"
 * @ejb.permission   role-name="Administrator"
 *
 * @ejb.transaction  type="Required"
 * @ejb.transaction-type type="Container"
 *
 * @author Steven
 */

public abstract class AppBean implements SessionBean
{
    /**
     * Add and return values.
     *
     * @ejb.interface-method view-type="remote"
     */
    public double adder(int x, int y)
    {
        return x + y;
    }

    public void ejbActivate( )
    {
    }

    public void ejbPassivate( )
    {
    }

    public void setSessionContext(SessionContext ctx)
    {
    }

    /**
     * Remove
     *
     * @ejb.transaction
     *    type="Mandatory"
     */
    public void ejbRemove( )
    {
    }
}
```

In the build file, you use `taskdef` to tell Ant about the `ejbdoclet` task:

```
        <taskdef
```

```
        name="ejbdoclet"
        classname="xdoclet.modules.ejb.EjbDocletTask"
        classpathref="app.class.path"/>
```

> Include the *.jar* file containing Sun's `javax.ejb.*` classes on the `taskdef` task's classpath when creating the `ejbdoclet` task in a build file.

You can create a deployment descriptor, *ejb-jar.xml* , with the `deploymentdescriptor` element:

```
<deploymentdescriptor
    destdir="${app.meta-inf.dir}"
    description="ejbbean"/>
```

The entire build file appears in Example 9-9 . This file is designed to be run from a directory named `ejbbuild` right under the XDoclet unzip directory with the servlet's code in the directory *build/src/java/app/web* .

Example 9-9. The EJB bean build file ch09/ejb/build.xml

```
<?xml version="1.0" ?>

<project default="main" basedir=".">

    <property name="lib.dir" value="../lib"/>
    <property name="app.dist.dir" value="output"/>
    <property name="app.src.dir" value="src"/>
    <property name="app.java.dir" value="${app.src.dir}/java"/>
    <property name="app.generated-src.dir" value="${app.dist.dir}/generated-src"/>
    <property name="app.web-inf.dir" value="${app.dist.dir}/web-inf"/>
    <property name="app.classes.dir" value="${app.dist.dir}/classes"/>
    <property name="app.lib.dir" value="lib"/>
    <property name="app.meta-inf.dir" value="meta-inf"/>
    <property name="app.xdoclet.force" value="false"/>

    <path id="app.class.path">
        <fileset dir="${lib.dir}">
            <include name="*.jar"/>
        </fileset>
        <fileset dir="${app.lib.dir}">
            <include name="*.jar"/>
        </fileset>
    </path>

    <target name="init">
        <tstamp>
            <format property="TODAY" pattern="d-MM-yy"/>
```

```
        </tstamp>

        <taskdef
            name="ejbdoclet"
            classname="xdoclet.modules.ejb.EjbDocletTask"
            classpathref="app.class.path"/>

        <mkdir dir="${app.classes.dir}"/>
        <mkdir dir="${app.generated-src.dir}"/>
        <mkdir dir="${app.meta-inf.dir}" />
    </target>

    <target name="ejbdoclet" depends="init">

        <ejbdoclet
            destdir="${app.generated-src.dir}"
            mergedir="parent-fake-to-debug"
            excludedtags="@version,@author,@todo"
            ejbspec="2.0"
            force="${app.xdoclet.force}"
            verbose="false">

            <fileset dir="src/java">
                <include name="**/*.java"/>
            </fileset>

            <remoteinterface/>
            <localinterface/>
            <homeinterface/>
            <localhomeinterface/>

            <entitycmp/>
            <entitybmp/>

            <session/>

            <deploymentdescriptor
                destdir="${app.meta-inf.dir}"
                description="ejbbean"/>

        </ejbdoclet>
    </target>

    <target name="compile" depends="ejbdoclet">

        <javac
            destdir="${app.classes.dir}"
            classpathref="app.class.path"
            debug="on"
            deprecation="on"
            optimize="off">
```

```
            <src path="${app.java.dir}"/>
            <src path="${app.generated-src.dir}"/>
        </javac>

    </target>

    <target name="main" depends="compile">
        <echo>Using EJBDoclet....</echo>
    </target>

</project>
```

Running this build file creates EJB interface code and a deployment descriptor, *ejb-jar.xml* . Here is the relevant part of the generated *ejb-jar.xml* :

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE ejb-jar PUBLIC "-//Sun Microsystems, Inc.//DTD Enterprise JavaBeans 2.0//EN"
"http://java.sun.com/dtd/ejb-jar_2_0.dtd">

<ejb-jar >

   <description><![CDATA[ejbbean]]></description>
   <display-name>Generated by XDoclet</display-name>

   <enterprise-beans>

      <!-- Session Beans -->
      <session >
         <description><![CDATA[App example bean]]></description>

         <ejb-name>App</ejb-name>

         <home>app.web.AppHome</home>
         <remote>app.web.App</remote>
         <local-home>app.web.AppLocalHome</local-home>
         <local>app.web.AppLocal</local>
         <ejb-class>app.web.AppSession</ejb-class>
         <session-type>Stateless</session-type>
         <transaction-type>Container</transaction-type>

         <security-role-ref>
            <role-name>admin</role-name>
            <role-link>Administrator</role-link>
         </security-role-ref>

      </session>
        .
        .
        .
   <!-- Assembly Descriptor -->
   <assembly-descriptor >
```

```
  <!--
    To add additional assembly descriptor info here, add a file to your
    XDoclet merge directory called assembly-descriptor.xml that contains
    the <assembly-descriptor></assembly-descriptor> markup.
  -->
   <security-role>
      <role-name>App</role-name>
   </security-role>
   <security-role>
      <role-name>Administrator</role-name>
   </security-role>

   <method-permission >
      <role-name>App</role-name>
      <role-name>Administrator</role-name>
      <method >
         <ejb-name>App</ejb-name>
         <method-name>*</method-name>
      </method>
   </method-permission>
     .
     .
     .
<!-- transactions -->
<container-transaction >
   <method >
      <ejb-name>App</ejb-name>
       <method-name>*</method-name>
    </method>
    <trans-attribute>Required</trans-attribute>
 </container-transaction>
<container-transaction >
   <method >
      <ejb-name>App</ejb-name>
      <method-intf>LocalHome</method-intf>
      <method-name>remove</method-name>
      <method-params>
      </method-params>
   </method>
   <trans-attribute>Mandatory</trans-attribute>
</container-transaction>
<container-transaction >
   <method >
      <ejb-name>App</ejb-name>
      <method-intf>Home</method-intf>
      <method-name>remove</method-name>
      <method-params>
      </method-params>
   </method>
   <trans-attribute>Mandatory</trans-attribute>
</container-transaction>
     .
```

```
        .
        .
</ejb-jar>
```

XDoclet is a powerful tool that's still developing. Currently, you can only run it in Ant, but a command-li
tool is in the works. Once you get the hang of it, XDoclet helps with Web and EJB application developme
in a way that makes sense; when you modify your code, you modify the deployment descriptors and the
EJB code you generate at the same time. It's a tool worth watching.

9.6. Developing Enterprise JavaBeans

Ant provides a number of optional tasks for developing EJBs. Generally, these tasks are specific to the particular vendor's EJB Server. Currently, these tasks support these servers:

- Borland Application Server 4.5
- IBM WebSphere 4.0
- iPlanet Application Server 6.0
- JBoss 2.1 and above EJB servers
- JOnAS 2.4.x and 2.5 Open Source EJB server
- Weblogic 4.5.1 through to 7.0 EJB servers

The Ant EJB tasks and the servers they target appear in Table 9-14.

Table 9-14. The Ant EJB tasks

Task	Does this	Application servers
`blgenclient`	Specifies you want to create a client *.jar* file corresponding to an EJB *.jar* file	Borland Application Server 4.5 and 5.x
`ddcreator`	Specifies you want to compile Weblogic text-based deployment descriptors into an EJB deployment descriptor	Weblogic 4.5.1
`ejbc`	Lets you run Weblogic's ejbc tool	Weblogic 4.5.1
`ejbjar`	Supports creation of EJB *.jar* files (EJB 1.1 & 2.0)	Borland Application Server 4.5 and 5.x, iPlanet Application Server 6.0, JBoss, JOnAS 2.4.x and 2.5, Weblogic 5.1 to 7.0, and IBM WebSphere 4.0
`iplanet-ejbc`	Supports compilation of EJB stubs and skeletons for iPlanet Application Server 6.0	iPlanet Application Server 6.0
`wlrun`	Lets you start a Weblogic server	Weblogic 4.5.1 to 7.0
`wlstop`	Lets you stop a Weblogic server	Weblogic 4.5.1 to 7.0

9.6.1. JARing Files

The largest and most general of the EJB tasks is the `ejbjar` task. This task works by scanning directories; for each deployment descriptor found, `ejbjar` will parse it to determine the necessary *.class* files which implement the bean. These files are assembled along with the deployment descriptors into a well-formed EJB *.jar* file. (Any support files which should be included in the created *.jar* file can be added with the `support` nested element.) For each class included in the *.jar* file, `ejbjar` will scan for any super classes or super interfaces, which will be added to the generated *.jar* file. The attributes of this task appear in Table 9-15.

Table 9-15. The Ant ejbjar task's attribute

Attribute	Description	Required	Default
`basejarname`	Specifies the base name you want used for the generated .jar files.	No	
`classpath`	Specifies the classpath you wnt used when resolving classes that are to be added to the .jar.	No	
`cmpversion`	Specifies the CMP version. Possible values are `1.0` or `2.0`.	No	`1.0`
`dependency`	Specifies which classes and interfaces are added to the .jar.	No	
`descriptordir`	Specifies the directory under which the task shoulc scan for EJB deployment descriptors.	No	
`destdir`	Specifies the directory into which you want generated JAR files to be placed.	Yes, unless you use vendor-specific deployment elements.	
`flatdestdir`	Specifies you want to store all generated JARs in the root of the `destdir`, rather than the location specified by the deployment descriptor. Set to true/false.	No	
`genericjarsuffix`	Specifies a string that you want appended to the deployment descriptor in order to create the filename of a generic EJB JAR file.	No	`-generic.jar`
`naming`	Specifies the naming convention you want to use to name generated EJB jars.	No	

Attribute	Description	Required	Default
`srcdir`	Specifies the base directory containing the .class files that make up the generated bean.	Yes	

You can nest `classpath` elements to set the classpath in the `ejbjar` task, and you can use nested `dtd` elements to specify the local location of DTDs to be used when parsing the EJB deployment descripto (see Table 9-2 for the `dtd` element's attributes).

You can use nested `support` elements to specify additional *.class* files to be included in the generated *.jar* files. The `support` element is a fileset, so it can reference a fileset declared elsewhere or it can be defined with the appropriate `include` and `exclude` nested elements. The `ejbjar` task supports vendor-specific nested elements, which let you use the vendors' deployment tools.

Vendor-specific nested elements provide support for various vendor deployment tools. (If no nested vendor-specific deployment elements are present, the task will create a generic EJB *.jar* file.) For each nested deployment element, the vendor-specific deployment tool is run to generate a *.jar* file for deployment to that vendor's EJB server. Here are the legal vendor-specific nested elements:

`borland`

: For Borland Application Server 4.5 and 5.x

`iPlanet`

: For iPlanet Application Server 6.0

`jboss`

: For JBoss

`jonas`

: For JOnAS 2.4.x and 2.5

`weblogic`

: For Weblogic 5.1 to 7.0

`websphere`

For IBM WebSphere 4.0

These vendor-specific elements can become involved. For example, the attributes of the `weblogic` element, used to control the `weblogic.ejbc` compiler for generating Weblogic EJB *.jar* files, appear in Table 9-16.

Table 9-16. The weblogic element's attribute

Attribute	Description	Required	Default
`args`	Specifies any additional arguments you want to pass to the `weblogic.ejbc` tool.	No	
`classpath`	Specifies the classpath that should be used when the task runs the `weblogic.ejbc` tool.	No	
`compiler`	Specifies a different compiler to be used for compiling the generated Java files.	No	
`destdir`	Specifies the directory where the generated JAR files should be stored.	Yes	
`ejbcclass`	Specifies the classname of the ejbc compiler. When used with Version 7, this attribute should be set to "weblogic.ejbc" to avoid a deprecation warning.	No	
`genericjarsuffix`	Specifies the suffix used for the generic JAR file. This JAR file is generated as an intermediate step in building the weblogic deployment JAR.	No	`-generic.jar`
`jvmargs`	Specifies any additional arguments you want passed to the JVM running the `weblogic.ejbc` tool.	No	
`jvmdebuglevel`	Specifies the debug level for messages. Set to 16 to avoid warnings about EJB Home and Remotes in the classpath.	No	
`keepgenerated`	Specifies if Weblogic will preserve the Java files it generates.	No	`false`
`keepgeneric`	Specifies if you want the generic file used for input to ejbc to be preserved.	No	`false`
`newCMP`	Specifies ejbjar should parse the Weblogic deployment descriptor to find the CMP descriptors. Set to true/false.	No	`false`
`noEJBC`	Specifies you don't want Weblogic's ejbc to be run on the EJB .jar file.	No	
`outputdir`	Specifies this directory as the output directory instead of a .jar file.	No	

Attribute	Description	Required	Default
rebuild	Specifies if weblogic.ejbc should always be used to build the .jar file.	No	TRue
suffix	Specifies the string that should be added to the deployment descriptor to create the WebLogic JAR filename.	No	.jar
wlclasspath	Specifies the classpath for the Weblogic classes to avoid a warning when the home and remote interfaces of a bean are on the classpath used by weblogic.ejbc.	No	

The weblogic nested element supports nested classpath and wlclasspath nested elementsthe wlclasspath element holds the classpath used by the Weblogic Server as detailed by thewlclasspath attribute in Table 9-16, and it takes the same attributes and nested elements asclasspath. The weblogic element supports nested sysproperty elements to allow Java system properties to be set.

Investigating them all would take us many pages deep into the mechanics of these six EJB servers, and far from Ant. If you're interested, you can find the details for using various vendor-specific tools in the Ant EJB Tasks User Manual at ${ant-home}/docs/manual/OptionalTasks/ejb.html.

Chapter 10. Optional Tasks

A significant number of optional tasks come with Antthe full list appears inTable 1-5and you'll see several of them in this chapter. Some of the optional tasks are specialized, but a number are useful in everyday builds. You've seen optional tasks like`junit` and `ftp`, and this chapter expands that coverage with a look at tasks like `sound`, `splash`, `replaceregexp`, and `depend`.

10.1. Using Sound

The `sound` task plays a sound-file at the end of the build according to whether the build failed or succeeded. You can specify one sound file to play, or if you specify a directory, the `sound` task will randomly select a sound file to play.

> If you're using Java 1.3 or later, you need the Java Media Framework on the classpath (javax.sound).

The sound task can contain `success` and `fail` elements. The `success` element specifies the sound you want played if the build succeeds and `failures` the sound if it fails. Here's an example where the build file specifies the sounds to play depending on if the build succeeded or failed:

```
<target name="sounds">
    <sound>
        <success source="${user.home}/sounds/success.wav"/>
        <fail source="${user.home}/sounds/noway.wav"/>
    </sound>
</target>
```

These `success` and `failure` elements support the attributes you see in Table 10-1.

Table 10-1. The success and fail elements' attributes

Attribute	Description	Required	Default
`source`	Specifies the name of a sound file	Yes	
`loops`	Specifies the number of times to play the sound file	No	`0`
`duration`	Specifies the time (measured in milliseconds) you want to play the sound file	No	

10.2. Creating Splash Screens

This task creates a splash screen displayed while the build is progressing. In Example 10-1, I'm using a splash screen that the Apache Jakarta Project makes available at http://jakarta.apache.org/images/jakarta-logo.gif, and I'm displaying it for five seconds.

Example 10-1. Using a splash screen (ch10/splash/build.xml)

```
<?xml version="1.0"?>

<project default="main" basedir=".">

    <property name="cvs.dir" value="project" />

    <target name="main" depends="splash">
        <echo>
            Checking out and updating....
        </echo>
    </target>

    <target name="splash">
        <splash imageurl="http://jakarta.apache.org/images/jakarta-logo.gif"
        showduration="5000"/>
    </target>

</project>
```

You can see the Apache Jakarta logo that appears when this task executes in Figure 10-1. This task provides a nice touch if you're distributing your build files to a team.

Figure 10-1. Sample build splash logo

The attributes of this task appear in Table 10-2.

Table 10-2. The splash attributes

Attribute	Description	Required	Default
`imageurl`	Specifies an URL that points to the image you want the splash screen to display.	No	`antlogo.gif` from the classpath
`showduration`	Sets the length of time the splash screen should be visible. Set to a value in milliseconds.	No	`5000`

> If you need to retrieve an image from behind a firewall, use the Ant `setproxy` task.

10.3. Subtituting Text Using Regular Expressions

The `replaceregexp` task can replace every occurrence of a given regular expression with a substitution pattern in a selected file or set of files.

> The output file is written only if it differs from the existing file.

Example 10-2 uses `replaceregexp`, where text in the XML comment in the build file matching "Here's a comment." is converted to "Here's an XML comment."

Example 10-2. Using regular expression substitutions (ch10/regexp/build.xml)

```
<?xml version="1.0"?>

<project default="main" basedir=".">

<!--Here's a comment.-->

    <target name="main">
        <replaceregexp
            match="a comment"
            replace="an XML comment">
            <fileset dir="." includes="**/*.xml" />
        </replaceregexp>
    </target>

</project>
```

Here's what the build file looks like after you run it:

```
<?xml version="1.0"?>

<project default="main" basedir=".">

<!--Here's an XML comment.-->

    <target name="main">
        <replaceregexp
            match="a comment"
```

```
            replace="an XML comment">
            <fileset dir="." includes="**/*.xml" />
        </replaceregexp>
    </target>

</project>
```

Changing the contents of other files this way will be useful if you need to rewrite build files that you're about to call with the `ant` task. Here's an example of editing build files to convert from a local to an FTP install:

```
<?xml version="1.0"?>

<project default="main" basedir=".">

    <target name="main">
        <replaceregexp
            match="<copy file='Project.jar' todir='dist'/>"
            replace="<ftp server='ftp.isp.com'><fileset dir='bin'/></ftp>"
            <fileset dir="subproject" includes="**/*.xml" />
        </replaceregexp>
    </target>

    <ant dir="subproject"/>

</project>
```

> Unless it's unavoidable, editing build files this way is not good programming practice. It's better to pass parameters along with the `ant` call.

Here's another example, this time of replacing all whitespace in documentation files with spaces:

```
<replaceregexp match="\s+" replace=" " flags="g">
    <fileset dir="docs" includes="**/*.html" />
</replaceregexp>
```

The attributes of this task appear in Table 10-3.

> Support exists for the regular expression library built into Java 1.4; you should have *jakarta-oro.jar* in the Ant *lib* directory.

Table 10-3. The replaceregexp attributes

Attribute	Description	Required	Default
`byline`	Specifies you want to process the file(s) one line at a time, executing the replacement on one line at a time.	No	`false`
`encoding`	Specifies the encoding of the file you're using. Available since Ant 1.6.	No	The default JVM encoding.
`file`	Specifies the file in which text matching the regular expression should be replaced.	Yes, if no nested `fileset` is used.	
`flags`	Specifies flags to use when matching the regular expression. For example, "g" means global replacement, "i" means case insensitive, and so on.	No	
`match`	Specifies the regular expression pattern you want to use to match text in the source file(s).	Yes, if no nested `regexp` is used.	
`replace`	Specifies the text to replace matched text with.	Yes, if no nested `substitution` is used.	

This task supports a nested `fileset` element. You can use a nested `regexp` element to specify the regular expression this way:

```
<regexp id="id" pattern="\s+"/>
<regexp refid="id"/>
```

The `replaceregexp` task supports a nested `substitution` element to specify the substitution pattern; here are some examples:

```
<substitution  id="id"  expression="beta\1alpha"/>
<substitution refid="id"/>
```

Team LiB

10.4. Handling Dependencies

The `javac` task does a good job of handling dependencies, but it's limited because it only compiles *.java* files if the corresponding *.class* file is older or does not exist. It doesn't check the files those *.java* files might depend on, such as parent or imported classes. The `depend` task, however, lets you perform this kind of dependency checking.

When this task finds out-of-date classes, it removes the *.class* files of any other classes that depend on them. To determine dependencies, this task analyzes the classes in all files passed to it, using the class references encoded into *.class* files by the compiler. (It does not parse or read source code.)

You typically use the `depend` task before compiling. Here's an example that uses `depend` before calling `javac`:

```
<?xml version="1.0" ?>
<project default="main">

    <property name="message" value="Building..." />
    <property name="src" location="source" />
    <property name="output" location="bin" />

    <target name="main" depends="init, compile, compress">
        <echo>
            ${message}
        </echo>
    </target>

    <target name="init">
        <mkdir dir="${output}" />
    </target>

    <target name="compile">
        <depend srcdir="${src}"
            destdir="${output}"
            closure="yes"/>
        <javac srcdir="${src}" destdir="${output}" />
    </target>

  <target name="compress">
        <jar destfile="${output}/Project.jar" basedir="${output}"
            includes="*.class" />
  </target>
</project>
```

The attributes of this task appear in Table 10-4.

> If you don't want to have to check dependencies, you can wipe all the directories that contain compiled code and rebuild from scratch. When there are a large number of files to compile, that's a less attractive option, and using the `depend` task can save significant time. (But experience shows that if your dependencies are complex, it can save time to do a wipe and start fresh.)

Table 10-4. The depend attributes

Attribute	Description	Required	Default
`cache`	Specifies the directory where you want the task to store dependency data	No	
`classpath`	Specifies the classpath, which should also be checked when checking dependencies	No	
`closure`	Specifies the task should traverse all class dependencies, deleting all classes that depend on out-of-date material	No	`false`
`destdir`	Specifies the root directory containing the class files that you want to check	No	The value of `srcdir`
`dump`	Specifies the dependency information should be sent to the debug log	No	
`srcdir`	Specifies the directory where the source is	Yes	

Like many other Ant tasks, this task forms an implicit FileSet and so supports all attributes of `fileset` (though `dir` becomes `srcdir`) as well as the nested `include`, `exclude`, and `patternset` elements. The `depend` task's classpath attribute is a path-like structure and can also be set using a nested `classpath` element. If you specify a classpath, `depend` will include classes and JARs on the classpath for dependency checking; any classes which depend on an item from the classpath and which are older than that item will be deleted.

> If you're going to include a classpath to check for dependencies, don't end up including the entire Java library structure by mistake; doing so will slow this task down.

Checking dependencies can become involved. For example, what if a class depends on another, which in turn depends on a third? If the third class is out of date, only the second class would normally be rebuilt, even if you use the `depend` task. But you can ensure the `depend` task catches *all* dependencies, including indirect ones like this, by setting the `closure` attribute to true.

> Nonpublic classes can also cause a couple of problems with this task. For example, depend cannot connect the class file containing a non-public class to a source file. depend can't detect when a nonpublic class is missing. If you've set the Java compiler to optimize its compilation, that can also cause problems. Inner classes, on the other hand, are no problem.

Normal Ant processing usually handles dependencies with no problem, but if you've got a complex dependency situation, or indirect dependencies, this task can work wonders. If you can't handle your dependencies with depend, wipe the output directories before compiling to start with a clean slate.

Chapter 11. Integrating Ant with Eclipse

Ant is the premiere build tool for Java developers, and Eclipse is the premiere integrated developmen environment (IDE) for Java programmers. Eclipse is great at visual development, and Ant is great fo builds. For that reason, the latest Eclipse version (3.0) comes with Ant 1.6.1 (the version of Ant this book was written with), and there's an extensive Ant interface in Eclipse.

> Doesn't Ant have its own IDE? Well, sort of. Antidote, started in 2000, was supposed to have been the Ant IDE; see http://ant.apache.org/projects/antidote/index.html. Unfortunately, that project appears to be more or less moribund, largely because the big guys behind Eclipse have been integrating Ant into their IDE now.

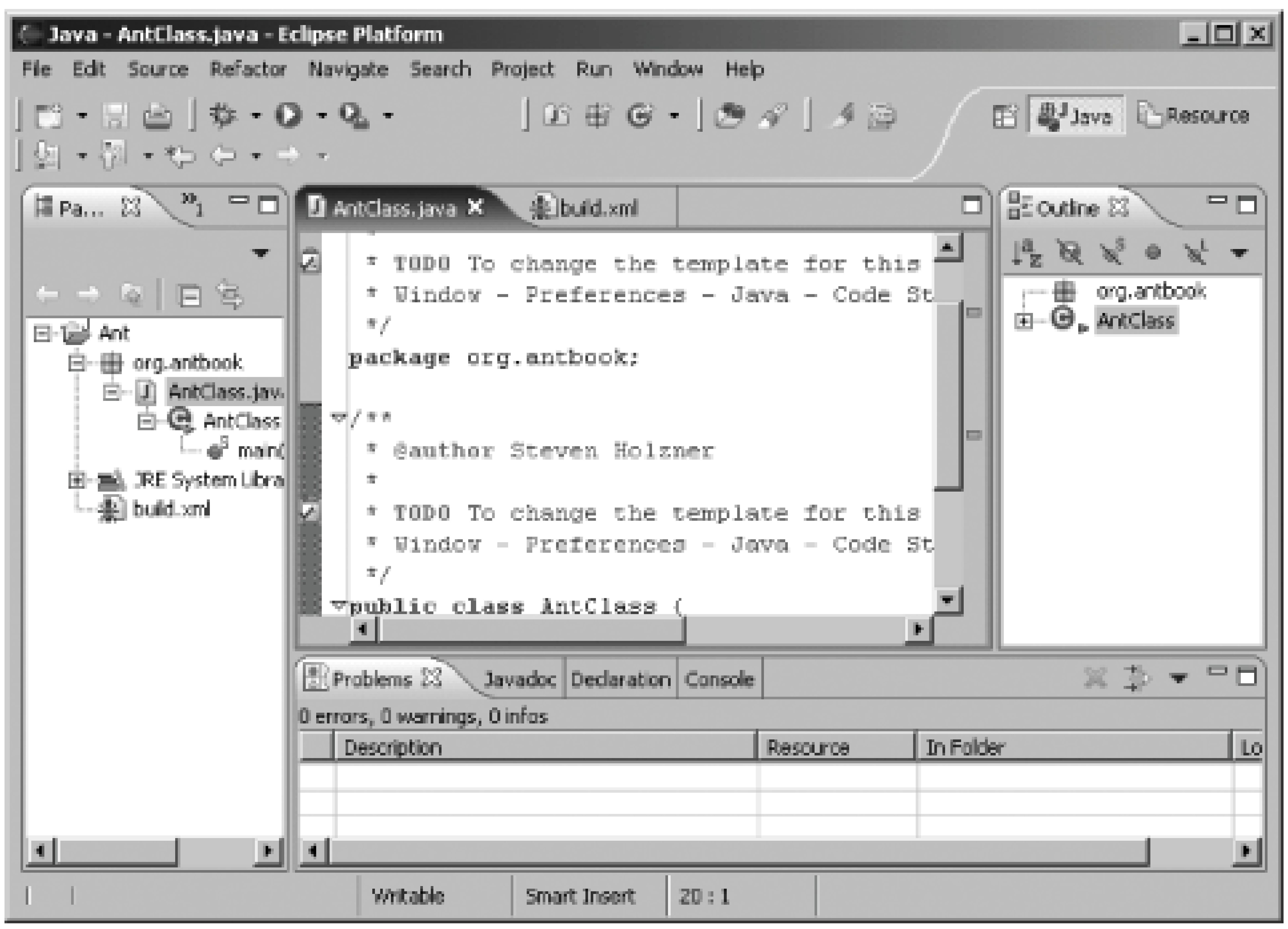
Team LiB

11.1. Introducing Eclipse

If you're a Java developer, you know how finicky Java can feel at times. Missed`import` statements, forgotten variable declarations, omitted semi-colons, garbled syntax, and typos will cause the Java command-line compiler, `javac`, to cough and display pages of error messages.

The error messages tell you that `javac` knows what the error is, so why doesn't it just fix the problem and let you continue developing? `javac` can't fix the problem; to do that, you can use an IDE, which will catch errors before you compile and suggest solutions. Java is badly in need of a good IDE, and the premiere Java IDE these days is Eclipse. You can see what it looks like in[Figure 11-1].

Figure 11-1. Eclipse



Eclipse is free for the downloading, like a number of other Java IDEs, but Eclipse has a serious advantage behind it, which is the power of IBM, reportedly spending $40 million developing it. It's nc an open source project, largely under IBM's development but part of a software consortium named `eclipse.org`.

Want to read more on Eclipse? See *Eclipse* by yours truly (O'Reilly).

11.1.1. Getting Eclipse

Eclipse is free for the downloading; all you have to do is navigate to http://www.eclipse.org/downloads. Select one of the download mirrors available on that page. When you do, you'll be presented with a list of the available downloads of these various types:

Release builds

These versions are for general use.

Stable builds

These are comparable to beta versions.

Integration builds

These builds are made up of components that have been fairly well tested, but their operation together may still have some issues.

Nightly builds

These are the most experimental of all publicly available Eclipse builds. They're created nightly by the Eclipse team, and there's really no guarantee that things will work well.

As with other software, you generally want to use the latest release version of Eclipse; I'll use Eclipse 3.0, the most recent release build, in this chapter.

Select the download for your operating system and click the appropriate link to download it. Installing Eclipse is easy; all you've got to do is to unzip or untar it, depending on your operating system. Since you download the version of Eclipse targeted to your operating system, you'll find the executable file ready to run as soon as you uncompress Eclipse. You start Eclipse by running the Eclipse executable. When you first run Eclipse, you should see the Welcome page. To get an overview of Eclipse or to run a tutorial, click the appropriate links. To close this Welcome page, click the X in the page's tab.

11.1.2. Creating an Eclipse Project

If you've installed Eclipse and have got it running, you have access to the Ant/Eclipse interface and no extra work is needed. Development work in Eclipse is based on *projects*, and I'll create a new project to show how to use Ant inside Eclipse. To create a new project, select File New Project, opening the New Project dialog. Select the Java Project item and click Next.

On the next page, give this project the name `AntExample`. Leave the other defaults as they are and click Finish.

This opens the new project in Eclipse; you can see the `AntExample` project at left in Eclipse's Package Explorer.

This project is empty so far; to add Java code, select the `AntExample` project in the Package Explorer and select File ⟶ New ⟶ Class, opening the New Java Class dialog. Give the package name as `org.antbook`, the name of the new class as `AntClass`, and select the checkbox marked `public static void main(String[] args)` to make Eclipse create a `main` method. Click the Finish button.

This creates the code, *AntClass.java*, you see in the Eclipse editor at the center of Figure 11-2, complete with a `main( )` method.

Figure 11-2. A new Java class

Add this code to make this class do something:

```
public static void main(String args[])
{
    System.out.println("No worries.");
}
```

Click the Save icon in the toolbar to save the changes to *AntClass.java*, and select Run   Run As → Java Application. You'll see the output of this code, `No worries.`, in the Console tab at the bottom of Eclipse.

11.1.3. Writing an Ant Build File in Eclipse

To create an Ant build file in Eclipse, right-click the `AntExample` project in the Package Explorer and select New → File. In the File Name box, enter **`build.xml`**, and click Finish, adding this new file to the `AntExample` project. To JAR the output of this project, enter this XML in the build file:

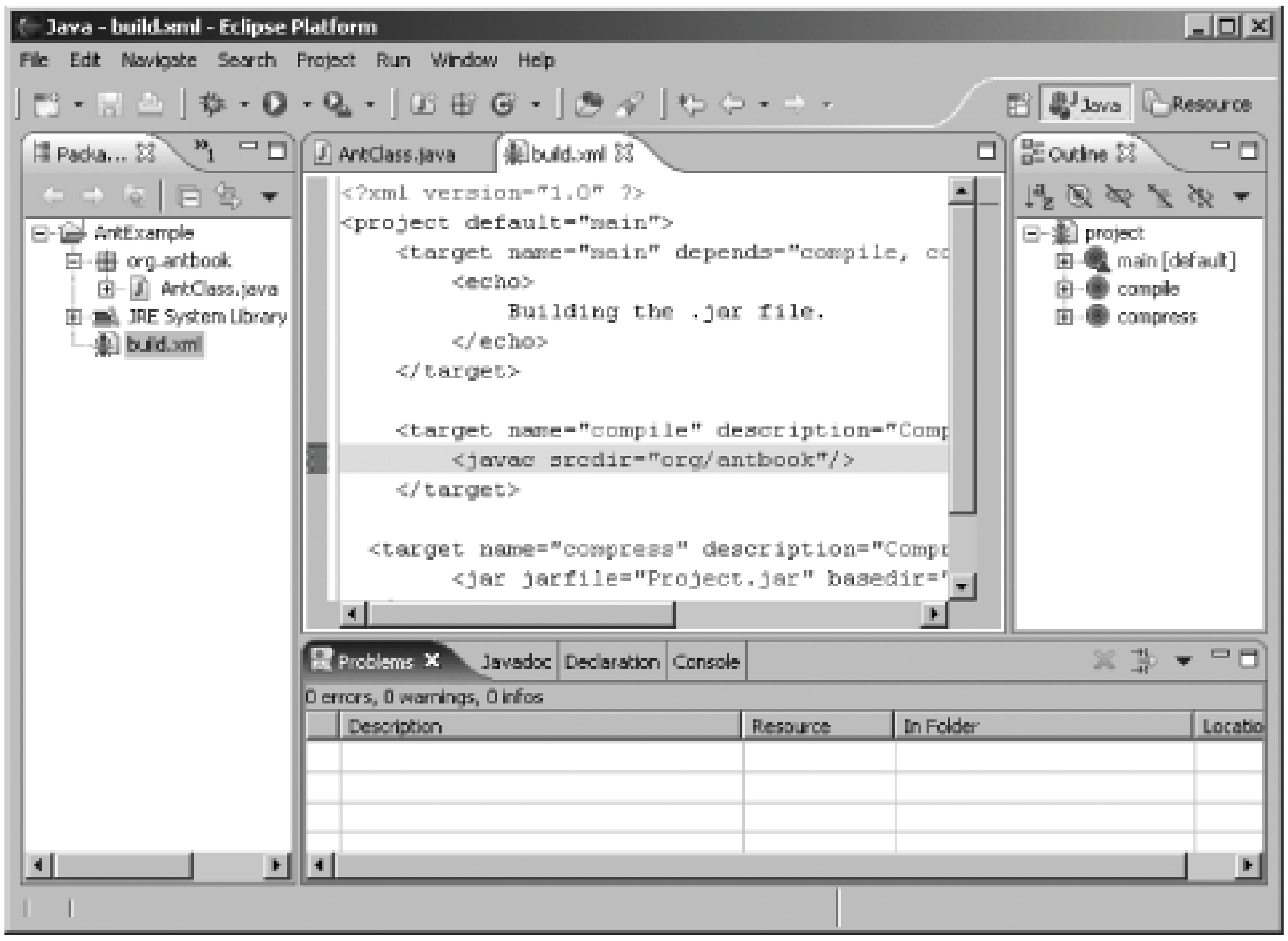
```
<?xml version="1.0" ?>
<project default="main">
    <target name="main" depends="compile, compress" description="Main target">
        <echo>
            Building the .jar file.
        </echo>
    </target>

    <target name="compile" description="Compilation target">
        <javac srcdir="org/antbook"/>
    </target>

  <target name="compress" description="Compression target">
        <jar jarfile="Project.jar" basedir="org/antbook" includes="*.class" />
  </target>
</project>
```

After entering this XML, save the new build file. The Eclipse support for Ant is evident; *build.xml* appears in the Package Explorer at left with an Ant icon and the syntax in the build file is colored witl XML declarations in one color, attribute values in another, and Ant keywords in another, as shown (ir glorious black and white) in Figure 11-3. The targets of this build file appear at right, in the Outline view.

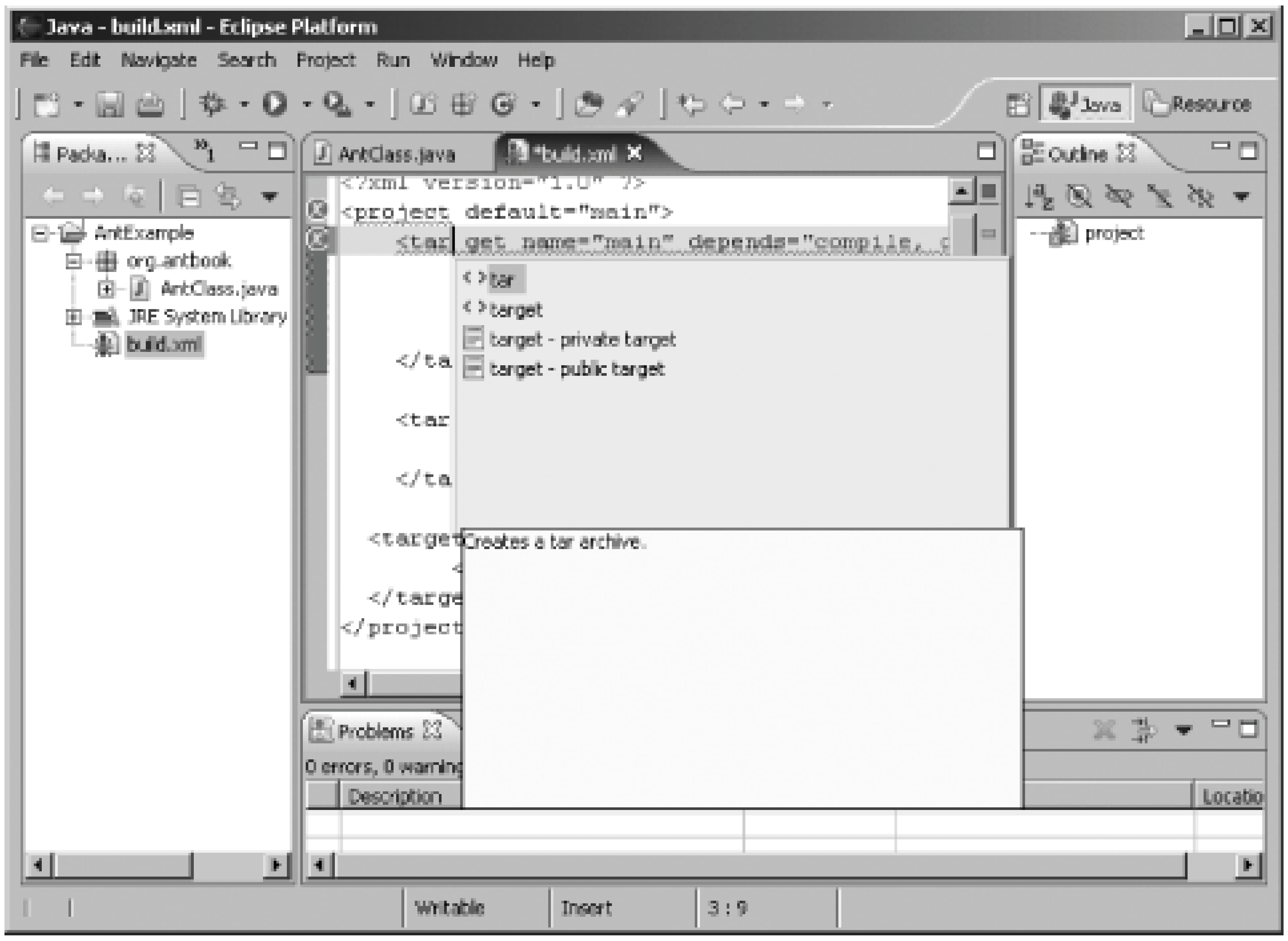
Figure 11-3. An Ant build file in Eclipse



If you close *build.xml*, you can open it again in the Eclipse Ant editor; double-click it in the Package Explorer. This is different than previous versions of Eclipse, which had no default Ant editor. You had to take extra steps to open Ant build files for editing.

Support for Ant is evident in Eclipse's*code assist* (also called *content assist*), which was added for Ant build files in Eclipse 3.0. When you enter partial text for Ant elements or attributes, you can press Ctrl-Space to open code assist, which will list possible completions of what you've been typing, as shown in Figure 11-4.

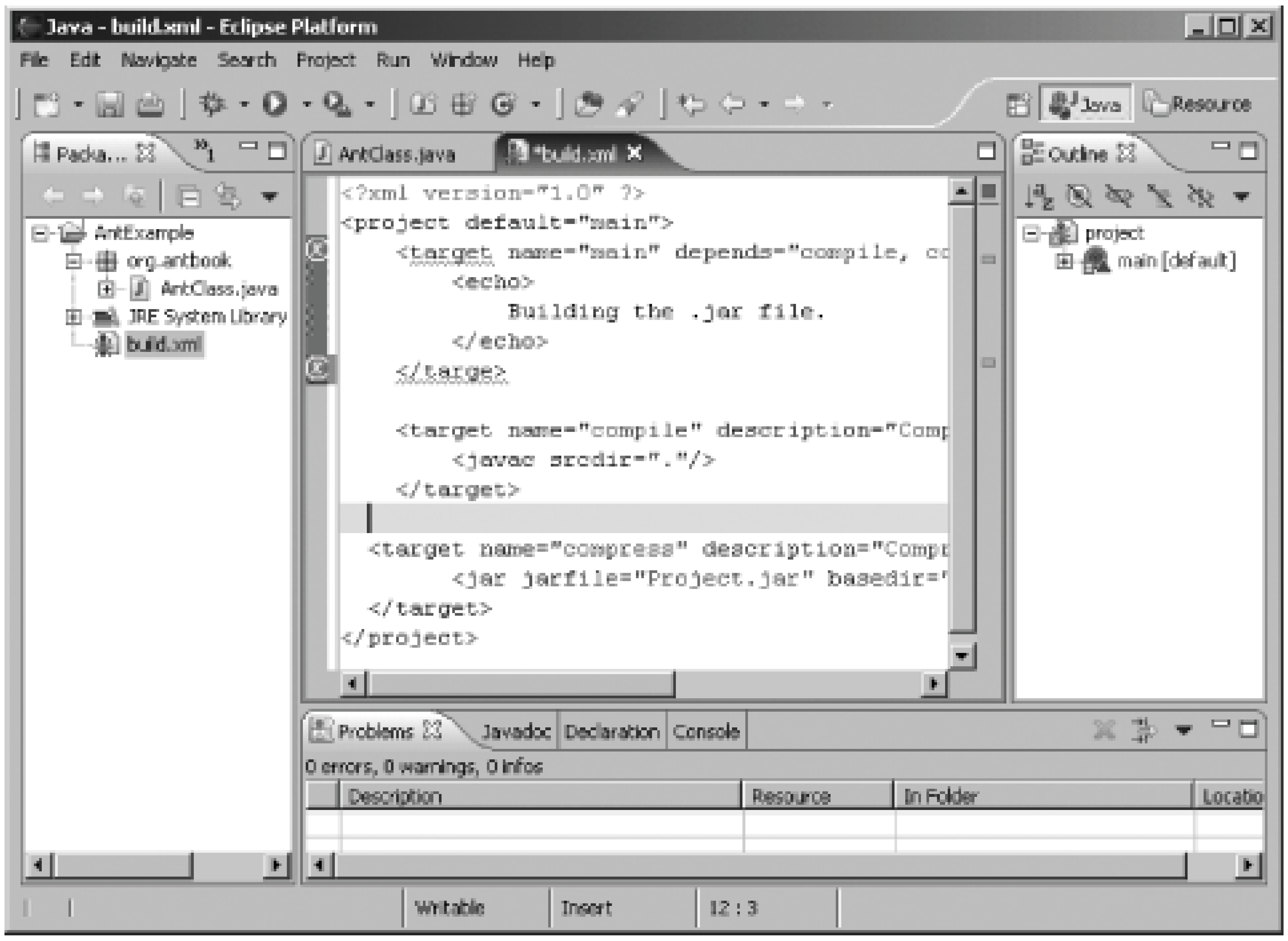
Figure 11-4. Using code assist



If you enter a $ and use code assist, Eclipse's Ant editor will list all the Ant property names it knows about.

Eclipse 3.0 can catch syntax errors in Ant build files. For example, ending a target with `</targe>`, instead of a `</target>` tag, is immediately caught by the Eclipse Ant editor, as shown in Figure 11-5. If you let your cursor rest over the circled X icon to the left of the problem line, you'll see Eclipse's explanation of the problem: "Expected `</target>' to terminate element starting on line 3." This kin of syntax checking and corrections alone are worth the price of admission.

Figure 11-5. Handling syntax errors



You can reformat an Ant build file-indenting everything nicely, using the Format command (Ctrl-Shift-F) from the Ant editor's context menu or by selecting Edit Format.

Want to see the value of a property? Let the mouse hover over it, and its value will appear in a tooltip.

Under some circumstances, Eclipse can generate Ant scripts for you. For example, if you're creating an Eclipse plug-in, which extends Eclipse with your own views and editors, you'll use a plug-in manifest file named *plugin.xml*. If you right-click the manifest file and select the Create Ant Build File item, Eclipse will create a build file for you. If you select Project Generate Javadoc, the Javadoc wizard will create an Ant build file that runs the `javadoc` tool, which you can edit as needed.

11.2. Running Ant Build Files

You have two options to run these build files from within Eclipse. You can right-click *build.xml* in the Package Explorer and select Run → Ant Build. Doing so runs Ant and gives you the results in Eclipse's Console view.

> Eclipse 3.0 runs Ant in a separate JVM, solving many problems that used to plague previous versions.

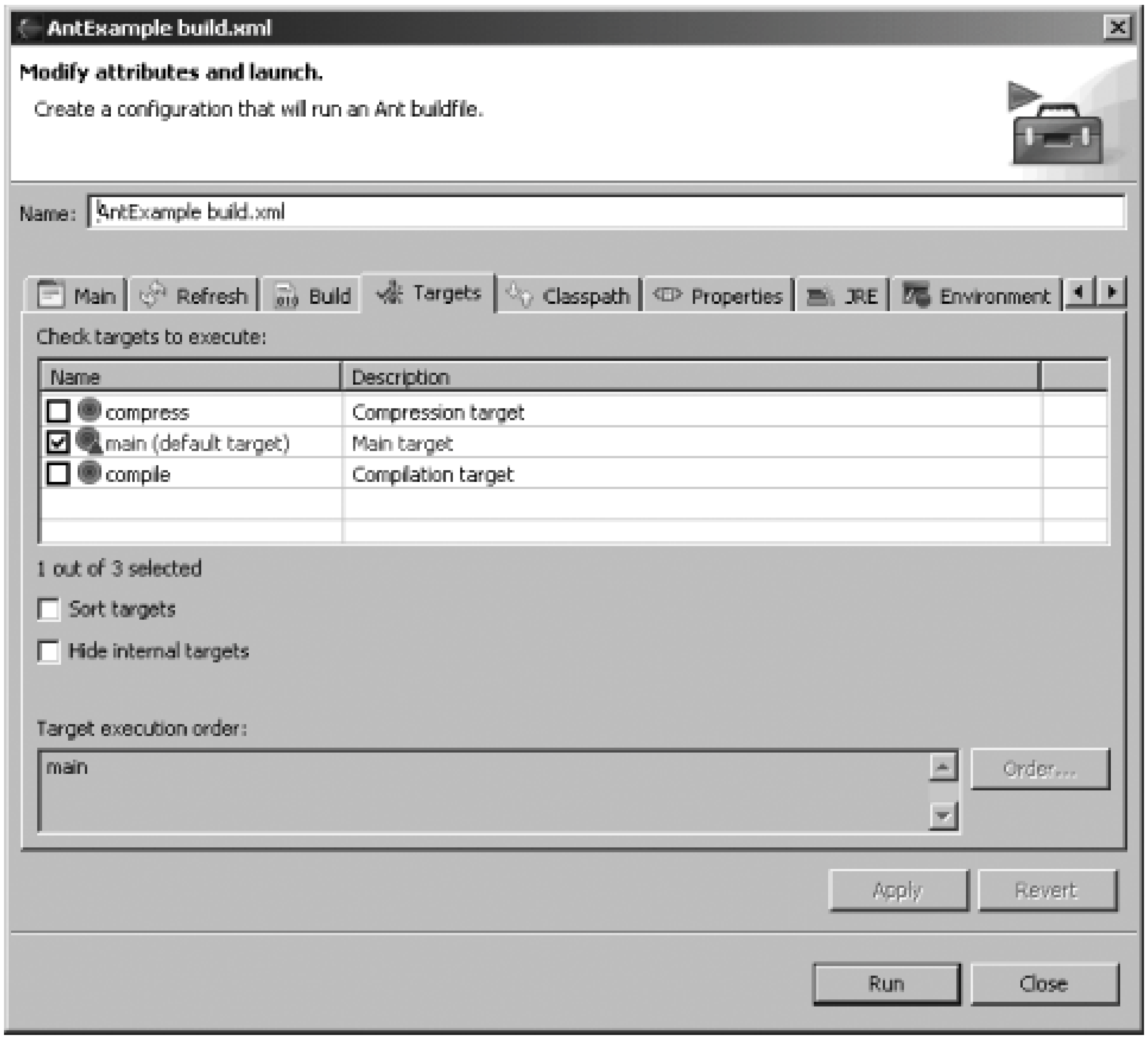
The output in the Console view is the same as you'd see from Ant if you ran the build file on the command line:

```
Buildfile:  D:\eclipse3\eclipse\workspace\AntExample\build.xml
compile:
    [javac] Compiling 1 source file
compress:
      [jar] Building jar: D:\eclipse3\eclipse\workspace\AntExample\Project.jar
main:
     [echo] Building the .jar file.
BUILD SUCCESSFUL
Total time: 2 seconds
```

If there are problems, you can see Ant's output in the Console view. Eclipse will give you a summary in the Problems view, which you can see by clicking the Problems tab at the bottom of Eclipse.

The other option to run a build file is to right-click *build.xml* in the Package Explorer and select Run Ant Build..., this time with an ellipsis (three dots). This opens the Ant launch configuration dialog you see in Figure 11-6. The Ant launch configuration is specific to the current project.

Figure 11-6. Selecting an Ant target



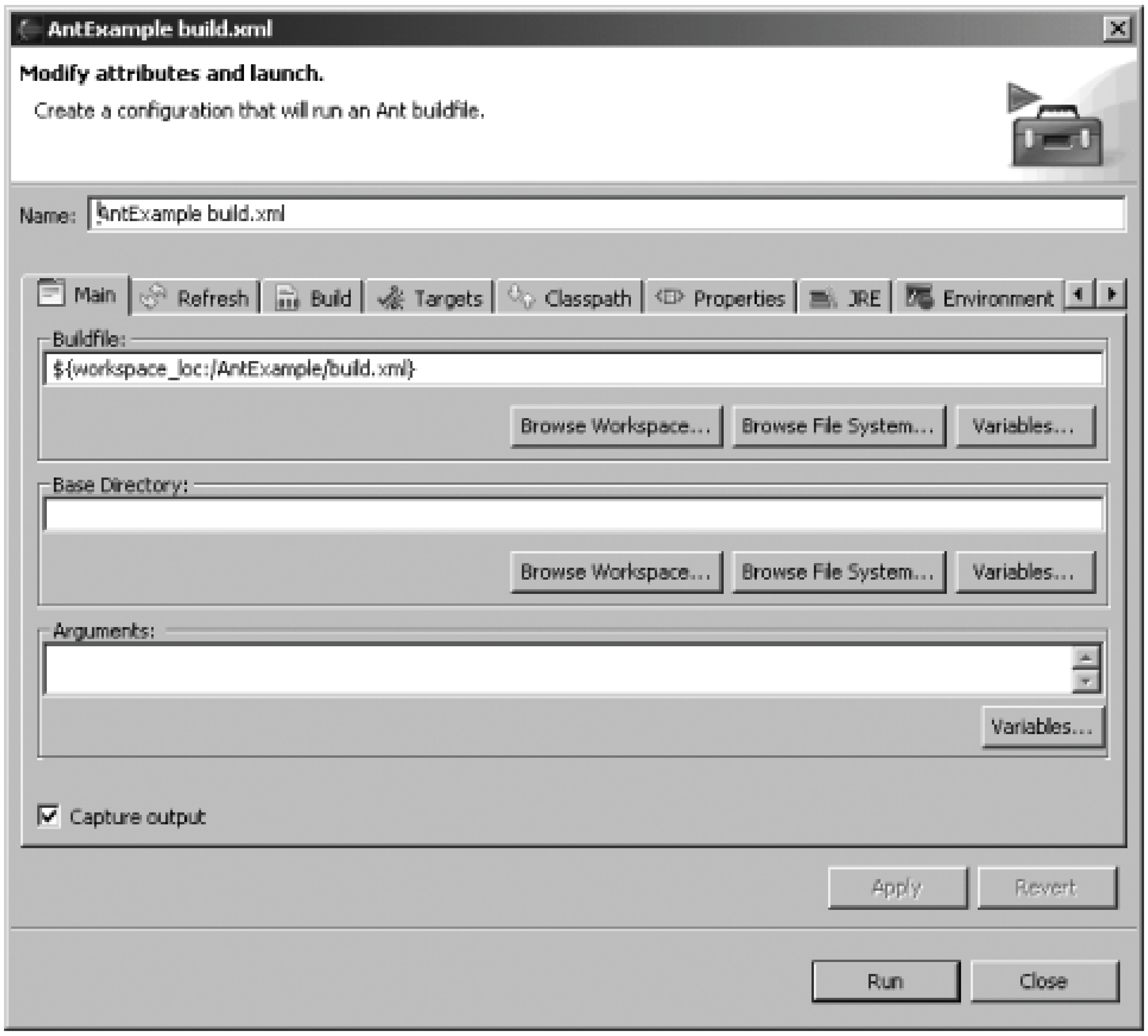
By default, the Targets tab is selected in this dialog, showing a list of the targets in *build.xml*. The default target has been selected; you can click the Run button to run that target, or you can select other targets to run. If you leave the default target selected and click Run, you'll see the same result as before in the Console view.

You can set the execution order of targets, shown in the Target execution order box at the bottom of the page (the order in which you select the items is the order in which they will run). Ant will still run each target's dependencies, but you have to be careful in case your changes mess up the overall build order.

11.2.1. Selecting the Build File and Passing Arguments to Ant

You can get as much use out of Ant in Eclipse as you can from the command line. For example, to pass arguments to Ant, right-click *build.xml* in the Package Explorer and select Run Ant Build... to open the Ant launch configuration. Click the Main tab shown in Figure 11-7. In this page, you can set the build file you want to use, the base directory for the build, and you can pass arguments to Ant.

Figure 11-7. Setting the build file and arguments to pass to Ant



The Capture output checkbox at the bottom of this dialog indicates whether you want to capture the Ant output to the Eclipse Console view, as we've been doing by default.

11.2.2. Modifying the Ant Classpath

When using an optional or custom task, adding extra libraries to the classpath may be necessary. Th Ant classpath can be modified globally or by using an individual project's launch configuration. To set the Ant classpath for an individual Eclipse project, open the Ant launch configuration for the project and click the Classpath tab. You can add external JARs by clicking the Add External JARs button.

You can modify the Ant classpath globally for all projects. To do that, select Window Preferences Ant Runtime, and click the Classpath tab. You can add JAR files as needed here, and they'll be used globally for all Ant builds.

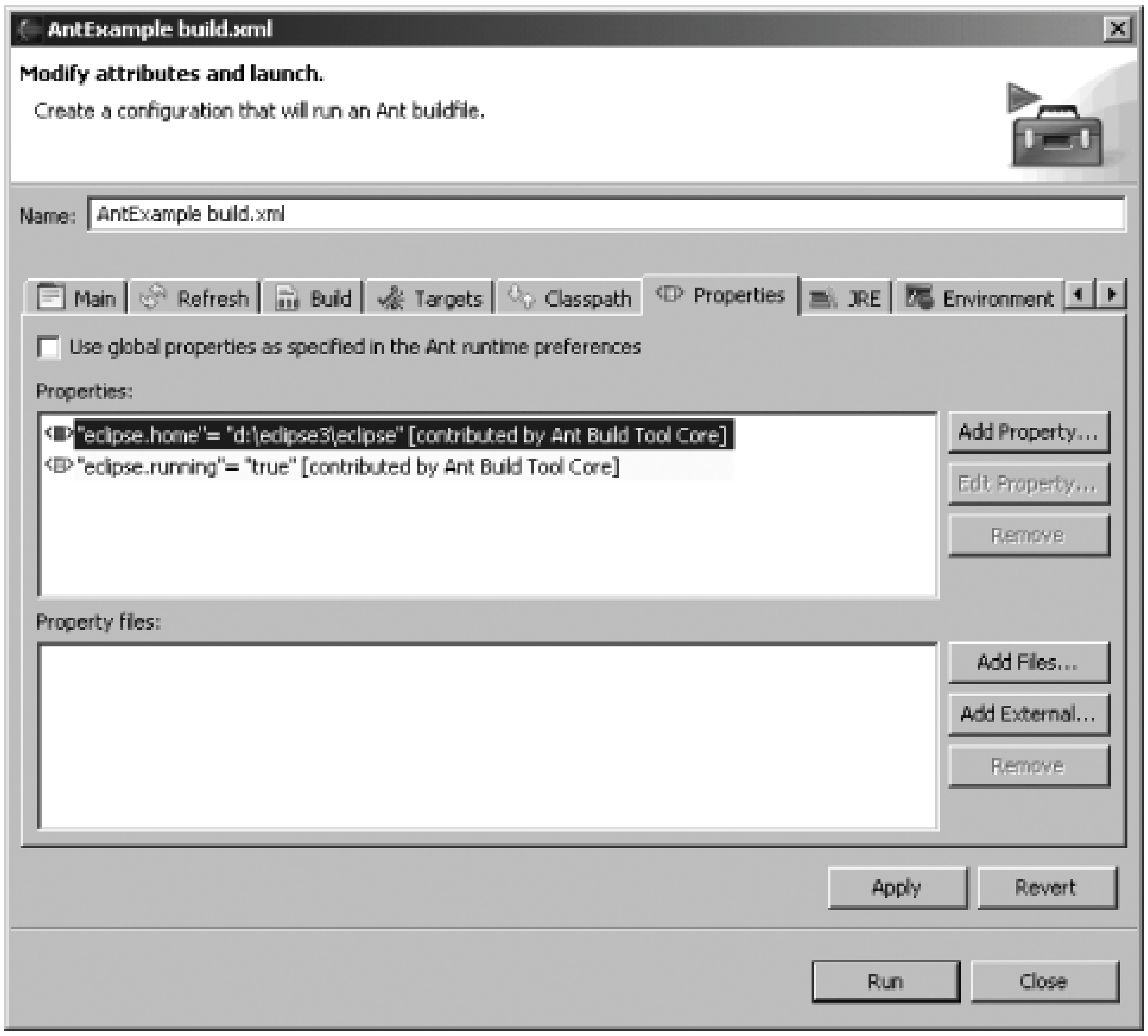
11.2.3. Setting Property Values

You can set global Ant properties using the Ant preferences page, which you open by selecting

Window⟶ Preferences⟶ Ant⟶ Runtime and clicking the Properties tab. To add a new property, click the Add Property button and fill in the Name and Value fields in the dialog that appears. This wil set the global properties for all Ant builds in Eclipse, and since properties are immutable, you will be setting the final value for such properties.

You can set properties on a project-by-project basis by setting the project's Ant launch configuration. Click the Properties tab in the launch configuration (as seen in Figure 11-8), deselect the "Use global properties as specified in the Ant runtime preferences" checkbox, and click the Add Property button to set new properties.

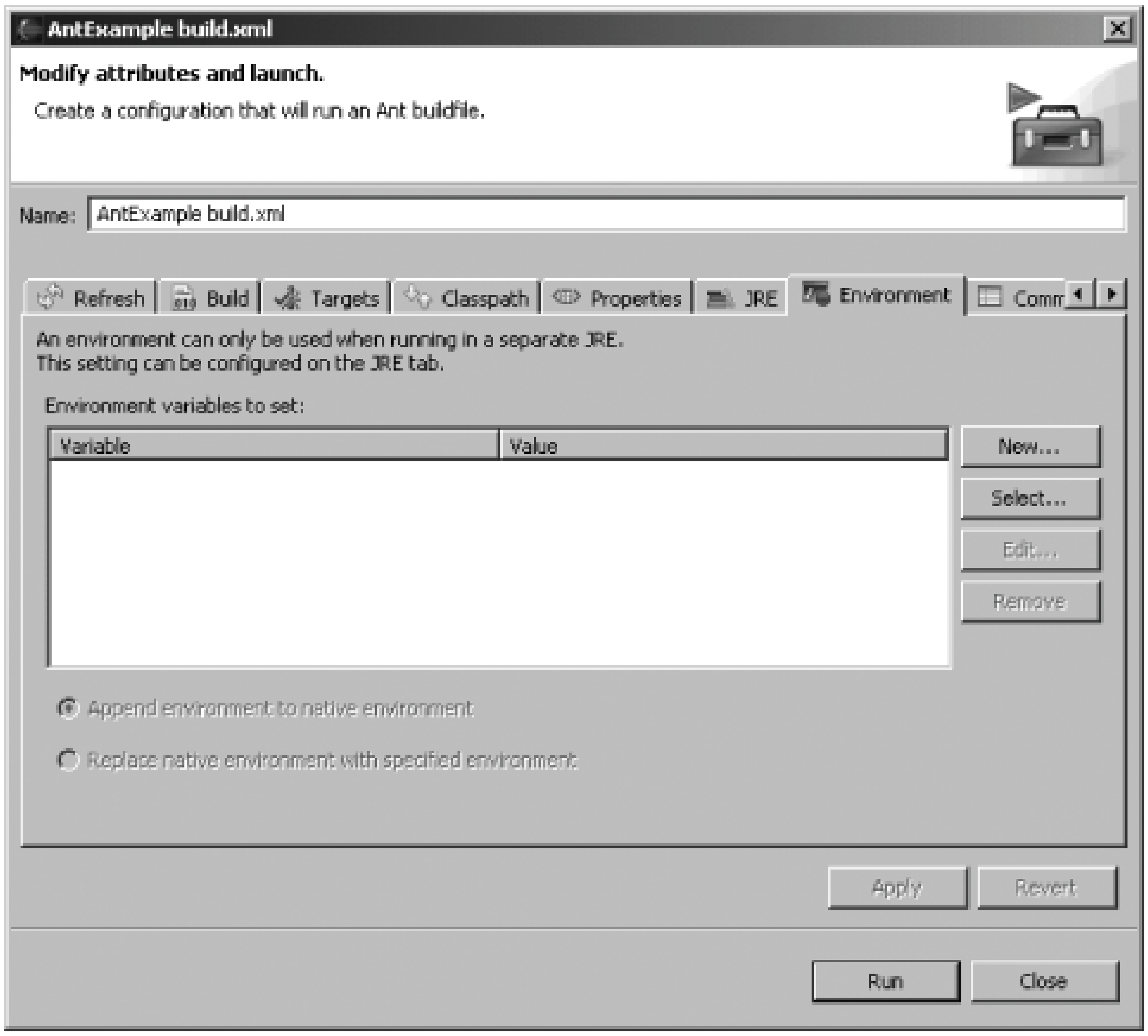
Figure 11-8. Setting properties



11.2.4. Setting Environment Variables

You can set the environment variables you want passed to Ant, but you have to ensure Ant will run in its own JRE (the default). In the project's Ant launch configuration, click the JRE tab and click the Separate JRE radio button. To set environment variables, click the Environment tab, shown in Figure 11-9, and click the New button to create a new environment variable.

Figure 11-9. Setting environment variables

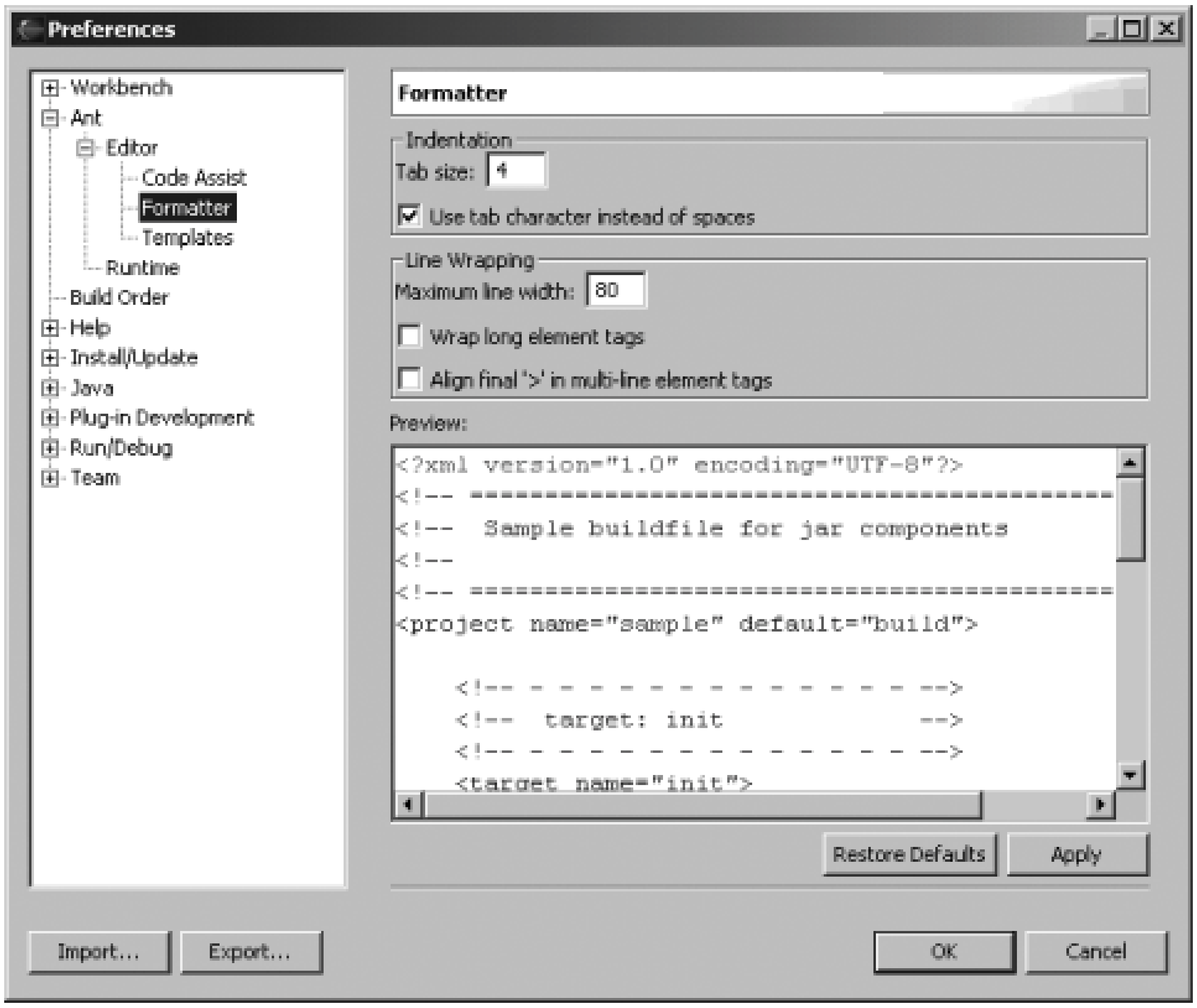


When you click the New button, the New Environment Variable dialog appears. Enter the name and value of the environment variable in the appropriate fields and click OK.

11.2.5. Configuring the Ant Editor

You can reformat an Ant build file using the Format command (Ctrl-Shift-F) from the Ant editor's context menu or by selecting Edit Format. To configure how that formatting works, open the Ant preferences page with Window Preferences Ant Editor Formatter, as shown in Figure 11-10. Any changes you make will be reflected in the Preview box.

Figure 11-10. Configuring Ant formatting



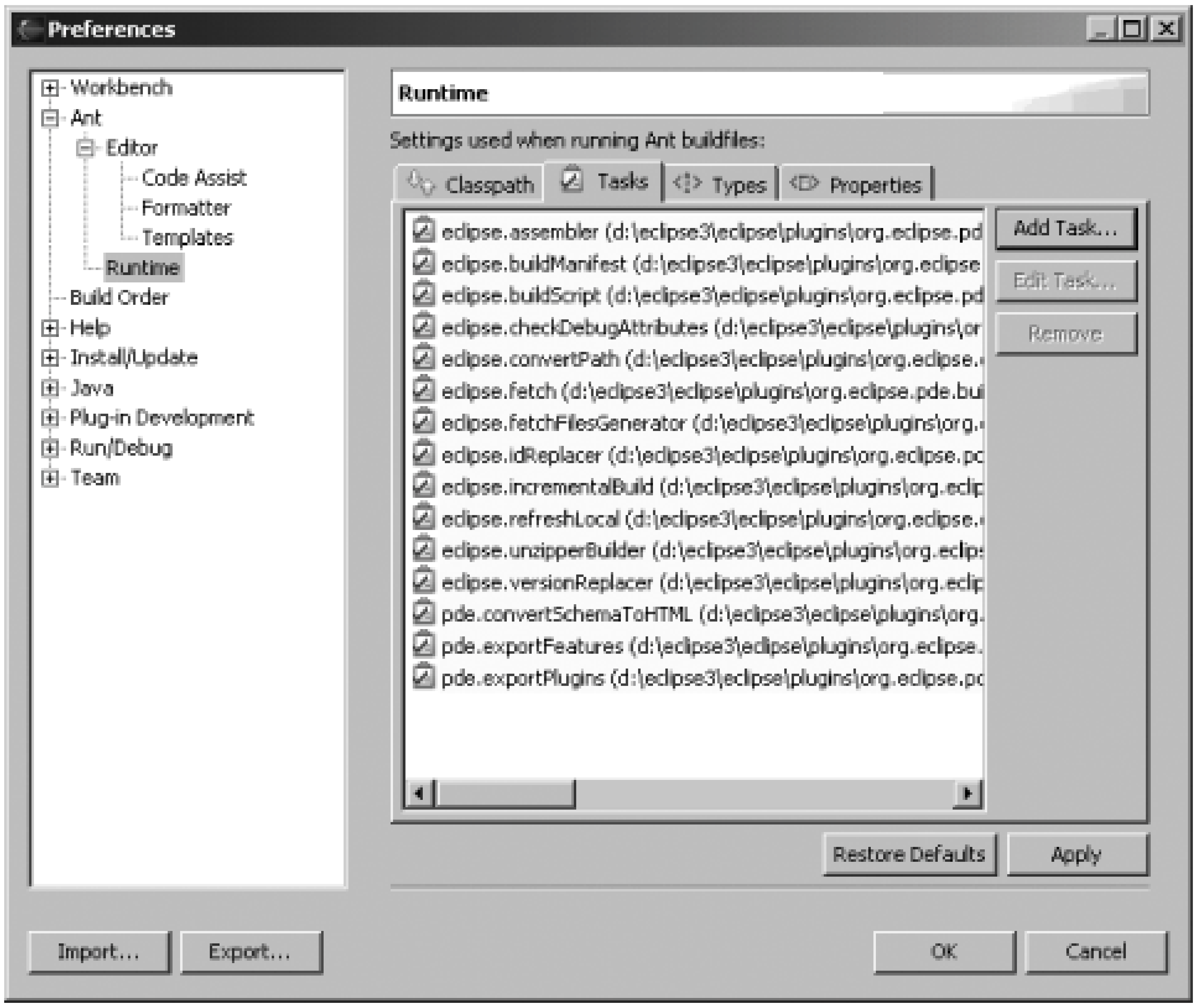
Selecting Window Preferences Ant Editor lets you configure the build file editor by setting tab widths, margins, highlighting and more.

11.2.6. Adding New Ant Tasks and Types

You can add new Ant tasks and types (covered in detail in the next chapter) to Eclipse by using the Ant preferences page at Window Preferences Ant Runtime. These tasks and types will be available for build files without having to use the `taskdef` or `typedef` tasks, which are normally needed.

To add a new task, select the Tasks tab, shown in Figure 11-11, click the Add Task button, and navigate to the JAR file in which the new Ant task is located. To add a new type, click the Types tab and follow the same steps.

Figure 11-11. Adding Ant tasks



If you can't find the JAR files you need, add them to the Ant classpath first.

Alternatively, you can add additional classes defining tasks and types to the Ant classpath by clicking the Classpath tab.

11.3. Using a Different Version of Ant

Eclipse comes with Ant 1.6.1, but it's possible to use a different version. Open the Ant preferences page by selecting Window→ Preferences Ant Runtime and clicking the Classpath tab.

When Eclipse runs Ant, it looks for the appropriate classes on the Ant classpath, as set in the Ant Home Entries item. To change the Ant Home Entries, click the Ant Home button and choose the Ant installation you wish to use.

> If you don't want to change the classpath, you can run Ant as an external tool from Eclipse. To do that, select Run External Tools External Tools to open the External Tools dialog. Click the Program item and then the New button. Enter a name for the new tool (such as "Ant 1.8" or whatever is appropriate). Next, to the Location field, click the Browse File System button and navigate to *ant.sh* or *ant.bat*, whichever is right for your operating system, and click Open. The External Tools dialog will reappear; in the Arguments field, enter any arguments you want to pass to Ant. Finally, in the Working Directory field, enter the directory of the build file you want to use and click Run to launch the new version of Ant. The problem with doing this is that you won't have easy access to predefined values that you have while working inside Eclipse. In most cases, it's far better to use Ant from inside Eclipse when building Eclipse projects.

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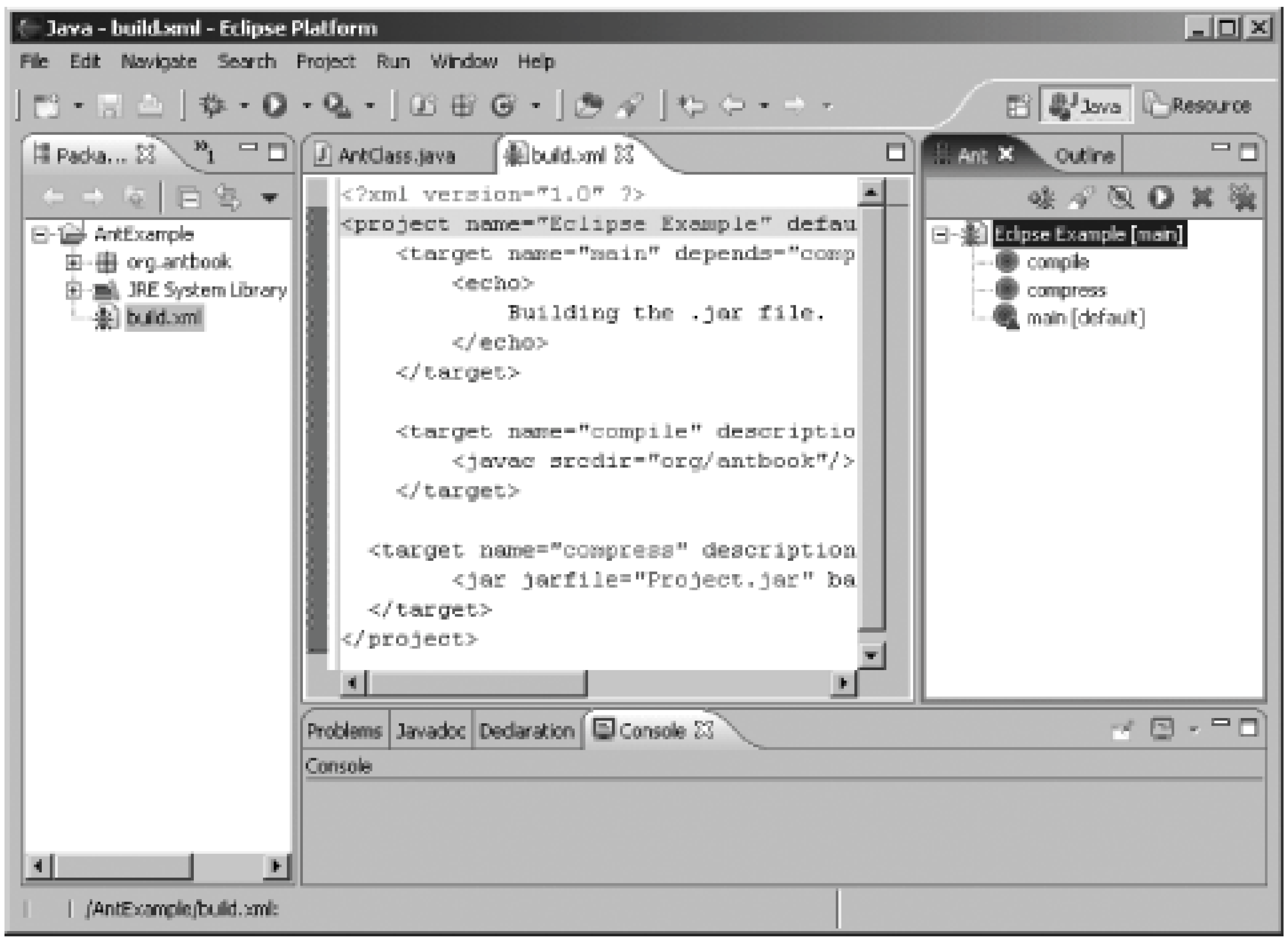
11.4. Using the Ant View

Eclipse comes with a dedicated view for working with Antcalled the Ant viewwhich is a window that gives you an overview of the targets in build files. To open this view, select Window → Show View → Ant; the Ant view appears at right in Figure 11-12.

Figure 11-12. The Ant view



The toolbar in this view contains these buttons (from left to right):

- Add Build Files
- Add Build Files with Search
- Hide Internal Targets
- Run the Default Target
- Remove Selected Build File

- Remove All Build Files

To add a build file to the Ant view, click the Add Build Files button, opening the Choose Location dialog. In the left box, select the Eclipse project you want to use, and in the right box, select the buil file you want to add to the Ant view. Click OK, adding the build file to the Ant view.

> In Windows, you can add build files to the Ant View with drag and drop.

Besides giving you an overview of a build file, the Ant view lets you run build files. Select a build file in the Ant view and click the Run the Default Target button. Or right-click a target and select the Run item in the context menu that appears. Double-clicking a build file in the Ant view opens it in the Ant editor (as does right-clicking the build file and selecting the Open With Ant Editor item).

Using Ant with Eclipse is a potent combination. Eclipse allows you to develop and debug code, and Ant lets you build and deploy it. Both of these tools are free for the downloading. It's a combination I recommend.

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Chapter 12. Extending Ant

There's more to Ant than what comes out of the box because you can extend Ant in various ways. The most common way of extending Ant is by creating your own tasks, and this chapter covers how to do that. You'll learn how to create new tasks, handle task attributes, access property values, work with nested text and elements, make builds fail, work with filesets, use custom tasks as wrappers for external programs, and more.

Besides creating new tasks, you can extend Ant in other ways, such as using scripting languages such as JavaScript, which I'll explain. You can even create listeners that respond to build file events by executing Java code, and create loggers that log data as a build progresses. And you can create custom filters and selectors, which you can use with some Ant tasks such as `copy`.

Team LiB

12.1. Creating a Simple Custom Ant Task

Creating new Ant tasks is simple since all you need is an`execute( )` method. Example 12-1 is a Java class named `Greeting` that displays the text "No worries.".

Example 12-1. A simple Ant task (ch12/greetingtask/src/Greeting java)

```
public class Greeting
{
    public void execute( )
    {
        System.out.println("No worries.");
    }
}
```

To install this class as a new Ant task, you compile this code and use the`taskdef` task to declare it in Ant. The attributes of the `taskdef` task are shown in Table 12-1.

> The `taskdef` task is based on the `typedef` task, except that the values of two attributes, `adapter` and `adapto`, are preset to fixed values ("org.apache.tools.ant.TaskAdapter" and "org.apache.tools.ant.Task", respectively).

Table 12-1. The taskdef task's attributes

Attribute	Description	Required	Default
`adapter`	Specifies the adapter, which adapts the defined class to another interface/class.	No	`org.apache.tools.ant.TaskAdapter`
`adaptto`	Specifies the interface/class to which to adapt. Used with the `adapter` attribute.	No	`org.apache.tools.ant.Task`
`classname`	Specifies the classname that will support/perform the type or task.	Yes, unless `file` or `resource` have been specified.	

Attribute	Description	Required	Default
classpath	Specifies the classpath you want to use when searching for classname.	No	
file	Specifies the name of the file from which to load definitions, if any.	No	
format	Specifies the format of the file or resource pointed to by the file or resource attributes. Possible values are properties or xml.	No	properties
loaderRef	Specifies the loader that you want to use to load the class.	No	
name	Specifies the name of the datatype or task you're creating.	Yes, unless the file or resource type attributes have been specified.	
onerror	Specifies what to do if there is an error while defining a type. Possible values are: fail Causes a build exception. report Outputs a warning. ignore Does nothing. Since Ant 1.6.	No	fail
resource	Specifies the name of the resource from which you want to load definitions.	No	

Attribute	Description	Required	Default
uri	Specifies the URI at which this type/task definition should be found. Since Ant 1.6.	No	

The taskdef task's classpath attribute is a path-like structure and can be set with a nested classpath element.

The build file in Example 12-2 builds the simple Ant task and JARs it in *greeting.jar*. The taskdef task in the same build file retrieves the task from that JARfile and executes the task, which should print out the "No worries." message.

Example 12-2. Build file for a simple Ant task (ch12/greetingtask/build.xml)

```
<?xml version="1.0"?>
<project default="main">

    <property name="src" location="src"/>
    <property name="output" location="output"/>

    <target name="main" depends="jar">
        <taskdef name="greeting" classname="Greeting" classpath="greeting.jar"/>
        <greeting/>
    </target>

    <target name="jar" depends="compile">
        <jar destfile="greeting.jar" basedir="${output}"/>
    </target>

    <target name="compile">
        <mkdir dir="${output}"/>
        <javac srcdir="${src}" destdir="${output}"/>
    </target>

</project>
```

Here's what you see when the build file runs. The execute( ) method of the task's code was indeed called, displaying the expected message:

```
%ant
Buildfile: build.xml

compile:
     [mkdir] Created dir: /home/steven/ant/ch12/greetingtask/output
     [javac] Compiling 2 source files to /home/steven/ant/ch12/greetingtask/output
```

```
jar:
      [jar] Building jar: /home/steven/ant/ch12/greetingtask/greeting.jar

main:
 [greeting] No worries.

BUILD SUCCESSFUL
Total time: 3 seconds
```

12.2. Extending the Task Class

Usually, you extend an Ant task class like `org.apache.tools.ant.Task` when you write custom tasks. Ant comes with a selection of task classes meant to be extended:

`AbstractCvsTask`

Abstract CVS task class

`JDBCTask`

Handles JDBC configuration needed by SQL type tasks

`MatchingTask`

Abstract task that should be extended by tasks required to include or exclude files based on patte matching

`Pack`

Abstract base class for pack tasks

`Task`

Generic task and the one most commonly extended

`Unpack`

Abstract base class for unpacking tasks

The `Task` class (i.e., `org.apache.tools.ant.Task`) is used for most of this chapter, though some samples will use `MatchingTask` . The methods of the `Task` class appear in Table 12-2.

Table 12-2. The Task class's methods

Method	Does this
`void execute( )`	Specifies the task should execute.
`java.lang.String getDescription( )`	Returns the task's description.
`Location getLocation( )`	Returns the file and location at which the ta is supported.
`Target getOwningTarget( )`	Returns the target that contains this task.
`RuntimeConfigurable getRuntimeConfigurableWrapper( )`	Returns the wrapper class instance the task uses for runtime configuration.
`java.lang.String getTaskName( )`	Returns the task name (used when when logging messages from the task).
`java.lang.String getTaskType( )`	Returns the type of task as a string.
`protected RuntimeConfigurable getWrapper( )`	Returns the runtime configurable structure f this task as a `RuntimeConfigurable` object.
`protected void handleErrorFlush(java.lang.String output)`	Handles errors by logging them with `ERR` priority.
`protected void handleErrorOutput(java.lang.String output)`	Handles errors by logging them with `WARN` priority.
`protected void handleFlush(java.lang.String output)`	Handles errors by logging them with `INFO` priority.
`protected int handleInput(byte[] buffer, int offset, int length)`	Handles input requests using byte buffers.
`protected void handleOutput(java.lang.String output)`	Handles string output by logging it using `INF` priority.
`void init( )`	Called automatically so the task can be initialized.
`protected boolean isInvalid( )`	Returns a value of `TRue` if this task is invalid
`void log(java.lang.String msg)`	Logs a string message, giving it (default) `INI` priority.
`void log(java.lang.String msg, int msgLevel)`	Logs a string message, giving it priority you specify.
`void maybeConfigure( )`	Configures the task, if it has not already bee configured.
`void perform( )`	Performs this task. If the task is not still val a replacement version will be created and th task will be performed with that.
`void reconfigure( )`	Reconfigures a task, forcing the reconfiguration if necessary.
`void setDescription(java.lang.String desc)`	Specifies a string description for this task.

Method	Does this
`void setLocation(Location location)`	Specifies the file and location where this tas was first defined.
`void setOwningTarget(Target target)`	Specifies the target that contains this task.
`void setRuntimeConfigurableWrapper(RuntimeConfigurable wrapper)`	Sets the wrapper class that should be used runtime configuration.
`void setTaskName(java.lang.String name)`	Specifes the task name (use for logging messages).
`void setTaskType(java.lang.String type)`	Specifies type of task in string format.

12.2.1. The Task Life Cycle

Tasks go through a well-defined life cycle, and here are the specific stages:

1. The task is instantiated using a no-argument constructor.
2. The task's references to its project and location inside the build file are initialized via inherited proj and location variables.
3. If the user specified an `id` attribute in this task, the project registers a reference to this newly creat task.
4. The task gets a reference to the target it belongs to through its inherited target variable.
5. The `init( )` method is called to initialize the task.
6. All child elements of the task's element are created through the task's `createXXX( )` methods or instantiated and added to this task with its `addXXX( )` methods.
7. All attributes of this task get set via their corresponding `setXXX( )` methods.
8. The character data sections inside the task's element are added to the task using its `addText()` method (if there is one).
9. All attributes of all child elements get set using their `setXXX( )` methods.
10. The `execute( )` method is called to run the task.

12.2.2. Accessing the Project and Properties in Code

When you extend the `Task` class, you have access to a great deal of data about the project. The `Task` clas inherits the `getProject( )` method, which returns a `Project` object that holds such items as the project's name and properties. You can see selected methods of the `Project` class in Table 12-3 . You can do nearl anything with these methods, from setting a project's default target and logging text to reading propert values and setting property values. That's a typical way for custom tasks to perform their work: reading property values with the `Project` object's `getProperty( )` method and setting property values with `setProperty( )`. After a property has been set, it can be accessed in the build file, letting the custom ta communicate with the rest of the build file.

Table 12-3. Selected Project class methods

Method	Does this
`void addBuildListener(BuildListener listener)`	Adds a build listener to the current project catch build events.
`void addTarget(Target target)`	Adds a new target to the project at runtime
`void addTaskDefinition(java.lang.String taskName, java.lang.Class taskClass)`	Adds the definition of a new task to the project.
`Task createTask(java.lang.String taskType)`	Creates a new task instance.
`int defaultInput(byte[] buffer, int offset, int length)`	Reads input data for the project from the default input stream.
`void executeTarget(java.lang.String targetName)`	Executes the specified target (and any targets it depends on).
`void executeTargets(java.util.Vector targetNames)`	Executes the specified targets in the given sequence (and the targets they depend on)
`java.io.File getBaseDir( )`	Returns the base directory of the project. T directory is returned as a `File` object.
`java.util.Vector getBuildListeners( )`	Returns the list of build listeners that have been added to the project.
`java.io.InputStream getDefaultInputStream( )`	Returns this project's default input stream a an `InputStream` object.
`java.lang.String getDefaultTarget( )`	Returns the name of the default target of th project as a string.
`java.lang.String getDescription( )`	Returns the project description as a string, one has been specified.
`java.lang.String getElementName(java.lang.Object element)`	Returns a description of the given element a string.
`java.lang.String getName( )`	Returns the name of the project if one has been specified.
`java.util.Hashtable getProperties( )`	Returns the project's properties table.
`java.lang.String getProperty(java.lang.String name)`	Returns the value of a property if it has bee set in the project.
`java.lang.Object getReference(java.lang.String key)`	Looks up a reference in the project by ID string.

Method	Does this
`java.util.Hashtable getReferences( )`	Returns a hashtable of the references in the project.
`java.util.Hashtable getTargets( )`	Returns the hashtable of the targets in the project.
`java.util.Hashtable getTaskDefinitions( )`	Returns the current task's definition hashtable.
`java.util.Hashtable getUserProperties( )`	Returns the user properties' hashtable.
`java.lang.String getUserProperty(java.lang.String name)`	Returns the value of a user property in the project if it has been set.
`void init( )`	Initializes the project, readying it for execution.
`void log(java.lang.String message)`	Writes a string message to the log. Uses th default log level, `MSG_INFO` .
`void log(java.lang.String message, int msgLevel)`	Writes a project-level message to the log. Uses message level you specify.
`void log(Target target, java.lang.String message, int msgLevel)`	Writes a message-level message to the log. Uses message level you specify.
`void log(Task task, java.lang.String message, int msgLevel)`	Writes a task-level message to the log. Use message level you specify.
`java.lang.String replaceProperties(java.lang.String value)`	Replaces any occurences of `${}` constructio in the given string with the value of the matching property.
`java.io.File resolveFile(java.lang.String fileName)`	Returns the full form of a filename.
`void setBaseDir(java.io.File baseDir)`	Specifies the base directory you want to us for the project.
`void setBasedir(java.lang.String baseD)`	Specifies the base directory, passed as a string, for the project.
`void setDefault(java.lang.String defaultTarget)`	Specifies the default target of the project, passed as a string.
`void setDefaultInputStream(java.io.InputStream defaultInputStream)`	Specifies the default System input stream a an `InputStream` object.
`void setDescription(java.lang.String description)`	Specifies the project description in string format.
`void setInheritedProperty(java.lang.String name, java.lang.String value)`	Specifies a user property by name and valu
`void setKeepGoingMode(boolean keepGoingMode)`	Specifies "keep-going" mode. In this mode, all targets that don`t depend on failed targets will be executed.

Method	Does this
`void setName(java.lang.String name)`	Specifies the name of the project as a strin
`void setNewProperty(java.lang.String name, java.lang.String value)`	Specifies the new value of a property if no value exists.
`void setProjectReference(java.lang.Object obj)`	Specifies a reference to this Project using tl specified object.
`void setProperty(java.lang.String name, java.lang.String value)`	Specifies a property, by name and value.
`void setUserProperty(java.lang.String name, java.lang.String value)`	Specifies a user property, by name and value.
`static java.lang.String translatePath(java.lang.String toProcess)`	Translates a general path into its OS-specif specific form.

Letting a custom task interact with the rest of the build through the use of properties is an important pa creating custom tasks. Take a look at Example 12-3, which is the code for an Ant task that reports the name of the project using the `ant.project.name` property, and the current location in the build file with t `getLocation( )` method.

Example 12-3. Accessing projects and properties (ch12/projecttask/src/Project.java)

```
import org.apache.tools.ant.Task;

public class Project extends Task
{
    public void execute( )
    {
        String name = getProject( ).getProperty("ant.project.name");

        System.out.println("Welcome to project " + name
            + " at " + getLocation( ));
    }
}
```

Example 12-4 shows the build file for this custom task.

Example 12-4. Build file for accessing properties (ch12/projecttask/build.x

```
<?xml  version="1.0"?>
<project name="TheTask" basedir="." default="main">

    <property name="src" location="src"/>
    <property name="output" location="output"/>
```

```
    <target name="main" depends="jar">
        <taskdef name="project" classname="Project" classpath="project.jar"/>
        <project/>
    </target>

    <target name="jar" depends="compile">
        <jar destfile="project.jar" basedir="${output}"/>
    </target>

    <target name="compile">
        <mkdir dir="${output}"/>
        <javac srcdir="${src}" destdir="${output}"/>
    </target>

</project>
```

The results show that the build file reports the name of the project as set by the `project` element's `name` attribute, and the line location in the build file:

```
%ant
Buildfile: build.xml

compile:
     [mkdir] Created dir: /home/steven/ant/ch12/projecttask/output
     [javac] Compiling 1 source file to /home/steven/ant/ch12/projecttask/output

jar:
       [jar] Building jar: /home/steven/ant/ch12/projecttask/project.jar

main:
  [project] Welcome to project TheTask at
  /home/steven/ant/ch12/projecttask/build.xml:9 :

BUILD SUCCESSFUL
Total time: 3 seconds
```

12.2.3. Handling Attributes in Custom Tasks

If your custom task supports attributes, Ant will pass the value of the attribute to your code if you have setter method, much as you'd use in a JavaBean. For example, if you have an attribute named `language` define a method, e.g., `public void setLanguage(String language)` . Ant will pass this method the string value (after performing any needed property expansion) of the `language` attribute.

Strings are the most common attribute values, but you can ask Ant to perform conversions of attribute values to other data types based on the type of the argument in your setter method. Here are the possi data types and how they're handled:

`boolean`

Your method will be passed the value true if the value specified in the build file is one of "true", "y
or "on", and false otherwise.

`char` (or `java.lang.Character`)

Your method will be passed the first character of the attribute value.

Primitive types (`int` , `short` , and so forth)

Ant will convert the value of the attribute into this type and pass it to your setter method.

`java.io.File`

Ant will pass you a File object if the attribute value corresponds to a valid filename.

`org.apache.tools.ant.types.Path`

Ant will tokenize the value specified in the build file, using `:` and `;` as path separators.

`java.lang.Class`

Ant will want to interpret the attribute value as a Java class name and load the named class from
system class loader.

Any other type that has a constructor with a single `String` argument

Ant will use this constructor to create a new instance using the name in the attribute.

A subclass of `org.apache.tools.ant.types.EnumeratedAttribute`

Ant will invoke this class's `setValue( )` method if your task supports enumerated attributes (i.e., attributes with values that must be part of a predefined set of legal values).

> What happens if more than one setter method is present for a given attribute? A method taking a `String` argument will not be called if more specific methods are available. If Ant could choose from other setters, only one of them will be calledbut which one is called is indeterminate, depending on your JVM.

Example 12-5 shows the code to handle a `String` attribute named `language` and displays the value assig
to this attribute in the build file. The `setLanguage( )` method will be passed the attribute's value.

Example 12-5. Accessing attributes (ch12/attributetask/src/Project.java)

```
import org.apache.tools.ant.Task;
import org.apache.tools.ant.BuildException;

public class Project extends Task
{
    private String language;

    public void execute( ) throws BuildException
    {
        System.out.println("The language is " + language);
    }

    public void setLanguage(String language)
    {
        this.language = language;
    }
}
```

The build file that builds the custom task in Example 12-5 and then uses it appears in Example 12-6. In th
example, Ant builds the code for the new task, `project` , and uses that task, setting the `language` attribu
to "English". The code for this task reads the value of the `language` attribute and displays it during the bu

Example 12-6. Build file for accessing attributes (ch12/attributetask/build.xml)

```
<?xml version="1.0"?>
<project basedir="." default="main">

    <property name="src" value="src"/>
    <property name="output" value="output"/>

    <target name="main" depends="jar">
        <taskdef name="project" classname="Project" classpath="Project.jar"/>
        <project language="English"/>
    </target>

    <target name="compile">
        <mkdir dir="${output}"/>
        <javac srcdir="${src}" destdir="${output}"/>
    </target>

    <target name="jar" depends="compile">
        <jar destfile="Project.jar" basedir="${output}"/>
    </target>
```

```
</project>
```

Here's what the build output looks like:

```
%ant
Buildfile: build.xml

compile:
    [javac] Compiling 1 source file to /home/steven/ant/ch12/attributetask/output

jar:
      [jar] Building jar: /home/steven/ant/ch12/attributetask/Project.jar

main:
  [project] The language is English

BUILD SUCCESSFUL
Total time: 4 seconds
```

12.2.4. Making Builds Fail

Want to make a build fail? Make your task code throw an `org.apache.tools.ant.BuildException` . For example, if your custom task supports a `failonerror` attribute, you might use code something like this:

```
public void setFailonerror(boolean failOnError)
{
    this.fail = failOnError;
}

public void execute( ) throws BuildException
{
    if (fail) {
        if error...
            throw new BuildException("Attribute language is required");
    } else {
        ....
    }
}
```

Ant will display the text you pass to the `BuildException` constructor in the fail message.

12.2.5. Handling Nested Text

Ant tasks can support nested text, and custom tasks can support such text as well. Take a look at Exam 12-7 , which includes a `project` task that contains the nested text "No worries.".

Example 12-7. Build file for accessing nested text (ch12/nestedtext/build.x

```
<?xml  version="1.0"?>
<project basedir="." default="main">

    <property name="src" value="src"/>
    <property name="output" value="output"/>

    <target name="main" depends="jar">
        <taskdef name="project" classname="Project" classpath="Project.jar"/>
        <project>No worries.</project>
    </target>

    <target name="compile">
        <mkdir dir="${output}"/>
        <javac srcdir="${src}" destdir="${output}"/>
    </target>

    <target name="jar" depends="compile">
        <jar destfile="Project.jar" basedir="${output}"/>
    </target>

</project>
```

In your task's code, you can receive access to an element's nested text with the `addText()` method. The text will be passed to this method, and Example 12-8 shows how to retrieve that text and display it.

Example 12-8. Accessing nested text (ch12/nestedtext/src/Project.java)

```
import org.apache.tools.ant.Task;

public class Project extends Task
{
    String text;

    public void addText(String text)
    {
        this.text = text;
    }

    public void execute( )
    {
        System.out.println(text);
    }
}
```

Here's what you get when you run this build file and the custom task with the nested text "No worries." Example 12-7 :

```
%ant
Buildfile: build.xml

compile:
     [mkdir] Created dir: /home/steven/ant/ch12/nestedtext/output
     [javac] Compiling 1 source file to /home/steven/ant/ch12/nestedtext/output

jar:
       [jar] Building jar: /home/steven/ant/ch12/nestedtext/Project.jar

main:
  [project] No worries.

BUILD SUCCESSFUL
Total time: 7 seconds
```

The supporting code for the custom task recovered the nested text and, in this case, displayed it during build.

> Want to handle properties in nested text? Use `replaceProperties-(java.lang.String value)` , which replaces `${}` style constructions in the given value with the string value of the corresponding datatypes, and returns the resulting string.

12.2.6. Handling Nested Elements

Nested text is one thing, but what if you have nested *elements* in a custom task? For instance, assume t your custom task has nested elements named `nested` , as in Example 12-9, and suppose that these elements have an attribute named `language` . How can you recover the values of the `language` attributes?

Example 12-9. Nested elements in a custom task (ch12/nestedelement/build.xml)

```
<?xml version="1.0"?>
<project basedir="." default="main">

    <property name="src" value="src"/>
    <property name="output" value="output"/>

    <target name="main" depends="jar">
        <taskdef name="project" classname="Project" classpath="Project.jar"/>
        <project>
            <nested language="English"/>
            <nested language="German"/>
        </project>
    </target>

    <target name="compile">
```

```
        <mkdir dir="${output}"/>
        <javac srcdir="${src}" destdir="${output}"/>
    </target>

    <target name="jar" depends="compile">
        <jar destfile="Project.jar" basedir="${output}"/>
    </target>

</project>
```

In the code supporting this custom task, shown in Example 12-10, you need a class, `Nested` , representin the `nested` element, and you can use a method named `createNested( )` to handle calls from Ant for each `nested` element. Each time `createNested( )` is called, the code adds the new `nested` element to a `Vector` named `nesteds` . The `language` attribute of each `nested` element is passed to the `setLanguage( )` method and can be recovered with the `getLanguage( )` method. After the `Vector` is filled, the `execute()` method is called and the code iterates over the `Vector` , displaying the `language` attribute value for each `nested` element.

Example 12-10. Handling nested elements (ch12/nestedelement/src/Project.java)

```
import java.util.Vector;
import java.util.Iterator;
import org.apache.tools.ant.Task;
import org.apache.tools.ant.BuildException;

public class Project extends Task
{
    public void execute( )
    {
        for (Iterator iterator = nesteds.iterator( ); iterator.hasNext( );){
            Nested element = (Nested)iterator.next( );
            System.out.println("The language is " + element.getLanguage( ));
        }
    }

    Vector nesteds = new Vector( );

    public Nested createNested( )
    {
        Nested nested = new Nested( );
        nesteds.add(nested);
        return nested;
    }

    public class Nested
    {
        public Nested( ) {}

        String language;
```

```
        public void setLanguage(String language)
        {
            this.language= language;
        }

        public String getLanguage( )
        {
            return language;
        }
    }
}
```

Here's what the build file looks like when running. The support code handled the nested elements and recovered the value of the `language` attributes:

```
%ant
Buildfile: build.xml

compile:
    [javac] Compiling 1 source file to /home/steven/ant/ch12/nestedelement/output

jar:
      [jar] Building jar: /home/steven/ant/ch12/nestedelement/Project.jar

main:
  [project] The language is English
  [project] The language is German

BUILD SUCCESSFUL
Total time: 3 seconds
```

12.2.7. Using Filesets

You can make your custom tasks support filesets with the right code. Example 12-11shows a custom tas `project` , acting as a fileset with an `include` nested element. In this case, the custom `project` element wi display all the *.java* files in and below the base directory.

Example 12-11. Supporting filesets in a build file (ch12/fileset/src/Project.java)

```
<?xml  version="1.0"?>
<project basedir="." default="main">

    <property name="src" value="src"/>
    <property name="output" value="output"/>

    <target name="main" depends="jar">
        <taskdef name="project" classname="Project" classpath="Project.jar"/>
```

```
        <project dir="${basedir}">
            <include name="**/*.java"/>
        </project>
    </target>

    <target name="compile">
        <mkdir dir="${output}"/>
        <javac srcdir="${src}" destdir="${output}"/>
    </target>

    <target name="jar" depends="compile">
        <jar destfile="Project.jar" basedir="${output}"/>
    </target>

</project>
```

To handle filesets, you extend the `MatchingTask` class. In this example, the code that supports the custom task reads the value assigned to the `dir` attribute and uses the `org.apache.tools.ant.DirectoryScanner` class's `getIncludedFiles( )` method to scan that directory. This method returns an array of filenames, which the code displays. All the support code appears in Example 12-12

Example 12-12. Supporting filesets (ch12/fileset/src/Project.java)

```
import java.io.File;
import org.apache.tools.ant.Task;
import org.apache.tools.ant.BuildException;
import org.apache.tools.ant.DirectoryScanner;
import org.apache.tools.ant.taskdefs.MatchingTask;

public class Project extends MatchingTask
{
    private File directory;

    public void setDir (File directory)
    {
        this.directory = directory;
    }

    public void execute( ) throws BuildException
    {
        DirectoryScanner directoryscanner = getDirectoryScanner(directory);
        String[] files = directoryscanner.getIncludedFiles( );

        for (int loopIndex = 0; loopIndex < files.length; loopIndex++) {
            System.out.println(files[loopIndex]);
        }
    }
}
```

Project.java is the only *.java* file in the project, and that's the file the custom `project` task picks up:

```
C:\ant\ch12\fileset>ant
Buildfile: build.xml

compile:
    [javac] Compiling 1 source file to /home/steven/ant/ch12/fileset/output

jar:
      [jar] Building jar: /home/steven/ant/ch12/fileset/Project.jar

main:
  [project] src/Project.java

BUILD SUCCESSFUL
Total time: 4 seconds
```

Extending `MatchingTask` to support `includes` and `excludes` nested elements, you can make your task support filesets.

12.2.8. Running External Programs

Custom Ant tasks are often wrappers for existing programs. You can launch an external program from tl support code for a custom task if you use the `org.apache.tools.ant.taskdefs.Execute` class. Example 12 13 shows how this works and launches Windows WordPad and opens the project's build file in it.

Example 12-13. Executing external programs (ch12/executetask/src/Project.java)

```
import java.io.IOException;
import org.apache.tools.ant.Task;
import org.apache.tools.ant.taskdefs.Execute;
import org.apache.tools.ant.types.Commandline;

public class Project extends Task
{
    public void execute( )
    {
        Commandline commandline = new Commandline( );
        commandline.setExecutable("C:\\Program Files\\Windows NT\\Accessories\\wordpad.
                                   exe");
          commandline.createArgument( ).setValue("C:\\ant\\ch12\\executetask\\build.xml"

        Execute runner = new Execute( );
        runner.setCommandline(commandline.getCommandline( ));

        try {
            runner.execute( );
        }
```

```
        catch (IOException e) {
            System.out.println(e.getMessage( ));
        }
    }
}
```

In this case, the code creates an `org.apache.tools.ant.types.Commandline` object holding the path and name of the executable to launch, uses the `Commandline` object's `createArgument( ).setValue` method to specify the file to open, and uses the `execute( )` method of the `org.apache.tools.ant.taskdefs.Execute` class to open WordPad.

The build file for this custom task appears in Example 12-14

Example 12-14. Build file for executing external programs (ch12/executetask/build.xml)

```
<?xml  version="1.0"?>
<project basedir="." default="main">

    <property name="src" value="src"/>
    <property name="output" value="output"/>

    <target name="main" depends="jar">
        <taskdef name="project" classname="Project" classpath="Project.jar"/>
        <project/>
    </target>

    <target name="compile">
        <mkdir dir="${output}"/>
        <javac srcdir="${src}" destdir="${output}" />
    </target>

    <target name="jar" depends="compile">
        <jar destfile="Project.jar" basedir="${output}"/>
    </target>

</project>
```

If you run this build file in Windows (after updating the hardcoded paths in the Java code as needed), it' launch WordPad, opening *build.xml* .

12.2.9. Running Scripts

While discussing how to execute external programs, Ant includes an optional task named `script` that can run scripts such as those written in JavaScript. You need *bsf.jar* , from http://jakarta.apache.org/bsf/ (n the IBM version), in the Ant *lib* directory to run this task. You'll need one or more of these *.jar* files, depending on the scripting language you want to use:

jacl.jar and *tcljava.jar*

Resources to run TCL scripts. Get them from http://www.scriptics.com/software/java/.

jruby.jar

Resources to run Ruby scripts. Get this from http://jruby.sourceforge.net/.

js.jar

JAR file for running JavaScript code. Get it from http://www.mozilla.org/rhino/.

judo.jar

Resources to run Judoscript code. Get this from http://www.judoscript.com/index.html.

jython.jar

JAR file to run Python scripts. Get it from http://jython.sourceforge.net/.

netrexx.jar

Resources to run Rexx scripts. Get this from http://www2.hursley.ibm.com/netrexx/ .

The BeanShell JAR files

You need these to run BeanShell scripts. Get them from http://www.beanshell.org/. (Ant 1.6 and later require Beanshell Version 1.3 or later.)

The attributes for the `script` task appear in Table 12-4.

Table 12-4. The script tasks's attributes

Attribute	Description	Require
`language`	Specifies the script's language. Must be a supported Apache BSF language.	Yes
`src`	Specifies the location of the script if it's stored in a file (as opposed to being inline).	No

In `script` , you can access Ant tasks with the *`Name`* `.createTask` method, where *`Name`* is the project's nam
For instance, Example 12-15 shows how to use the `echo` task from JavaScript to display numbers using a
loop. Ant properties are available to your script's code, as in this case, where the `message` property's valu
is displayed.

> You have access to a built-in `project` object in scripts, so, for example, you could find the value of the `message` property as `project.getProperty("message")` .

Example 12-15. Build file for executing JavaScript (ch12/script/build.xml)

```
<project name="js" default="main" basedir=".">

    <property name="message" value="No worries."/>

    <target name="main">

        <script language="javascript"> <![CDATA[

            echo = js.createTask("echo");
            main.addTask(echo);

            for (loopIndex = 1; loopIndex <= 10; loopIndex++) {
                echo.setMessage(loopIndex);
                echo.execute( );
            }
            echo.setMessage(message);
        ]]> </script>

    </target>
</project>
```

Here's what this build file looks like at work, where JavaScript is executing the Ant `echo` task. Cool.

```
%ant
Buildfile: build.xml

main:
     [echo] 1
     [echo] 2
     [echo] 3
     [echo] 4
     [echo] 5
     [echo] 6
     [echo] 7
     [echo] 8
```

```
     [echo] 9
     [echo] 10
     [echo] No worries.

BUILD SUCCESSFUL
Total time: 1 second
```

Want to work with Ant types like filesets in script? Use the `project` object's `createDataType( )` method. Here's an example that creates Java `File` objects from a fileset, all in JavaScript:

```
importClass(java.io.File);

fileset = project.createDataType("fileset");
fileset.setDir(new File(dir));
fileset.setIncludes(includes);

directoryscanner = fileset.getDirectoryScanner(project);
files = directoryscanner.getIncludedFiles( );

for (loopIndex=0; loopIndex < files.length; loopIndex++) {
    var filename = files[loopIndex];
    var file = new File(fileset.getDir(project), filename);
}
```

12.3. Creating Custom Listeners

Ant tracks build events, such as when tasks start and finish, and you can catch those events with a *listener*. Listeners implement the `org.apache.tools.antBuildListener` interface and will receive `BuildEvents` for these events:

- Build started
- Build finished
- Target started
- Target finished
- Task started
- Task finished
- Message logged

To add a listener in code, you can create an ant `Project` object and then call its `addBuildListener( )` method to add a listener to the project. You can attach a listener to a build from the command line as in this example:

```
ant -listener org.apache.tools.ant.XmlLogger
```

which runs Ant with a listener that generates an XML version of the build progress.

> Listeners and loggers must not access `System.out` and `System.err` because output on these streams is redirected by Ant's core to the build event system. In other words, accessing these streams may cause an infinite loop.

To implement the listener interface, you implement methods such as `buildStarted( )`, `buildFinished( )`, `targetStarted( )`, and so on. In *SoundListener.java*, shown in Example 12-16, the listener code uses the `org.apache.tools.ant.taskdefs.optional.sound.AntSoundPlayer` class to play a sound when the build is finished. The `addBuildSuccessfulSound(java.io.File file`, `int loops`, `java.lang.Long duration)` method is used to add a sound to play for build success, and `addBuildFailed-Sound(java.io.File fileFail`, `int loopsFail`, `java.lang.Long duration)` to add a sound indicating build failure. In the listener's `buildFinished( )` method, the sound player's `buildFinished( )` method is called to play the sound.

> If you run this example, substitute your own local filenames for *file1.wav* and *file2.wav* in *SoundListener.java*. The `AntSoundPlayer` can play sound files in *.wav* and *.aiff* format.

Example 12-16. A new listener (ch12/listener/SoundListener.java)

```
import java.io.File;
import org.apache.tools.ant.BuildEvent;
import org.apache.tools.ant.BuildListener;
import org.apache.tools.ant.taskdefs.optional.sound.AntSoundPlayer;

public class SoundListener implements BuildListener
{
    AntSoundPlayer soundplayer = new AntSoundPlayer( );

    public SoundListener( )
    {
         soundplayer.addBuildSuccessfulSound(new File("file1.wav"), 1,
            new Long(500));

         soundplayer.addBuildFailedSound(new File("file2.wav"), 1, new Long(500));
    }

    public void buildStarted(BuildEvent event) {}

    public void buildFinished(BuildEvent event)
    {
        soundplayer.buildFinished(event);
    }

    public void targetStarted(BuildEvent event) {}

    public void targetFinished(BuildEvent event) {}

    public void taskStarted(BuildEvent event) {}

    public void taskFinished(BuildEvent event) {}

    public void messageLogged(BuildEvent event) {}
}
```

To build this listener, include *ant-jmf.jar* in the classpath to pick up `AntSoundPlayer`. Here's the file this example builds, *Project.java*:

```
public class Project
{
    public void execute( )
    {
```

```
        System.out.println("No worries.");
    }
}
```

Here's the build file. Nothing special.

```
<?xml  version="1.0"?>
<project basedir="." default="main">

    <property name="src" value="src"/>
    <property name="output" value="output"/>

    <target name="main" depends="jar">
        <taskdef name="project" classname="Project" classpath="Project.jar"/>
        <project/>
    </target>

    <target name="compile">
        <mkdir dir="${output}"/>
        <javac srcdir="${src}" destdir="${output}"/>
    </target>

    <target name="jar" depends="compile">
        <jar destfile="Project.jar" basedir="${output}"/>
    </target>

</project>
```

To attach the listener to the build, run Ant this way:

```
%ant -listener SoundListener
```

If the build finishes successfully, you'll hear the sound you've added for a build; otherwise, you'll hea the sound you've set for failure.

> Want to know what task or target fired a build event? Use the`BuildEvent` object's `getTask( )` or `getTarget( )` methods, in which a `BuildEvent` object is passed to each listener method.

12.4. Creating Custom Loggers

You can handle build events with custom loggers as well if you extend the Ant`DefaultLogger` class. Example 12-17 shows a logger that will log each task as it's executed. Like listeners, loggers must not access `System.out` and `System.err` directly, so to display messages to the standard out device, this code uses the Ant `log( )` method (which defaults to standard out).

Example 12-17. A new logger (ch12/logger/ProjectLogger.java)

```
import org.apache.tools.ant.BuildEvent;
import org.apache.tools.ant.DefaultLogger;
import org.apache.tools.ant.util.StringUtils;

public class ProjectLogger extends DefaultLogger
{
    public void taskStarted(BuildEvent event)
    {
        String text = "Running task " + event.getTask( ).getTaskName( )
            + StringUtils.LINE_SEP;
        printMessage(text, out, event.getPriority( ));
        log(text);
    }
}
```

For this example, use a simple custom task:

```
public class Project
{
    public void execute( )
    {
        System.out.println("No worries.");
    }
}
```

Here's the build file:

```
<?xml  version="1.0"?>
<project basedir="." default="main">

    <property name="src" value="src"/>
    <property name="output" value="output"/>

    <target name="main" depends="jar">
```

```
        <taskdef name="project" classname="Project" classpath="Project.jar"/>
        <project/>
    </target>

    <target name="compile">
        <mkdir dir="${output}"/>
        <javac srcdir="${src}" destdir="${output}"/>
    </target>

    <target name="jar" depends="compile">
        <jar destfile="Project.jar" basedir="${output}"/>
    </target>

</project>
```

When you execute this build file with the custom logger, each task will be displayed as it's executed. To attach the logger to the build, use this command line:

```
%ant -logger ProjectLogger
```

When the build runs, you'll see each task logged like this:

```
%ant -logger ProjectLogger
Buildfile: build.xml
Running task property

Running task property

compile:
Running task mkdir

     [mkdir] Created dir: C:\ant\ch12\logger\output
Running task javac

     [javac] Compiling 1 source file to C:\ant\ch12\logger\output

jar:
Running task jar

       [jar] Building jar: C:\ant\ch12\logger\Project.jar

main:
Running task taskdef

Running task project

  [project] No worries.

BUILD SUCCESSFUL
Total time: 3 seconds
```

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12.5. Creating Custom Filters

You can implement custom Ant filters. To do that, you can extend Ant classes like `org.apache.tools.ant.filters.BaseParamFilterReader` . If you want your filter to be chainable, impleme the `org.apache.tools.ant.filters.ChainableReader` interface.

Example 12-18 shows how to write a filter. In this example, the code reads each line of a Java file using the `read( )` method and adds a Java single-line comment, `//` , at the beginning of each line. When the code reaches the end of the file, it returns a value of `-1` to quit.

Example 12-18. A new filter (ch12/filter/src/ProjectFilter.java)

```
import java.io.Reader;
import java.io.IOException;
import org.apache.tools.ant.filters.ChainableReader;
import org.apache.tools.ant.filters.BaseParamFilterReader;

public final class ProjectFilter extends BaseParamFilterReader implements ChainableReade
{
    String data = null;

    public ProjectFilter( )
    {
        super( );
    }

    public ProjectFilter(final Reader reader)
    {
        super(reader);
    }

    public final Reader chain(final Reader reader)
    {
        ProjectFilter filter = new ProjectFilter(reader);
        filter.setInitialized(true);
        return filter;
    }

    public final int read( ) throws IOException
    {
        int leadChar = -1;

        if(data != null) {
            leadChar = data.charAt(0);
            data = data.substring(1);
            if(data.length( ) == 0) {
```

```
                data = null;
            }
        }
        else {
            data = readLine( );

            if(data == null) {
                leadChar = -1;
            }
            else {
                data = "// " + data;
                return read( );
            }
        }
        return leadChar;
    }
}
```

You can see how to use this new filter in the build file in Example 12-19 . This build file copies all *.java* files in the project, comments out each line, and stores the result in a directory named *commented* .

Example 12-19. Build file for the new filter (ch12/filter/build.xml)

```
<?xml  version="1.0"?>
<project basedir="." default="main">

    <property name="src" value="src"/>
    <property name="output" value="output"/>
    <property name="commented" value="commented"/>

    <target name="main" depends="jar">
        <copy todir="${commented}">
            <fileset dir="${src}" includes="**/*.java"/>
            <filterchain>
                <filterreader
                  classname="ProjectFilter"
                  classpath="Project.jar"/>
            </filterchain>
        </copy>
    </target>

    <target name="compile">
        <mkdir dir="${output}"/>
        <mkdir dir="${commented}"/>
        <javac srcdir="${src}" destdir="${output}"/>
    </target>

    <target name="jar" depends="compile">
        <jar destfile="Project.jar" basedir="${output}"/>
    </target>
```

```
</project>
```

When you run this build file, every line in the copied *Project.java* file is commented out when filtered and copied:

```
// import java.io.Reader;
// import java.io.IOException;
// import org.apache.tools.ant.filters.ChainableReader;
// import org.apache.tools.ant.filters.BaseParamFilterReader;
//
// public final class ProjectFilter extends BaseParamFilterReader implements
ChainableReader
// {
//     String data = null;
        .
        .
        .
```

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12.6. Creating Custom Selectors

Writing custom Ant selectors is possible if you extend a class like `org.apache.tools.ant.types.selectors.BaseExtendSelector`. In code, selectors are passed `File` objects and return true or false depending on whether or not a file is acceptable. Say, for example, that you want to copy files less than a megabyte in length. Example 12-20 shows a selector that tests file length and returns true if the file is OK, false otherwise.

Example 12-20. A new selector (ch12/selector/src/ProjectSelector.java)

```
import java.io.File;
import org.apache.tools.ant.BuildException;
import org.apache.tools.ant.types.selectors.BaseExtendSelector;

public class ProjectSelector extends BaseExtendSelector
{
    public boolean isSelected(File basedir, String filename, File file)
    throws BuildException
    {
        if(file.length( ) < 1024 * 1024){
            return true;
        }
        else {
            return false;
        }
    }
}
```

Example 12-21 is a build file that uses this new selector when copying files; in particular, it copies over its own source code to a directory named *sizeOK*.

Example 12-21. Build file for the new selector (ch12/selector/build.xml)

```
<?xml version="1.0" ?>
<project basedir="." default="main">

    <property name="src" value="src"/>
    <property name="output" value="output"/>
    <property name="sizeOK" value="sizeOK"/>

    <target name="main" depends="jar">

        <copy todir="${sizeOK}">
```

```
            <fileset dir="${src}">
                <selector>
                    <custom classname="ProjectSelector" classpath="Project.jar"/>
                </selector>
            </fileset>
        </copy>

    </target>

    <target name="compile">
        <mkdir dir="${output}"/>
        <mkdir dir="${sizeOK}"/>
        <javac srcdir="${src}" destdir="${output}"/>
    </target>

    <target name="jar" depends="compile">
        <jar destfile="Project.jar" basedir="${output}"/>
    </target>

</project>
```

Here's what you see when you run this build file:

```
%ant
Buildfile: build.xml

compile:
     [mkdir] Created dir: /home/steven/ant/ch12/selector/output
     [mkdir] Created dir: /home/steven/ant/ch12/selector/writeable
     [javac] Compiling 1 source file to /home/steven/ant/ch12/selector/output

jar:
       [jar] Building jar: /home/steven/ant/ch12/selector/Project.jar

main:
      [copy] Copying 1 file to /home/steven/ant/ch12/selector/sizeOK

BUILD SUCCESSFUL
Total time: 3 seconds
```

In this case, the code only copies files less than a megabyte in length, but custom seletors like this can select on anything, e.g., file creation date, read/write status, filename, and so on.

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12.7. Creating New Types

When creating new tasks, it's sometimes useful to create new datatypes to be used by those tasks. In this example, I'll create a new datatype that extends the Ant`FileList` type and interfaces easily to attributes in a custom task.

This example centers around a new data type, `ProjectType`, which extends the Ant `FileList` class. To use that data type, I'll develop a new custom task, `projectTask`, that supports nested elements named `multiFile`, each of which supports an attribute named `files`. You can set the `files` attribute to a string containing multiple file-names such as "ed.txt george.txt", and the code will create an object of a custom data type, `ProjectType`, to contain that list of files.

Example 12-22 holds the code for the new datatype, `ProjectType`, which extends the `org.apache.tools.ant.types.FileList` class. In this example, the code simply passes the list of files on back to the `FileSet` base class, but you can adapt this code to handle the list of files any way you want.

Example 12-22. The new data type (ch12/type/src/ProjectType.java)

```
package data;

import org.apache.tools.ant.types.FileList;

public class ProjectType extends FileList
{
    public void setFiles(String files)
    {
        super.setFiles(files);
    }
}
```

The build file for the custom task appears in Example 12-23; the nested `multiFile` element's `files` attribute takes the list of files that will be stored in internal filelist of the object of the custom data type.

Example 12-23. Build file for the datatype example (ch12/type/build.xml

```
<?xml version="1.0" ?>
<project basedir="." default="main">

    <property name="src" value="src"/>
    <property name="output" value="output"/>
```

```
    <target name="main" depends="jar">

    <taskdef name="projectTask" classname="ProjectTask" classpath="Project.jar" />

        <projectTask>
            <multiFile dir="src" files="ed.txt george.txt"/>
        </projectTask>
    </target>

    <target name="compile">
        <mkdir dir="${output}"/>
        <javac srcdir="${src}" destdir="${output}"/>
    </target>

    <target name="jar" depends="compile">
        <jar destfile="Project.jar" basedir="${output}"/>
    </target>

</project>
```

ProjectTask.java, which implements the `projectTask` task and uses the new datatype, appears in Example 12-24.

Example 12-24. Task that uses the new type (ch12/type/src/ProjectTask.java)

```
import data.ProjectType;
import org.apache.tools.ant.Task;
import org.apache.tools.ant.BuildException;

public class ProjectTask extends Task
{
    ProjectType multiFile = null;

    public void execute( ) throws BuildException
    {
        String[] files = multiFile.getFiles(getProject( ));

         for(int loopIndex = 0; loopIndex < files.length; loopIndex++)
        {
            System.out.println(files[loopIndex]);
        }
    }

    public ProjectType createMultiFile( )
    {
        multiFile = new ProjectType( );
        return multiFile;
    }
```

```
}
```

Here's how it works. *ProjectTask.java* handles the nested `multiFile` element with a `createMultiFile( )` method, which creates a new object of the `ProjectType` class (our custom data type, based on the `FileList` class):

```
    ProjectType multiFile = null;
        .
        .
        .
    public ProjectType createMultiFile( )
    {
        multiFile = new ProjectType( );
        return multiFile;
    }
```

The `setFiles( )` method in the custom data type's support code creates a filelist from the list of files in the `multiFile` element's `files` attribute:

```
    public void setFiles(String files)
    {
        super.setFiles(files);
    }
```

The files are now stored in the new datatype object named `multiFile`. When the task executes, it will display their names, using that object:

```
    public void execute( ) throws BuildException
    {
        String[] files = multiFile.getFiles(getProject( ));

        for(int loopIndex = 0; loopIndex < files.length; loopIndex++)
        {
            System.out.println(files[loopIndex]);
        }
    }
```

When this build file executes, the custom task creates a new object of the custom datatype and displays the files in it:

```
%ant
Buildfile: build.xml

compile:
    [javac] Compiling 3 source files to /home/steven/ant/ch12/type/output

jar:
      [jar] Building jar: /home/steven/ant/ch12/type/Project.jar
```

```
main:
[projectTask] ed.txt
[projectTask] george.txt

BUILD SUCCESSFUL
Total time: 3 seconds
```

Customizing data types for use with custom tasks can be a powerful technique as you develop and extend Ant to better fulfill your needs.

Colophon

Our look is the result of reader comments, our own experimentation, and feedback from distribution channels. Distinctive covers complement our distinctive approach to technical topics, breathing personality and life into potentially dry subjects.

The animal on the cover of Ant: The Definitive Guide, Second Edition, is a horned lizard. There are 13 species of the horned lizard in North America. Horned lizards prefer a dry, warm climate, such as the desert or a dry woodland, and they can be found in Texas, Oklahoma, Kansas, and New Mexico. Adults grow to 3-5 inches. They depend on their environment to control their body temperature, and use burrows and shade to prevent overheating. The horned lizard has a wide, flat body ideal for desert camouflage, and a short neck and short legs. It has spines on its body and prominent horns on its head. It is also known as the horny "toad."

Despite the horned lizards' fierce appearance, they are not aggressive. Their primary diet consists of ants, although they sometimes eat beetles, grasshoppers, and other insects, which they catch with their long tongues. The horned lizards' first line of defense from predators is their camouflage, but they are also known to hiss and inflate their bodies to appear more intimidating. As a last resort, the have the ability to squirt blood from the corners of their eyes in an attempt to confuse attackers. In Texas and Oklahoma, horned lizards are considered a threatened species. It is illegal to possess a horned lizard without a scientific permit.

Matt Hutchinson was the production editor for Ant: The Definitive Guide, Second Edition . GEX, Inc. provided production services. Mary Brady, Sanders Kleinfeld, and Darren Kelly provided quality control.

Hanna Dyer designed the cover of this book, based on a series design by Edie Freedman. The cover image is a 19th-century engraving from the Dover Pictorial Archive. Karen Montgomery produced the cover layout with Adobe InDesign CS using Adobe's ITC Garamond font.

David Futato designed the interior layout. This book was converted by Keith Fahlgren to FrameMaker 5.5.6 with a format conversion tool created by Erik Ray, Jason McIntosh, Neil Walls, and Mike Sierra that uses Perl and XML technologies. The text font is Linotype Birka; the heading font is Adobe Myria Condensed; and the code font is LucasFont's TheSans Mono Condensed. The illustrations that appear in the book were produced by Robert Romano, Jessamyn Read, and Lesley Borash using Macromedia FreeHand MX and Adobe Photoshop CS. The tip and warning icons were drawn by Christopher Bing. This colophon was written by Colleen Gorman.

The online edition of this book was created by the Digital Books production group (John Chodacki, Ken Douglass, and Ellie Cutler) using a set of Frame-to-XML conversion and cleanup tools written anc maintained by Erik Ray, Benn Salter, John Chodacki, Ellie Cutler, and Jeff Liggett.

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