

Supplement I.2: NetBeans 4.0 Tutorial

For Introduction to Java Programming, 5E

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This supplement covers the following topics:

- Getting Started with NetBeans (§1)
- Creating a Project (§2)
- Creating a Class (§3)
- Compiling a Class (§4)
- Running a Java Application (§5)
- Running Book Examples (§6)
- Using Compact Windows Mode vs. Separate Windows Mode (§7)
- Getting Help in NetBeans (§8)
- Forcing a Program to Terminate (§9)
- Using Packages (§10)
- Run Java Applications from the Command Line (§11)
- Debugging in NetBeans (§12)
- Creating and Running Java Applets (§13)

NOTE: To use this supplement with the text, you may cover Sections 1 - 11 in this supplement after Chapter 1 in the text, cover Section 12 in this supplement after Chapter 2 in the text, and cover Section 13 in this supplement at the beginning of Chapter 14 in the text.

0 Introduction

This tutorial is for students who are currently taking a Java course using NetBeans with Introduction to Java Programming, 5E.

You can use the JDK command line utility to write Java programs. The JDK command line utility consists of a set of separate programs, such as compiler and interpreter, each of which is invoked from a command line. Besides the JDK command line utility, there are more than a dozen Java development tools on the market today, including Borland JBuilder, NetBeans, Sun ONE Studio (a commercial version of NetBeans), Eclipse, and WebGain Visual Café. These tools support an *integrated development environment* (IDE) for rapidly developing Java programs. Editing, compiling, building, debugging, and online help are integrated in one

graphical user interface. Using these tools effectively will greatly increase your programming productivity.

This brief tutorial will help you to become familiar with NetBeans 4.0. Specifically, you will learn how to create projects, create programs, compile, run, and debug programs.

NOTE: NetBeans can run on any platform with a Java Virtual Machine. The screen shots in the tutorial are taken from Windows using NetBeans 4.0. You can download NetBeans 4.0 from www.netbeans.org.

INSTALLATION NOTE: You must install JDK 1.5 or JDK 1.4 before installing NetBeans. JDK 1.5 can be downloaded from <http://java.sun.com/j2se/1.5/download.html>.

1 Getting Started with NetBeans

Assume that you have successfully installed NetBeans on your machine. Start NetBeans from Windows, Linux, or Solaris. The NetBeans main window appears, as shown in Figure 1.

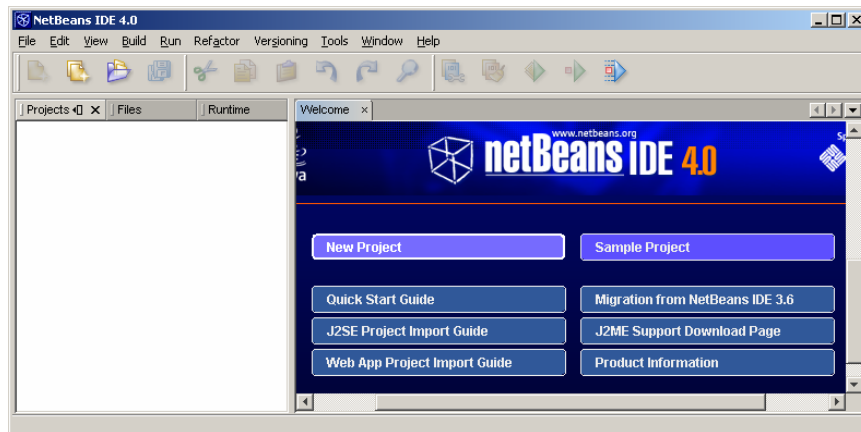


Figure 1

The NetBeans main window is the command center for the IDE.

The NetBeans main window contains menus, toolbars, project pane, files pane, runtime pane, output pane, and other panes.

1.1 The Main Menu

The main menu is similar to that of other Windows applications and provides most of the commands you need to use NetBeans, including those for creating, editing, compiling, running, and debugging programs. The menu items

are enabled and disabled in response to the current context.

1.2 The Toolbar

The toolbar provides buttons for several frequently used commands on the menu bar. The toolbars are enabled and disabled in response to the current context. Clicking a toolbar is faster than using the menu bar. For many commands, you also can use function keys or keyboard shortcuts. For example, you can save a file in three ways:

- Select File, Save from the menu bar.
- Click the "save" toolbar button (📁).
- Use the keyboard shortcut Ctrl+S.

TIP: You can display a label known as *ToolTip* for a toolbar button by pointing the mouse to the button without clicking.

1.3 Workspaces

A workspace is a collection of windows that are pertinent to performing certain types of operations, such as editing, execution, output, or debugging. The workspace windows can be displayed from the Window menu.

2 Creating a Project

A project contains information about programs and their dependent files, and it also stores and maintains the properties of the IDE. To create and run a program, you have to first create a project.

NOTE: NetBeans 4.0 manages projects differently from the previous versions of NetBeans. The projects in NetBeans 4.0 are created differently from the previous versions.

Here are the steps to create a demo project:

1. Choose *File, New Project* to display the New Project dialog box, as shown in Figure 2.
2. Select General in the Categories section and Java Application in the Projects section and click *New* to display the New Java Application dialog box, as shown in Figure 3.
3. Type demo in the Project Name field and c:\michael in Project Location field.

- (Optional) You can create classes after a project is created. Optionally you may also create the first class when creating a new project. To do so, check the *Create Main Class* box and type a class name, say First, as the Main Class name. (NOTE: Due to an error in NetBeans, the template file may contain the package statement `package Templates.Classes`, delete this line.)
- Click *Finish* to create the project. The new project is displayed, as shown in Figure 4.

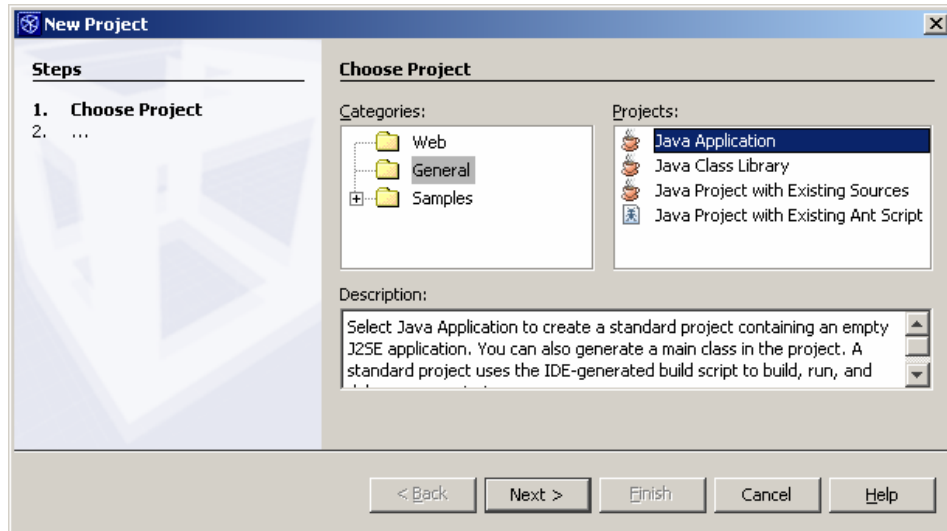


Figure 2

The New Project dialog box enables you to specify a project type.

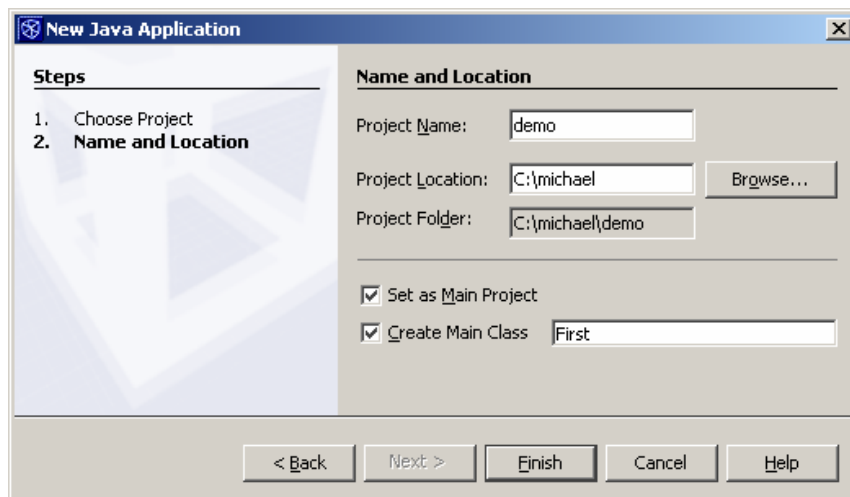


Figure 3

The New Java Application prompts you to enter a project name, location, and a main class name.

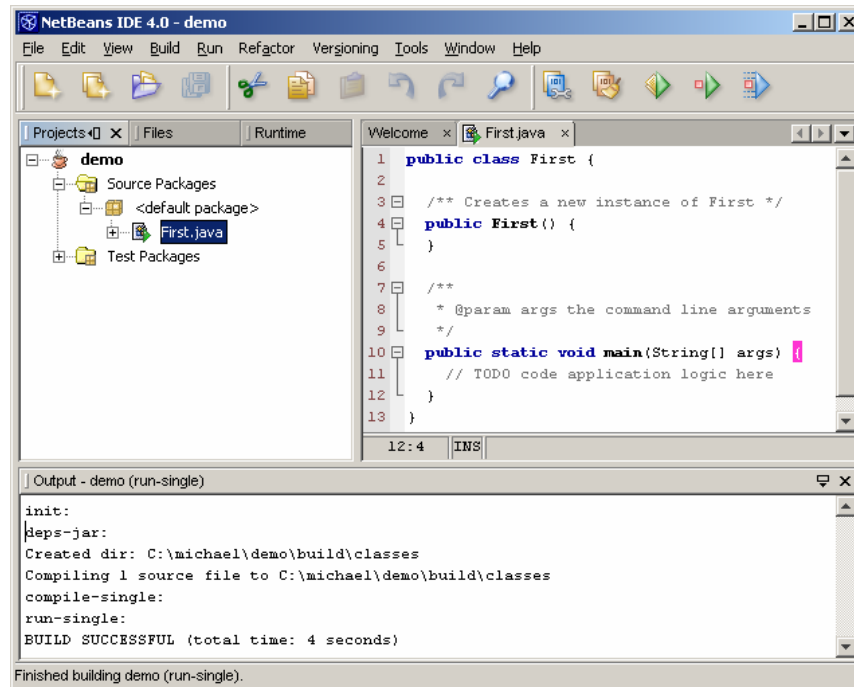


Figure 4

A new demo project is created.

3 Creating a Class

You can create any number of classes in a project. Here are the steps to create `Welcome.java` in Listing 1.1 from the text on page 20 in the demo project.

1. Right-click the top demo node in the project pane to display a context menu, as shown in Figure 5. Choose *New, Java Class* to display the New Java Class dialog box, as shown in Figure 6.
2. Type `Welcome` in the Class Name field and select the Source Packages in the Location field. Leave the Package field blank. This will create a class in the default package. (Note that it is not recommended to use the default package, but it is fine to use the default package to match the code in the book. Using default package is appropriate for new Java students. Section 10, "Using Packages," will introduce how to create a class in a non-default package.)
3. Click *Finish* to create the `Welcome` class, as shown in Figure 7. The source code file `Welcome.java` is placed under the `<default package>` node, because you did not

- specify a package name for the class in Figure 6.
4. Modify the code in the Welcome class to match Listing 1.1.

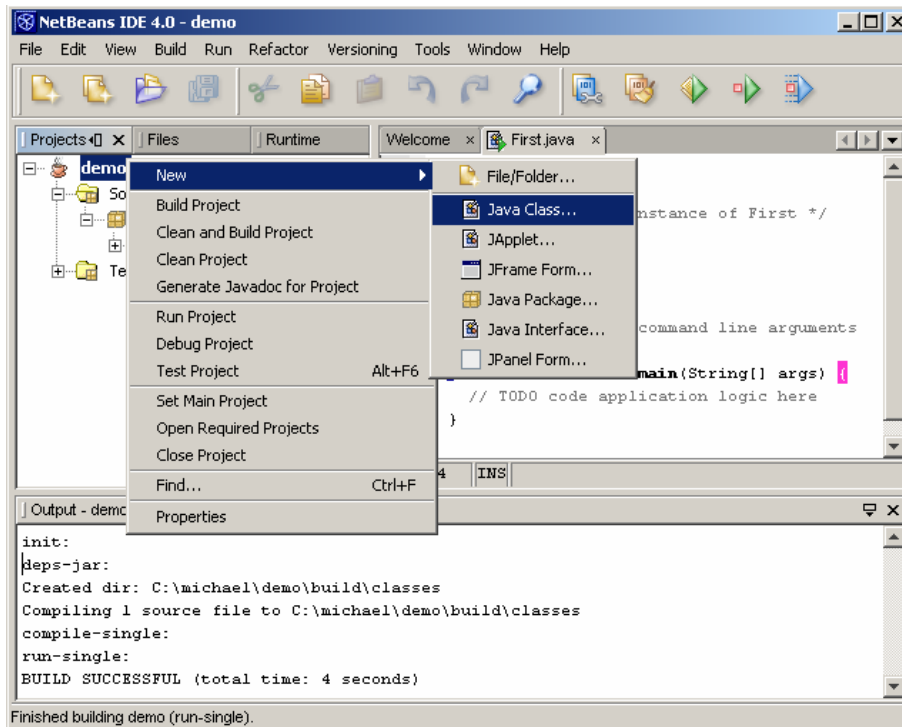


Figure 5

You can create a new class in a project.

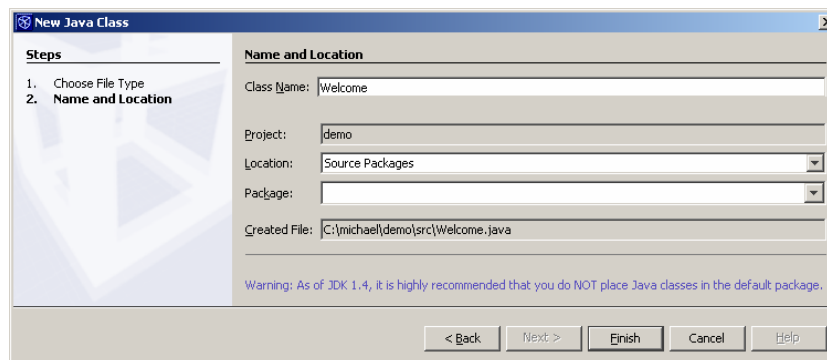


Figure 6

The New Java Class dialog box enables you to specify a class name, location, and package name to create a new class.

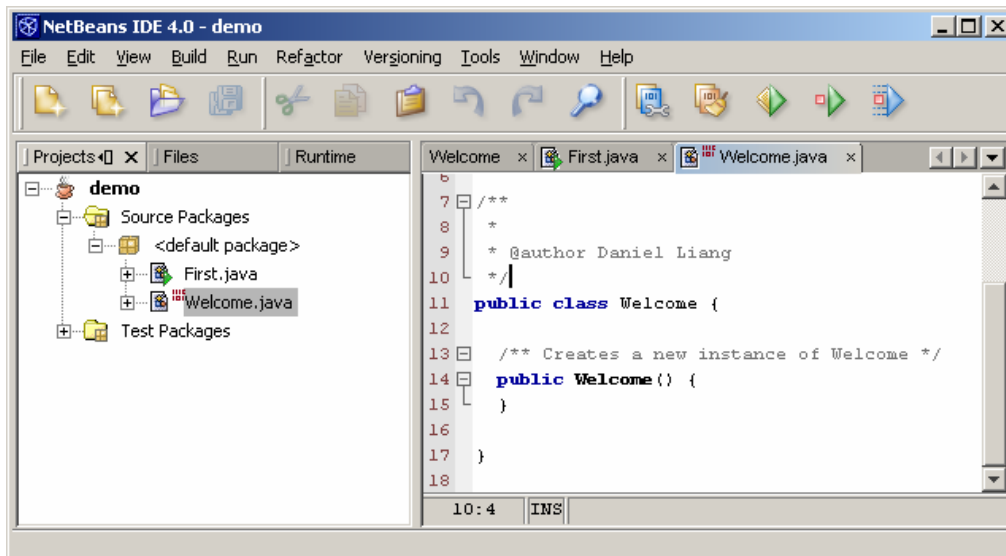


Figure 7

A new Java class is created in the project.

TIP

You can show line numbers in the Source Editor by choosing *View, Show Line Numbers* from the main menu.

NOTE

The source file `Welcome.java` is stored in `c:\michael\demo\src`.

4 Compiling a Class

To compile `Welcome.java`, right-click `Welcome.java` to display a context menu and choose *Compile File*, or simply press F9, as shown in Figure 8.

The compilation status is displayed in the Output pane, as shown in Figure 9. If there are no syntax errors, the *compiler* generates a file named `Welcome.class`, which is stored in `c:\michael\demo\build\classes`.

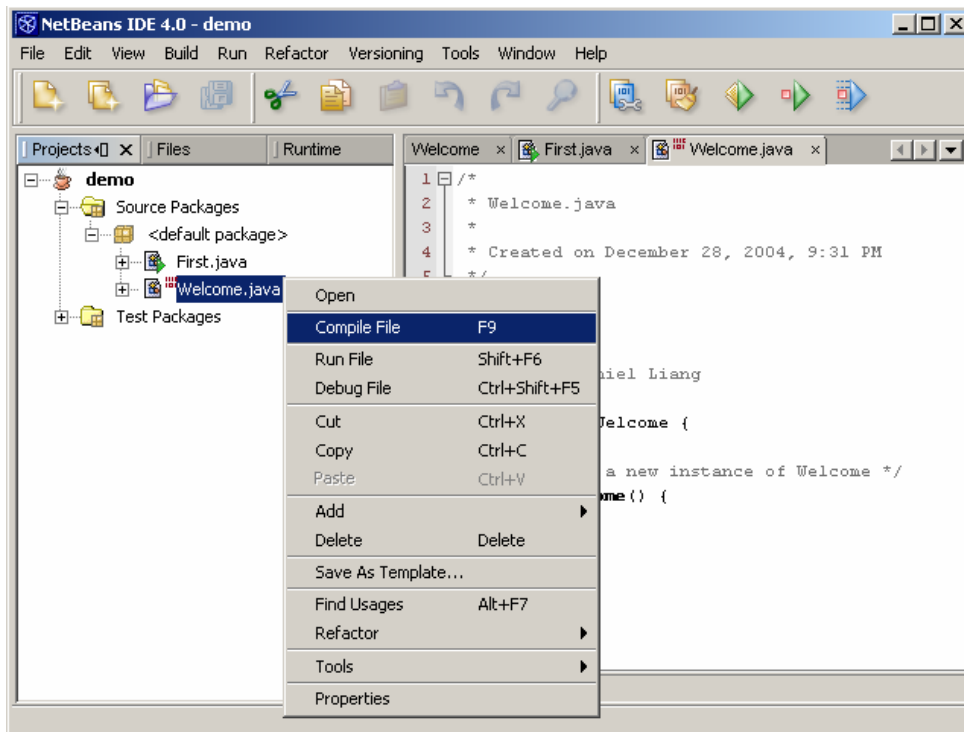


Figure 8

The Compile File command in the context menu compiles a source file.

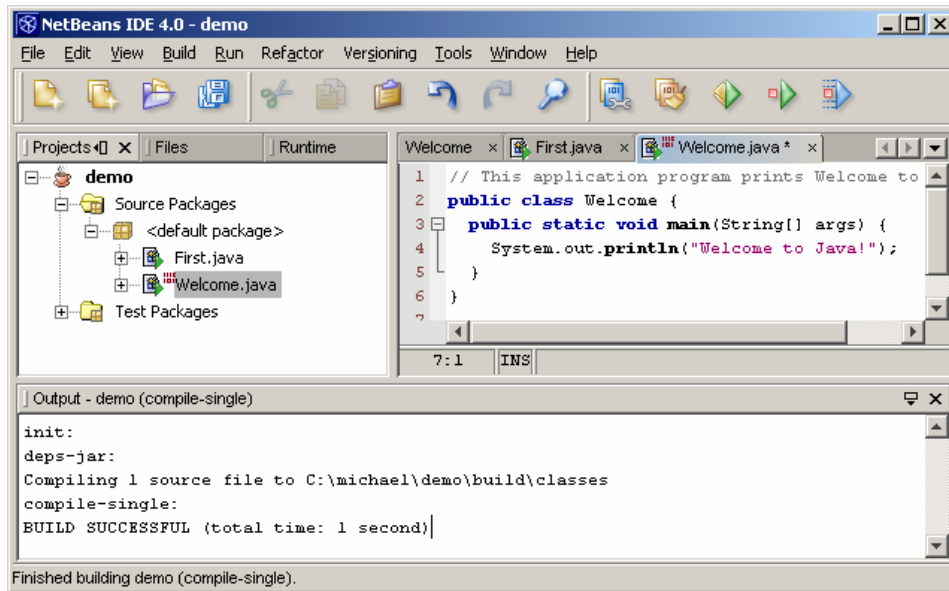





Figure 9

The compilation status is shown in the output pane.

NOTE: When you compile the file, it will be automatically saved.

NOTE: The icon for Java source code is . A Java source code may have an additional icon , which indicates that the file is not compiled. If the class has a main method, the icon is  after the class is compiled.

TIP: You can get descriptions of the node icons from NetBeans Help. Choose *Help, Help Contents* from the main window, and type Node Icons under the Search tab to display the descriptions for the icons, as shown in Figure 10.

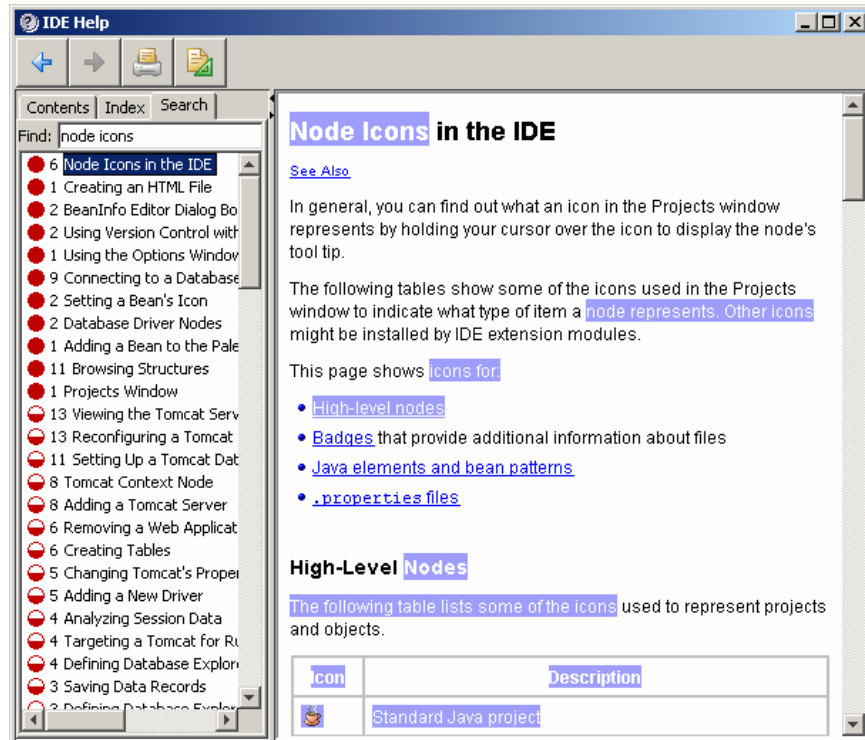


Figure 10

You can get descriptions of the node icons in the project pane from NetBeans Help.

5 Running a Java Application

To run **Welcome.java**, right-click **Welcome.java** to display a context menu and choose *Run File*, or simply press Shift + F6, as shown in Figure 11. The output is displayed in the Output pane, as shown in Figure 12.

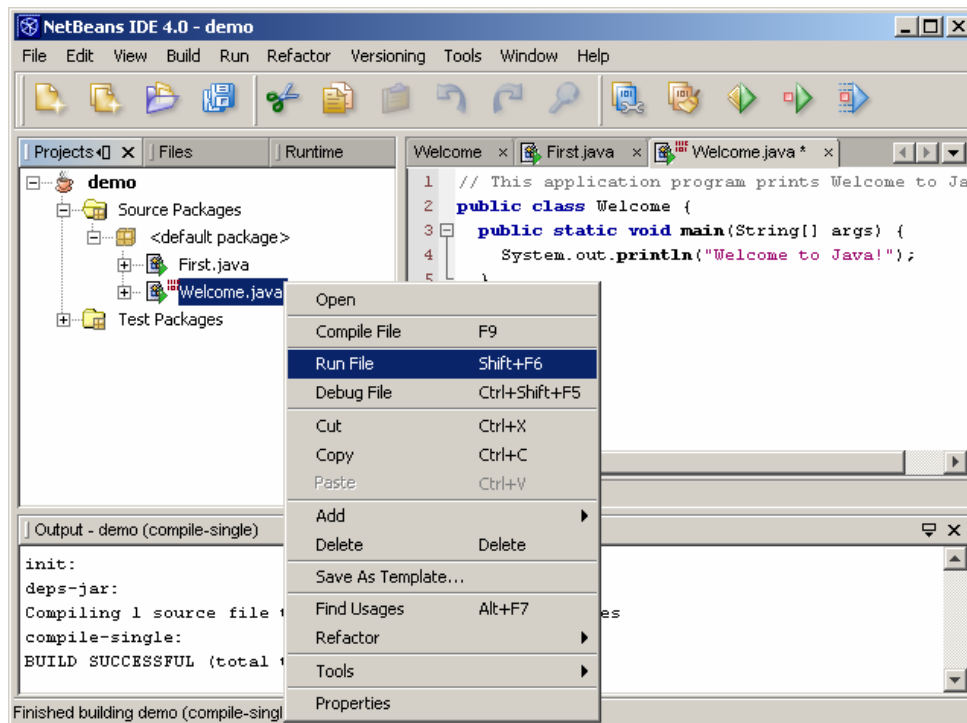


Figure 11

The Run File command in the context menu runs a Java program.

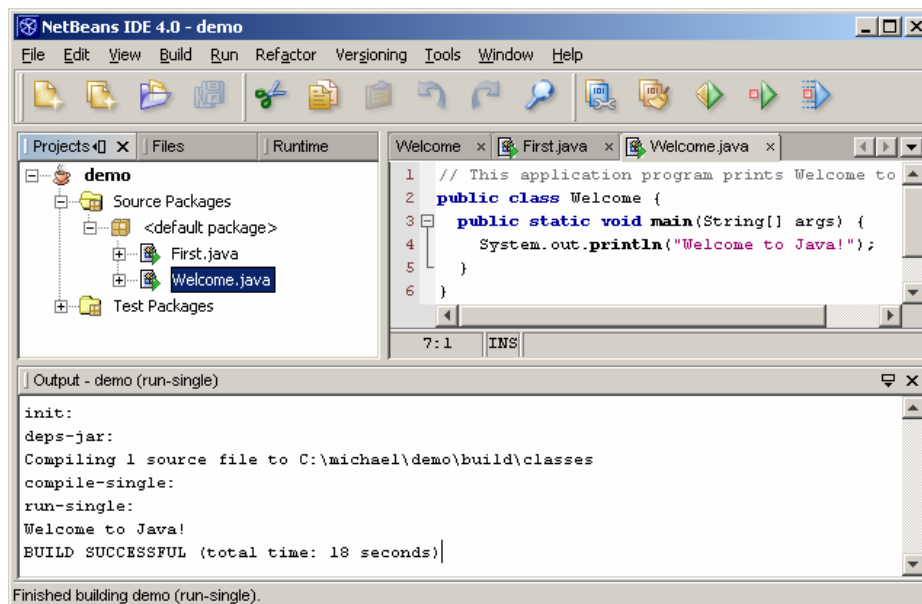


Figure 12

The execution result is shown in the Output pane.

NOTE: The *Run File* command invokes the *Compile File* command if the program is not compiled or was modified after the last compilation.

6 Running Book Examples

All the examples in the text can be downloaded from the book's Web site. To run them, store the source code files into `c:\michael\demo\src`. You will see the Java source code files appearing under the `<default package>` node, as shown in Figure 13. For example, to run `AnimationDemo.java` in Listing 12.7 in Chapter 12, "Event-Driven Programming," select `AnimationDemo.java` in the project pane and press `Shift + F6`.

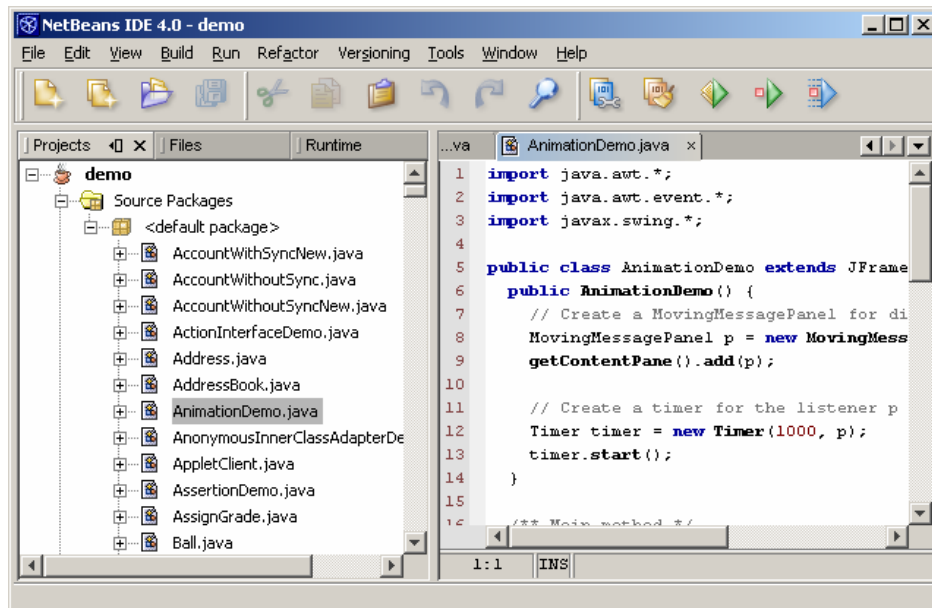


Figure 13

You can run the examples in the text from the demo project.

If the program (e.g., `TextAreaDemo.java` in Listing 13.7 in Chapter 13) uses resources (e.g., image, audio, text), you have to set the project working directory to the resource directories. Suppose you place the image files under `c:\michael\demo\build\classes`, here are the steps to set the working directory:

1. Right-click the demo project node to display a context menu and choose Properties, as shown in Figure 14.
2. Select Running Project in the left section of the project properties dialog box, as shown in Figure 15. Enter `C:\michael\demo\build\classes` in the Working Directory field.

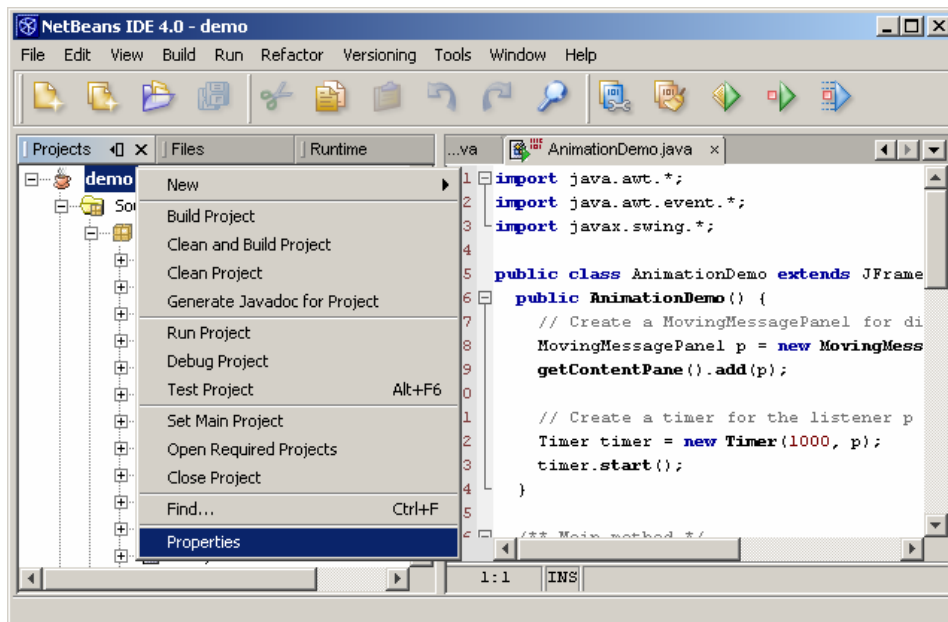


Figure 14

You can display Project Properties from the context menu of the project node.

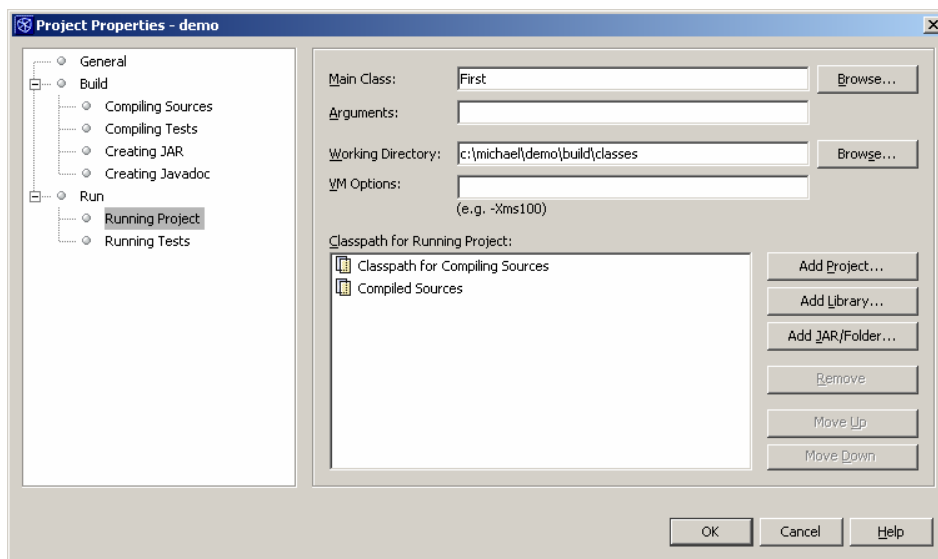


Figure 15

You can set properties for the project in the project properties dialog box.

7 Using Compact Windows Mode vs. Separate Windows Mode

By default, the NetBeans IDE uses the compact windows mode, which confines all supplementary windows inside the main window. You can also use the separate windows mode, which

display floatable windows for project pane, editor pane, output pane, and so on.

To set up a new interface, choose *Tools, Setup Wizard* to display the Setup wizard, as shown in Figure 16. To use the separate windows mode, select *Separate Windows Mode*. Click *Finish* to switch to the new interface, as shown in Figure 17.

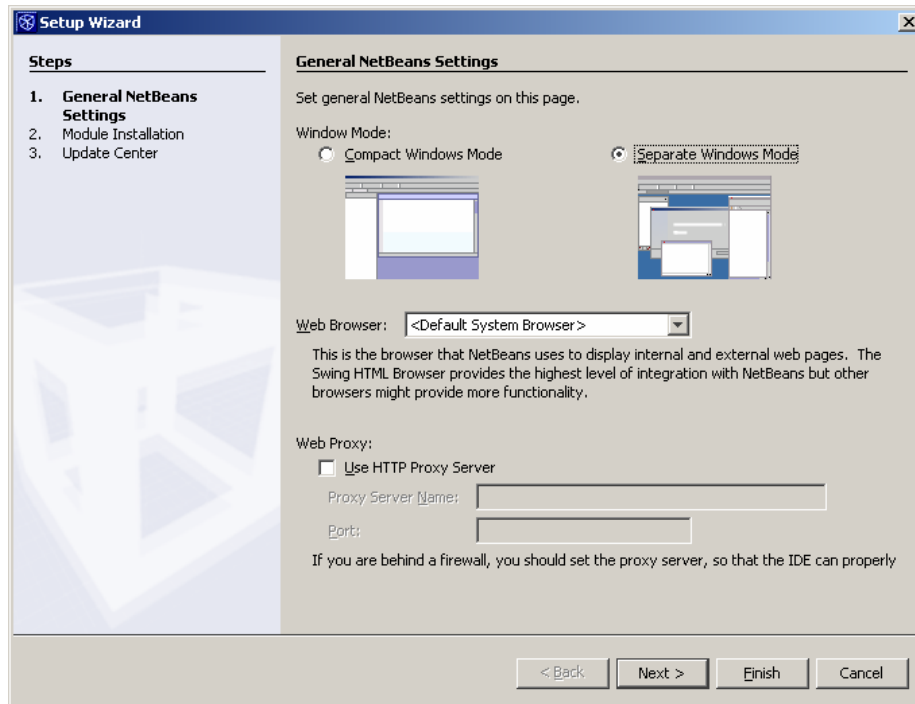


Figure 16

You can set up a new IDE interface from the Setup wizard.

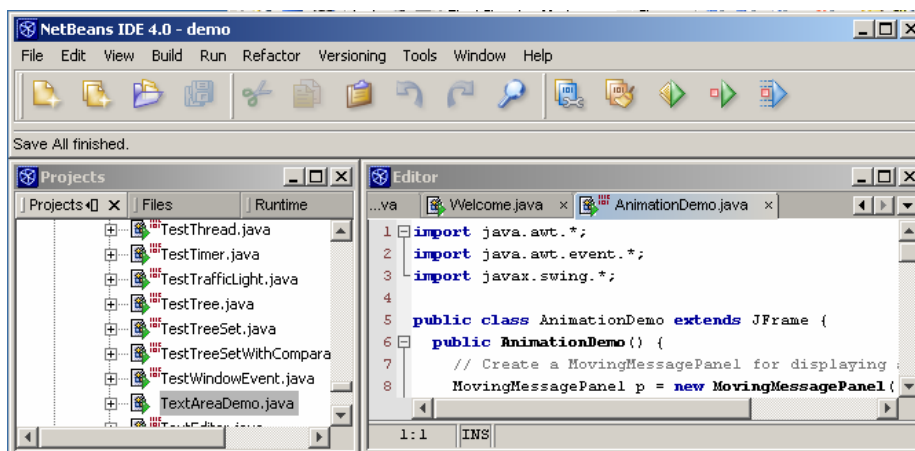


Figure 17

You can use the separate windows mode interface in NetBeans.

8 NetBeans's Online Help

NetBeans provides a large number of documents online, giving you a great deal of information on a variety of topics pertaining to the use of NetBeans.

To access online help, choose *Help*, *Help Contents* to display NetBeans Help, as shown in Figure 18.

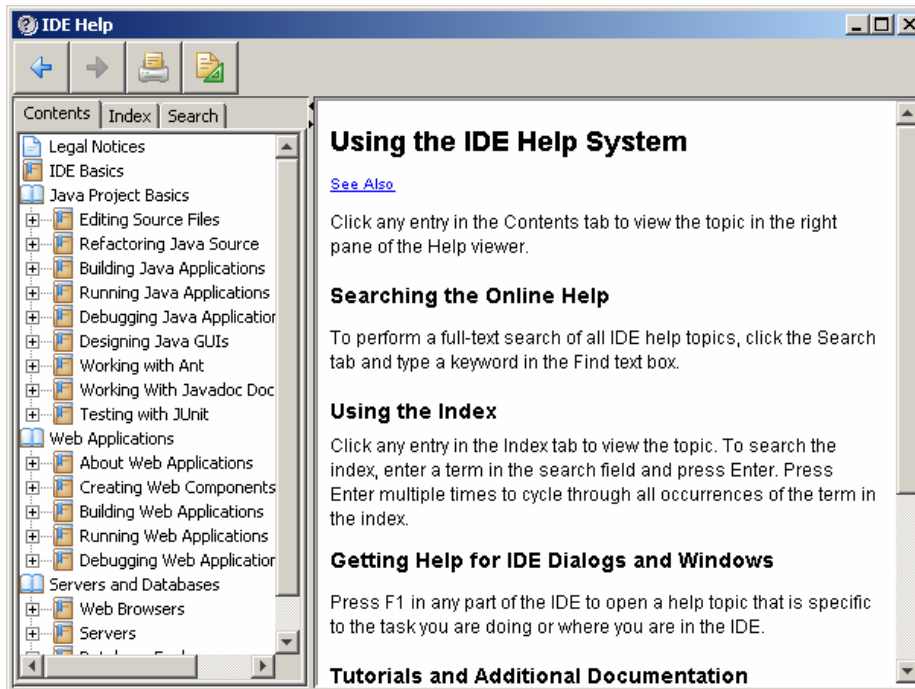


Figure 18

All help documents are displayed in NetBeans Help.

NetBeans Help behaves like a Web browser and contains the toolbar buttons, navigation window, and content window. The toolbar buttons contain four buttons: *Previous*, *Next*, *Print*, and *Print Setup*. The *Previous* and *Next* buttons let you go to the previous and next topics in the history list. The *Print* button prints the document in the content window. The *Print Setup* button enables you to set up the print layout.

The navigation window contains three tabs: **Contents**, **Index**, and **Search**. The **Contents** tab displays available documents. The table of contents of the document is displayed in a tree-like list in the navigation window. To view a given topic, select the node in the tree associated with the topic. NetBeans Help displays the document for the topic in the content window.

The Index tab shows the index entries for the current document. The Search tab shows the combined index entries for all the available documents in NetBeans.

9 Forcing a Program to Terminate

If a program does not terminate due to a logic error, you can force it to terminate by clicking *Terminate* in the context menu of the process in the runtime pane. For example, suppose a program has an infinite loop. You can terminate it by clicking *Terminate* in the context menu of the process, as shown in Figure 19.

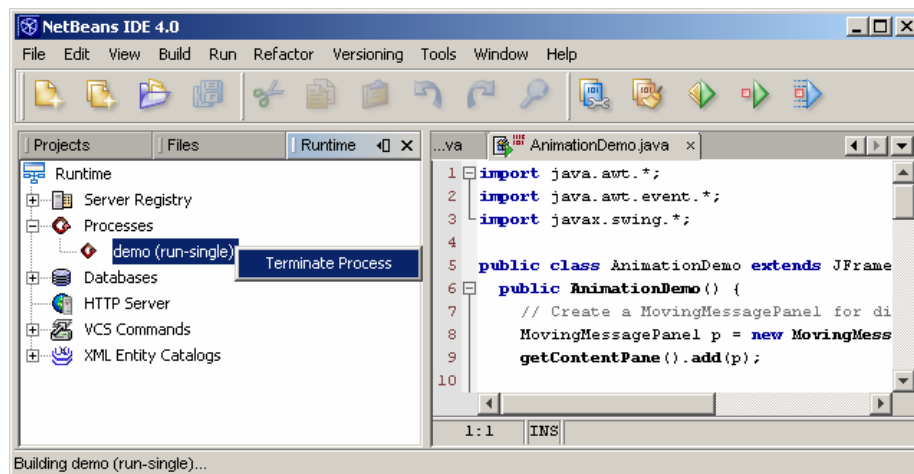


Figure 19

You can force a program to terminate from the runtime pane.

10 Using Packages (Optional)

The Welcome class created in Section 1.4 "Creating a Java Program" does not have the package statement. If you want to create classes with the package statement, you need to enter a package name in the New Java Class wizard. Here are the steps to create a new class Welcome in the package named chapter1:

1. In the context menu of the demo project, choose *New, Java Class* to display the New Java Class wizard, as shown in Figure 20.
2. Type chapter1 in the Package field and click *Finish* to create the template for the Welcome class, as shown in Figure 21.
3. Welcome.java is created under package chapter1. The first statement in the source code is

```
package chapter1;
```

Modify Welcome.java to match the code in Listing 1.1, as shown in Figure 22.

4. Choose *Run File* from the context menu of Welcome.java in the project pane to run the program.

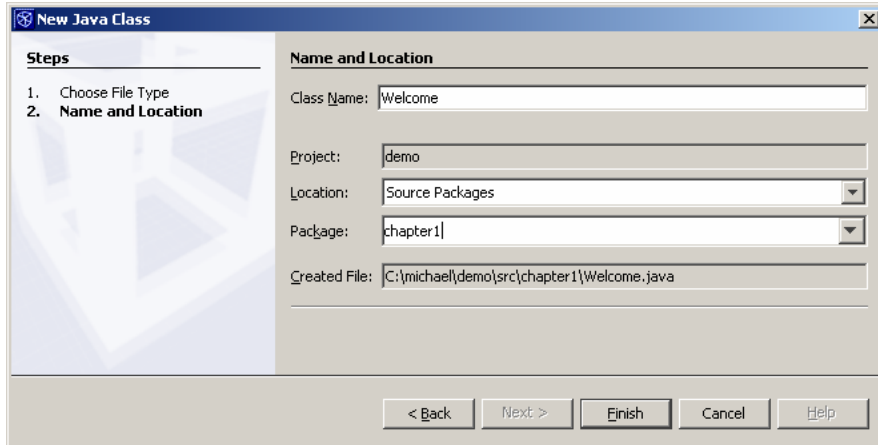


Figure 20

You can enter a package name to create a class.

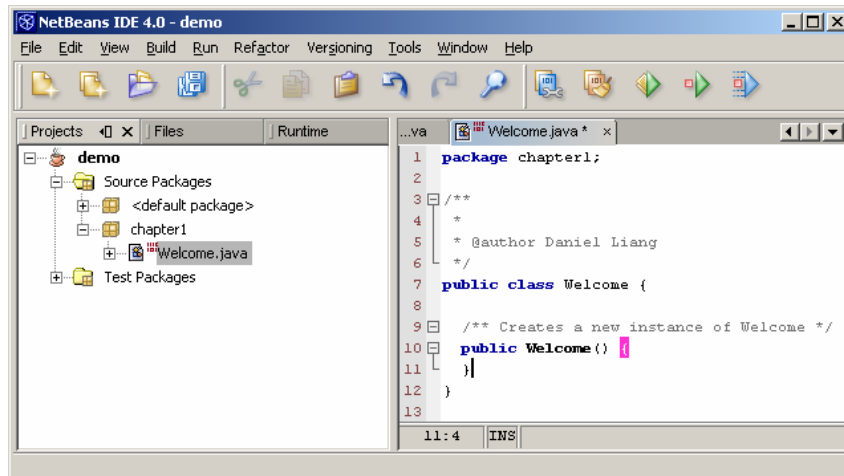


Figure 21

The new Welcome class is created under package chapter1.

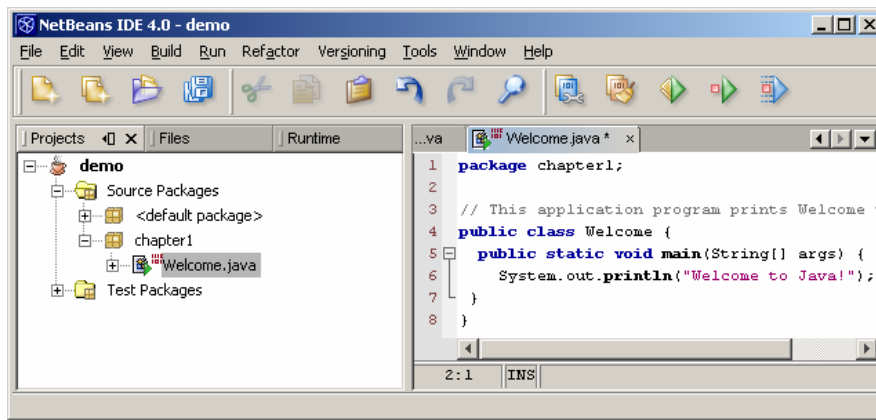


Figure 22

The modified Welcome.java is shown in the Source Editor.

NOTE: The package in Java corresponds to the directory in the file system. **chapter1** is also a directory. Welcome.java is stored in `c:\michael\demo\src\chapter1` and Welcome.class is stored in `c:\michael\demo\build\classes\chapter1`.

11 Run Java Applications from the Command Line

So far you have run programs in the NetBeans IDE. You also can run program standalone directly from the operating system. Here are the steps in running the **Welcome** application with the default package created in Section 3 from the DOS prompt.

1. Start a DOS window by clicking the Windows Start button, Programs, MS-DOS Prompt in Windows.
2. Type the following commands to set up the proper environment variables for running Java programs in the DOS environment in Windows:


```

set path=%path%;c:\Program Files\java\j2sdk1.5\bin
set classpath=.;%classpath%

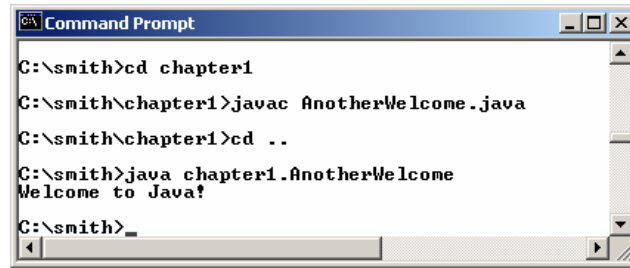
```
3. Type **cd c:\michael\demo\build\classes** to change the directory to **c:\michael\demo\build\classes**
4. Type **java Welcome** to run the program. A sample run of the output is shown in Figure 23.



Figure 23

You can run the Java program from the DOS prompt using the `java` command.

NOTE: To run `Welcome` in the `chapter1` package created in Section 10, type **java chapter1.AnotherWelcome** from the `c:\michael\demo\build\classes` directory, as shown in Figure 24.



```
Command Prompt
C:\smith>cd chapter1
C:\smith\chapter1>javac AnotherWelcome.java
C:\smith\chapter1>cd ..
C:\smith>java chapter1.AnotherWelcome
Welcome to Java!
C:\smith>_
```

Figure 24

If a class has the package statement, you have to specify its full path, including the package name.

NOTE: On Windows 95 or Windows 98, insert the following two lines

```
set path=%path%;c:\j2sdk1.5\bin
set classpath=.;%classpath%
```

in the `autoexec.bat` file to avoid setting the environment variables in Step 2 for every DOS session. On Windows NT or Windows 2000, select System from the Control Panel to set the environment variables.

Setting environment variables enables you to use the JDK command-line utilities. The `java` command invokes the Java interpreter to run the Java bytecode.

12 Debugging in NetBeans

The debugger utility is integrated in NetBeans. You can pinpoint bugs in your program with the help of the NetBeans debugger without leaving the IDE. The NetBeans debugger enables you to set breakpoints and execute programs line by line. As your program executes, you can watch the values stored in variables, observe which methods are being called, and know what events have occurred in the program.

The debugger is an indispensable, powerful tool that boosts your programming productivity. It is also a valuable tool for learning Java. It helps you understand how a program is executed.

12.1 Setting Breakpoints

You can execute a program line by line to trace it, but this is time-consuming if you are debugging a large program. Often, you know that some parts of the program work fine. It makes no sense to trace these parts when you only need to trace the lines of code that are likely to have bugs. In cases of this kind, you can use breakpoints.

A *breakpoint* is a stop sign placed on a line of source code that tells the debugger to pause when this line is encountered. The debugger executes every line until it encounters a breakpoint. You can then trace the part of the program at the breakpoint, quickly moving over the sections that work correctly and concentrating on those causing problems.

There are several ways to set a breakpoint. One quick way is to click the cutter of the line on which you want to put a breakpoint. You will see the line highlighted. You also can set breakpoints by choosing *Run, New Breakpoint*. To remove a breakpoint, simply click the cutter of the line.

When debugging a program, you can set as many breakpoints as you want, and can remove breakpoints at any time during debugging. The project retains the breakpoints when you exit the project. They are restored when you reopen it.

12.2 Starting the Debugger

Let us use Listing 2.4, *ShowCurrentTime.java*, to demonstrate debugging. Create a new class named *ShowCurrentTime* in the default package in the demo project, as shown in Figure 25.

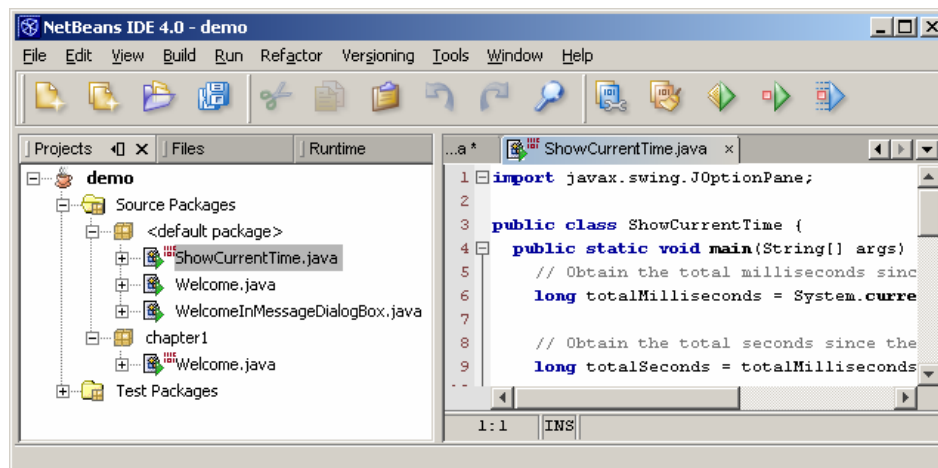


Figure 25

ShowCurrentTime.java is created in the project.

There are several ways to start the debugger. A simple way is as follows:

1. Activate *ShowCurrentTime.java* in the editor pane.
2. Set a breakpoint at where you want your program to pause, say Line 6. A breakpoint can be set by clicking the cutter of the line, as shown in Figure 26. You can remove it by clicking on the cutter of line again.
3. In the context menu of *ShowCurrentTime.java* in the project pane, choose *Debug File*. If the program compiles properly, an output pane and debug pane will be displayed, as shown in Figure 27. If the debug pane is not shown, choose *Window, Debugging, Local Variables* to display it.

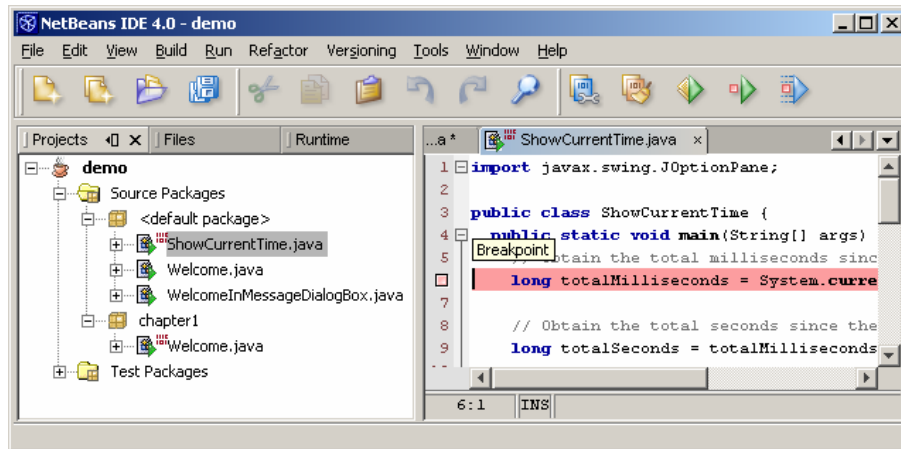


Figure 26

Clicking the line number sets/removes a breakpoint at the line in the source code.

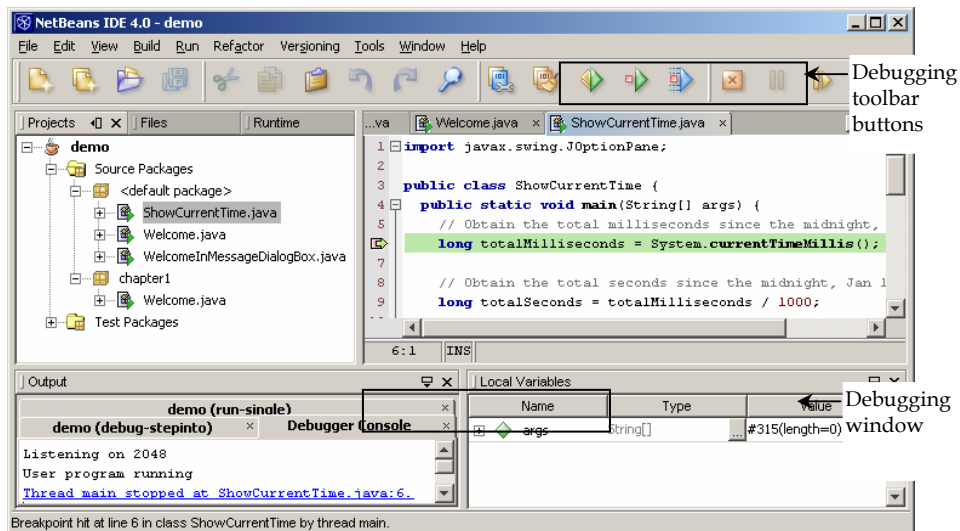


Figure 27

The debugger starts to run *ShowCurrentTime.java*.

12.3 Controlling Program Execution

The program pauses at the breakpoint. The paused line is highlighted in green. This line is also called the *current execution point*, which points to next statement to be executed by the debugger.

When the program pauses, you can issue debugging commands to control the execution of the program. You also can inspect or modify the values of variables in the program.

When NetBeans is in the debugging mode, the toolbar buttons for debugging are displayed, as shown in Figure 27. The toolbar button commands also appear in the Run menu (see Figure 28). Here are the commands for controlling program execution:

- **Start** begins to debug the current program.
- **Finish** ends the current debugging session.
- **Attach** opens a dialog box in which you can connect the debugger to an application on another virtual machine. This is useful for remote debugging in distributed systems.
- **Pause** temporarily stops execution of a program.

- **Run to Cursor** runs the program, starting from the current execution point, and pauses and places the execution point either on the line of code containing the cursor or at a breakpoint.
- **Step Over** executes a single statement. If the statement contains a call to a method, the entire method is executed without stepping through it.
- **Step Into** executes a single statement or steps into a method.
- **Step Out** executes all the statements in the current method and returns to its caller.
- **Continue** resumes the execution of a paused program.

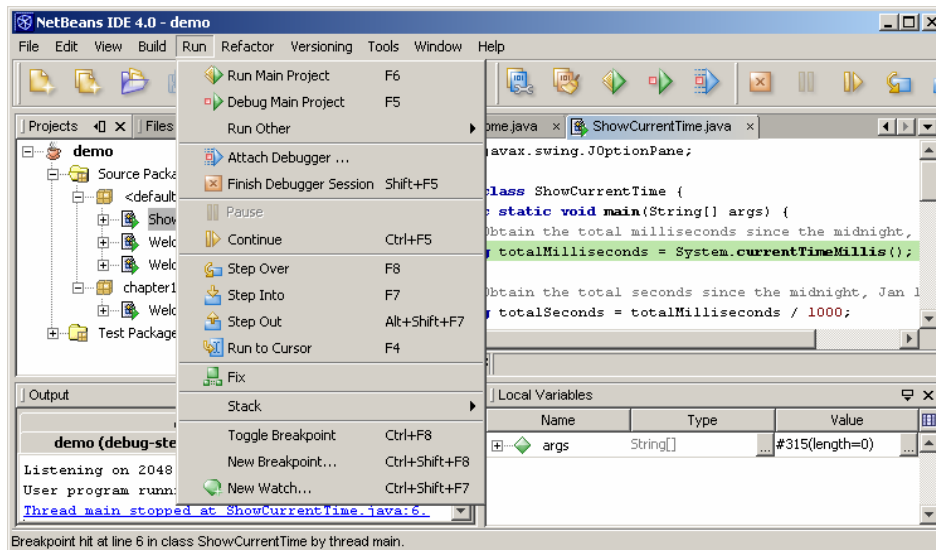


Figure 28

The debugging commands appear under the Run menu.

12.4 The Debugger Window

The Debugger window has tabbed panes for Local Variables, Watches, and Call Stack, as shown in Figure 27. Other tabbed panes such as Breakpoints, Sessions, and Threads can be added by choosing Window, Debugging from the main menu. These panes can be selected or deselected. The *Sessions* pane lists the current debug sessions. The *Breakpoints* pane lists all the breakpoints you have set. The *Threads* pane lists threads and thread groups in the current debugging process. The *Call Stack* pane lists the method calls that the process has made since it began running. The *Watches* pane lists the variables and expressions that are under continuous watch. The *Local*

Variables pane shows all the variables before the current execution point in a local method. The *Classes pane* lists all the classes that have been loaded by the process being debugged.

12.5 Examining and Modifying Data Values

Among the most powerful features of an integrated debugger is its capability to reveal current data values and enable programmers to modify values during debugging. You can examine the values of variables, array items, and objects, or the values of the parameters passed in a method call. You also can modify a variable value if you want to try a new value to continue debugging without restarting the program.

The Local Variables pane lists all variables accessible at the current execution point. The Watches pane lists the selected variables.

12.5.1 The Add Watch Command

NetBeans provides the Add Watch command to enable you to add variables to the Watches pane in the Debugger window. To add the variable totalMilliseconds to the Watch view, perform the following steps:

1. Suppose the execution point is currently at the first line in the main method. Highlight totalMilliseconds in the Source Editor and right-click the mouse to reveal a context menu.
2. Choose *New Watch* in the context menu to bring up a dialog box, as shown in Figure 29. Click *OK* to add totalMilliseconds to the Watch list.
3. Choose the Watches tab in the Debugger window. The variable along with its content is shown in Figure 30.
4. Choose *Debug, Step Over* to observe the changing value of totalMilliseconds in the Watches pane.

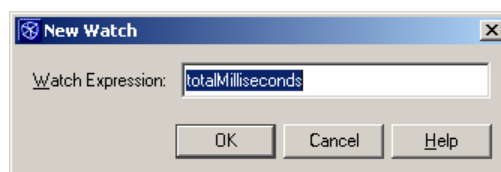


Figure 29

The New Watch dialog box enables you to add a variable or an expression to the Watch view.

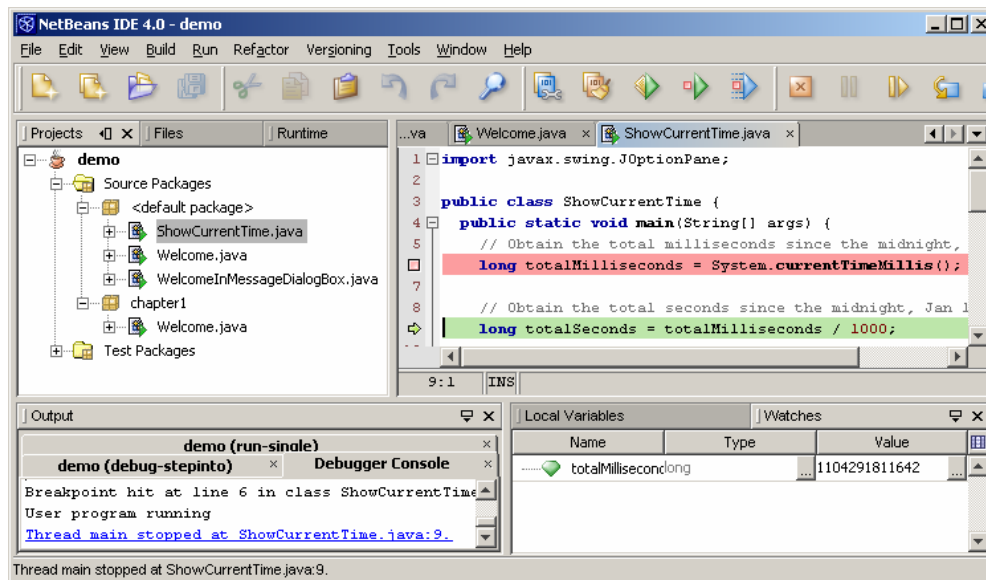


Figure 30

The variable `totalMilliseconds` was added to the Watches tab.

NOTE:

You can also add expressions such as `i > 0` to the Watches tab from the Add New Watch dialog box.

12.5.2 Modifying Variables

You can modify variables from the Watches pane or the Variables pane. For instance, to change the value for `totalMilliseconds`, enter a new value, say 1000, in the value field for the variable and press the Enter key (See Figure 31).

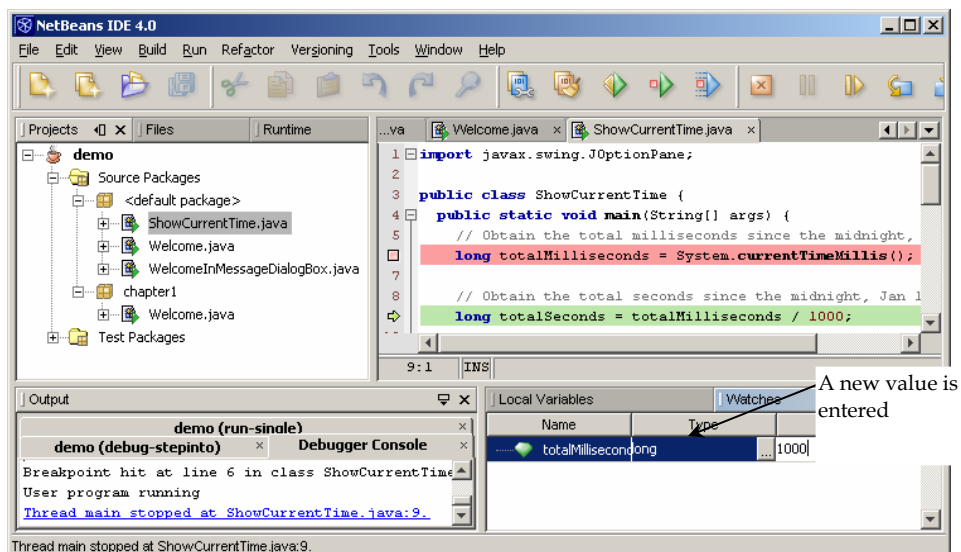


Figure 31

The value for variable totalMilliseconds is changed to 1000.

13 Creating and Testing Java Applets

In the preceding section, you learned how to create, compile, and execute a Java program. Applets are special type of Java program. NetBeans provides the Applet wizard to create Java applets.

13.1 Creating a Java Applet

Let us use `WelcomeApplet.java` on page 500 in the text to demonstrate how to create an applet:

1. In the context menu of the demo project, choose *New, File/Folder* (See Figure 32) to display the New File wizard, as shown in Figure 33.
2. Select `JApplet` under the `Java Classes` node and click *Next* to display the Applet wizard, as shown in Figure 34.
3. Type `WelcomeApplet` in the `Class Name` field, and click *Finish* to create the template for the applet, as shown in Figure 35.
4. Modify the code in the `WelcomeApplet` class to display a text on a label, and place the label in the center of the applet, as shown in Figure 36. The code is the same as on page 500 in the text.
5. Choose *Run File* in the context menu of `WelcomeApplet.java` to run the applet. NetBeans automatically generates `WelcomeApplet.html` in `C:\michael\demo\build` and runs the applet using the applet viewer, as shown in Figure 37.

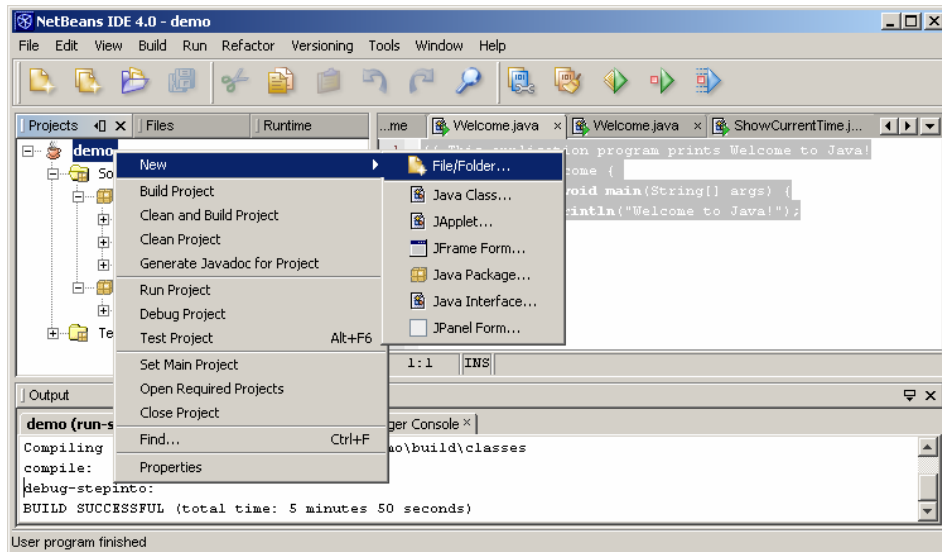


Figure 32

You can create an applet from the File/Folder menu.

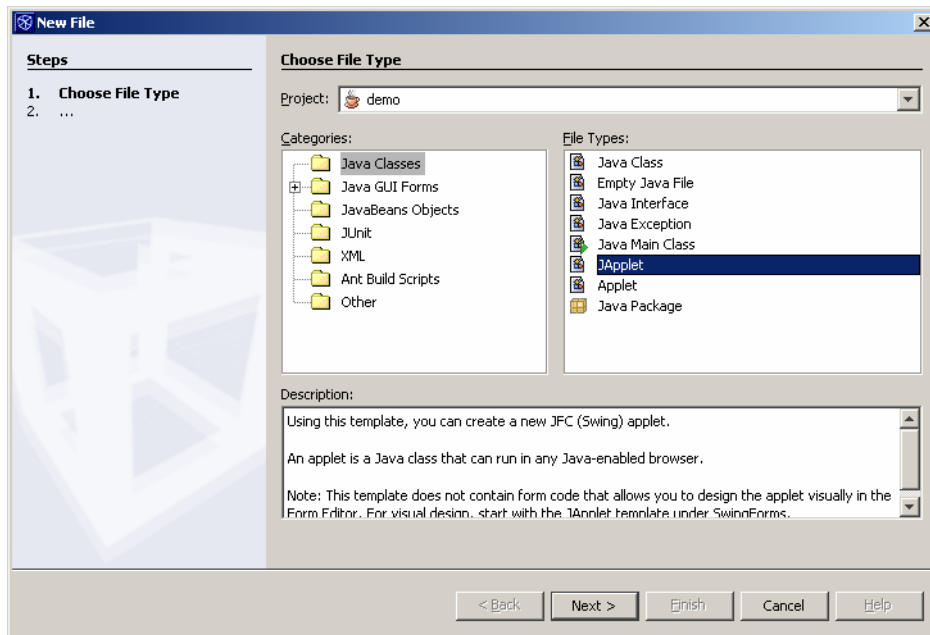


Figure 33

You can choose an applet template from the New File wizard.

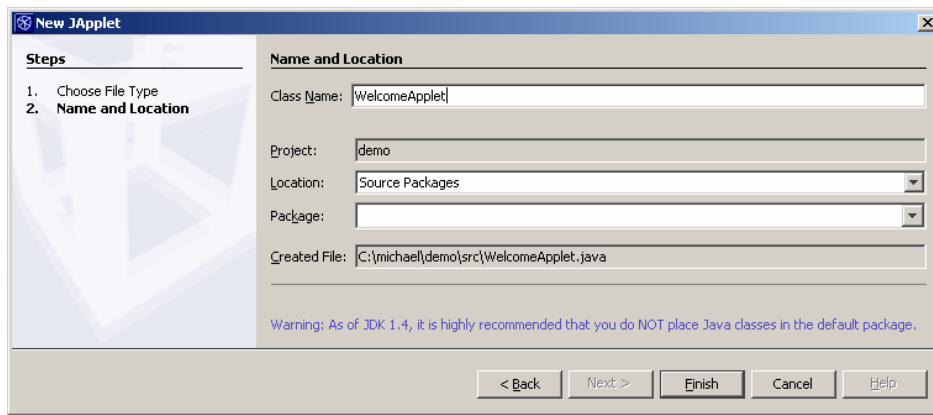


Figure 34

You can create an applet from the Applet wizard.

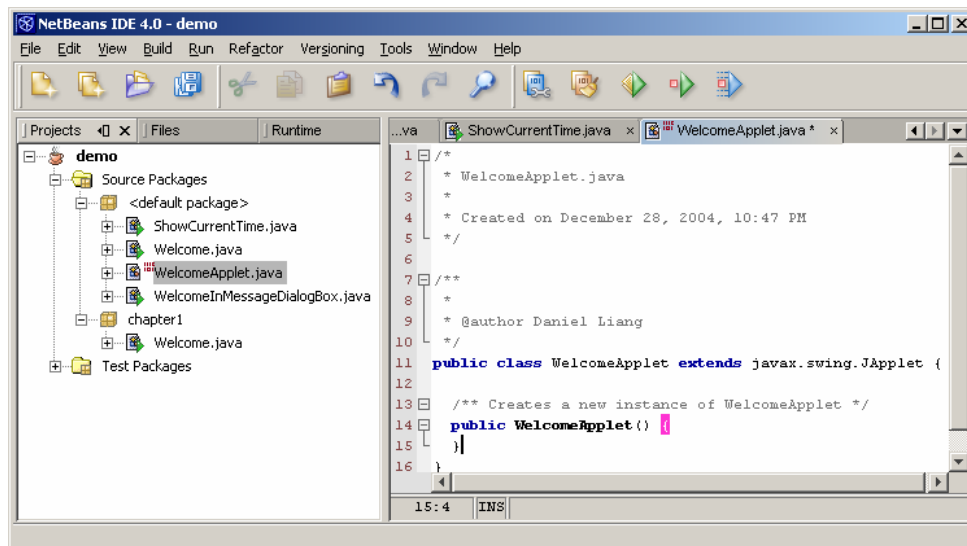


Figure 35

The Applet wizard generates the template for the applet.

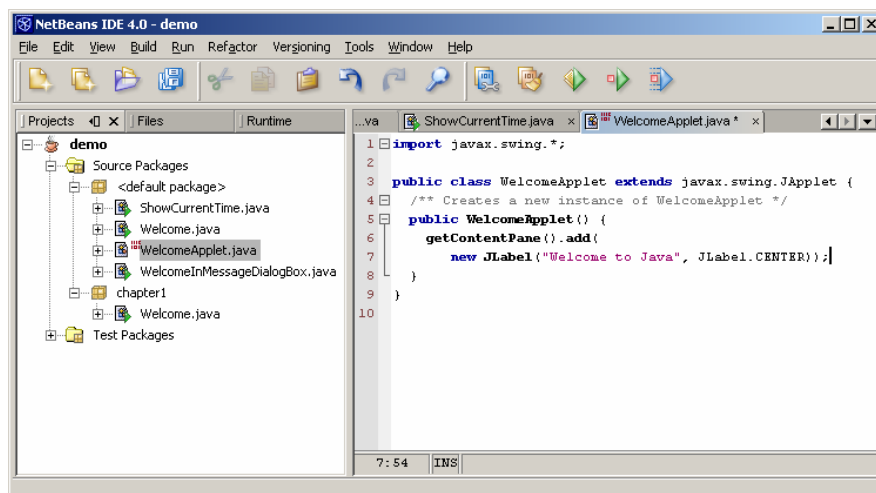


Figure 36

The source code of the applet was modified.



Figure 37

The WelcomeApplet program runs from the applet viewer.

13.2 Viewing Applets from a Web Browser

Applets are eventually displayed in a Web browser. Using the applet viewer, you do not need to start a Web browser. The applet viewer functions as a browser. It is convenient for testing applets during development. However, you should also test the applets from a Web browser before deploying them on a Web site. To display an applet from a Web browser, open the applet's HTML file (i.e., WelcomeApplet.html). Its output is shown in Figure 38.

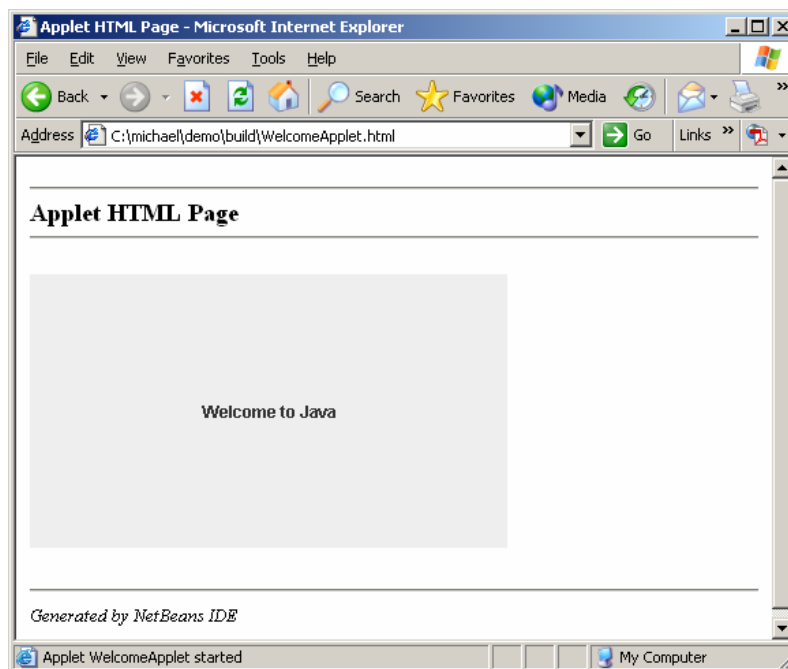


Figure 38

The WelcomeApplet program is displayed in Internet Explorer.