Chapter 23. XML Processing with Java

Topics in This Chapter

- Representing an entire XML document using the Document Object Model (DOM) Level 2
- Using DOM to display the outline of an XML document in a JTree
- Responding to individual XML parsing events with the Simple API for XML Parsing (SAX) 2.0
- Printing the outline of an XML document using SAX
- Counting book orders using SAX
- Transforming XML using XSLT
- Invoking XSLT through custom JSP tags
- Hiding vendor-specific details with the Java API for XML Processing (JAXP)

XML is a "meta" markup language used to describe the structure of data. XML has taken the computer industry by storm since its inception and is now the markup language of choice for configuration files, data interchange, B2B transactions, and Java 2 Enterprise architectures. XML is even being used to represent calls to distributed objects through the Simple Object Access Protocol (SOAP), an XML application.

XML has numerous advantages including being easy to read, easy to parse, extensible, and widely adopted. In addition, you can define a grammar through a Document Type Definition (DTD) to enforce application-specific syntax. However, the greatest single advantage of XML is that the data can be easily processed by other applications; XML data is not in a proprietary format. In essence, XML has done for data what the Java language has done for programs:

Java = Portable Programs

XML = Portable Data

This chapter doesn't focus on how to *write* XML but rather how to *process* XML documents with Java. We show you how to use Java to process XML documents by using the Document Object Model (DOM), the Simple API for XML (SAX), and the Extensible Style sheet Language for Transformations (XSLT). If you are new to XML, here are some good starting points for additional information:

XML 1.0 Specification

http://www.w3.org/TR/REC-xml

Sun Page on XML and Java

http://java.sun.com/xml/

WWW Consortium's Home Page on XML

http://www.w3.org/XML/

Apache XML Project

http://xml.apache.org/

XML Resource Collection

http://xml.coverpages.org/

O'Reilly XML Resource Center

http://www.xml.com/

23.1 Parsing XML Documents with DOM Level 2

The Document Object Model (DOM) represents an entire XML document in a tree-like data structure that can be easily manipulated by a Java program. The advantages of DOM are that it is relatively simple to use and you can modify the data structure in addition to extracting data from it. However, the disadvantage is that DOM parses and stores the entire document, even if you only care about part of it. Section 23.3 (Parsing XML Documents with SAX 2.0) discusses an alternative approach appropriate for cases when you are dealing with very large XML documents but care about only small sections of them.

Installation and Setup

DOM is not a standard part of either Java 2 Standard Edition or the servlet and JSP APIs. So, your first step is to download the appropriate classes and configure them for use in your programs. Here is a summary of what is required.

1. **Download a DOM-compliant parser.** The parser provides the Java classes that follow the DOM Level 2 API as specified by the WWW Consortium. You can obtain a list of XML parsers in Java at http://www.xml.com/pub/rg/Java_Parsers.

   We use the Apache Xerces-J parser in this book. See http://xml.apache.org/xerces-j/. This parser also comes with the complete DOM API in Javadoc format.

2. **Download the Java API for XML Processing (JAXP).** This API provides a small layer on top of DOM that lets you plug in different vendor's parsers without making any changes to your basic code. See http://java.sun.com/xml/.

3. **Set your `CLASSPATH` to include the DOM classes.** In the case of Apache Xerces, you need to include `*xerces_install_dir*\xerces.jar`. For example, for desktop applications on Windows you would do

   ```
   set CLASSPATH=xerces_install_dir\xerces.jar;%CLASSPATH%
   ```

   If you wanted to use DOM from servlets and JSP, you would copy the appropriate JAR file to the server's `lib` directory (if supported), unpack the JAR file (using `jar -xvf`) into the server's `classes` directory, or explicitly change the server's `CLASSPATH`, usually by modifying the server start-up script.

4. **Set your `CLASSPATH` to include the JAXP classes.** These classes are in *jaxp_install_dir*/`jaxp.jar`. For example, on Unix/Linux and the C shell, you would do

   ```
   setenv CLASSPATH jaxp_install_dir/jaxp.jar:$CLASSPATH
   ```

   For use from servlets and JSP, see the preceding step.

5. **Bookmark the DOM Level 2 and JAXP APIs.** The official DOM specification can be found at http://www.w3.org/TR/DOM-Level-2-Core/, but the API in Javadoc format that comes with Apache Xerces is easier to read and also includes the JAXP and SAX (see Section 23.3) APIs.

6. **Print the JAXP specification for your reference.** Download it from http://java.sun.com/xml/jaxp-1_1-spec.pdf.

Parsing

With DOM processing, there are two high-level tasks: turning an XML document into a DOM data structure and looking through that data structure for the data that interests you. The following list summarizes the detailed steps needed to accomplish these tasks.

1. **Tell the system which parser you want to use.** This can be done in a number of ways: through the `javax.xml.parsers.DocumentBuilderFactory` system property, through `jre_dir/lib/ jaxp.properties`, through the J2EE Services API and the class specified in `META-INF/services/javax.xml.parsers.DocumentBuilderFactory`, or with a system-dependent default parser. The system property is the easiest method. For example, the following code permits users to specify the parser on the command line with the `-D` option to `java`, and uses the Apache Xerces parser otherwise.

   ```
   public static void main(String[] args) {
     String jaxpPropertyName =
       "javax.xml.parsers.DocumentBuilderFactory";
     if (System.getProperty(jaxpPropertyName) == null) {
       String apacheXercesPropertyValue =
         "org.apache.xerces.jaxp.DocumentBuilderFactoryImpl";
       System.setProperty(jaxpPropertyName,
                          apacheXercesPropertyValue);
     }
     ...
   }
   ```

2. **Create a JAXP document builder.** This is basically a wrapper around a specific XML parser.

   ```
   DocumentBuilderFactory builderFactory =
     DocumentBuilderFactory.newInstance();
   DocumentBuilder builder =
     builderFactory.newDocumentBuilder();
   ```

   Note that you can use the `setNamespaceAware` and `setValidating` methods on the `DocumentBuilderFactory` to make the parser namespace aware and validating, respectively.

3. **Invoke the parser to create a Document representing an XML document.** You invoke the parser by calling the `parse` method of the document builder, supplying an input stream, URI (represented as a string), or `org.xml.sax.InputSource`. The `Document` class

represents the parsed result in a tree structure.

```
Document document = builder.parse(someInputStream);
```

4. **Normalize the tree.** This means to combine textual nodes that were on multiple lines and to eliminate empty textual nodes.

   ```
   document.getDocumentElement().normalize();
   ```

5. **Obtain the root node of the tree.** This returns an `Element`, which is a subclass of the more general `Node` class that represents an XML element.

   ```
   Element rootElement = document.getDocumentElement();
   ```

6. **Examine various properties of the node.** These properties include the name of the element (`getNodeName`), the node type (`getNodeType`; compare the return value to predefined constants in the `Node` class), the node value (`getNodeValue`; e.g., for text nodes the value is the string between the element's start and end tags), the attributes used by the element's start tag (`getAttributes`), and the child nodes (`getChildNodes`; i.e., the elements contained between the current element's start and end tags). You can recursively examine each of the child nodes.

7. **Modify properties of the nodes.** Instead of just extracting data from an XML document, you can modify the document by adding child nodes (`appendChild`), removing child nodes (`removeChild`), and changing the node's value (`setNodeValue`). Unfortunately, however, DOM doesn't provide a standard method of writing out a DOM structure in textual format. So, you have to either do it yourself (printing out a "<", the node name, the attribute names and values with equal signs between them and quotes around the values, a ">", etc.) or use one of the many existing packages that generate text from a DOM element.

23.2 DOM Example: Representing an XML Document as a JTree

Listing 23.1 shows a class that represents the basic structure of an XML document as a `JTree`. Each element is represented as a node in the tree, with tree node being either the element name or the element name followed by a list of the attributes in parentheses. This class performs the following steps:

1. Parses and normalizes an XML document, then obtains the root element. These steps are performed exactly as described in steps one through five of the previous section.

2. Makes the root element into a `JTree` node. If the XML element has attributes (as given by `node.getAttributes`), the tree node is represented by a string composed of the element name (`getNodeName`) followed by the attributes and values in parentheses. If there are no attributes (`getLength` applied to the result of `node.getAttributes` returns 0), then just the element name is used for the tree node label.

3. Looks up the child elements of the current element using `getChildNodes`, turns them into `JTree` nodes, and links those `JTree` nodes to the parent tree node.

4. Recursively applies step 3 to each of the child elements.

Listing 23.2 shows a class that creates the `JTree` just described and places it into a `JFrame`. Both the parser and the XML document can be specified by the user. The parser is specified when the user invokes the program with

```
java -Djavax.xml.parsers.DocumentBuilderFactory=xxx XMLFrame
```

If no parser is specified, the Apache Xerces parser is used. The XML document can be supplied on the command line, but if it is not given, a `JFileChooser` is used to interactively select the file of interest. The file extensions shown by the `JFileChooser` are limited to `xml` and `tld` (JSP tag library descriptors) through use of the `ExtensionFileFilter` class of Listing 23.3.

Figure 23-1 shows the initial file chooser used to select the `perennials.xml` file (Listing 23.4; see Listing 23.5 for the DTD). Figures23-2 and 23-3 show the result in its unexpanded and partially expanded forms, respectively.

Figure 23-1. `JFileChooser` that uses `ExtensionFileFilter` (Listing 23.3) to interactively select an XML file.

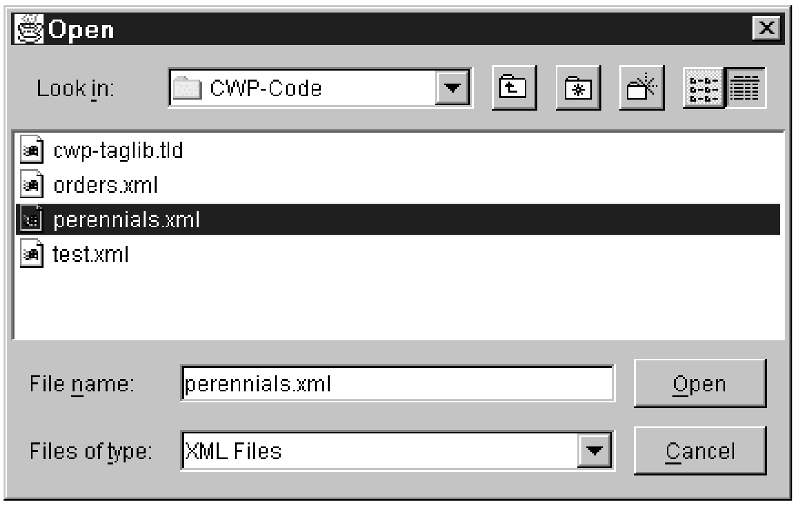
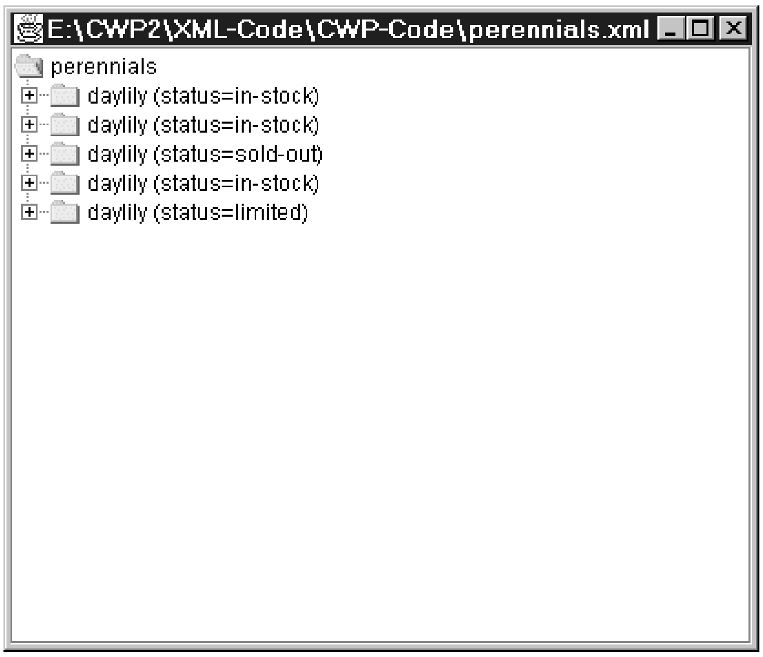
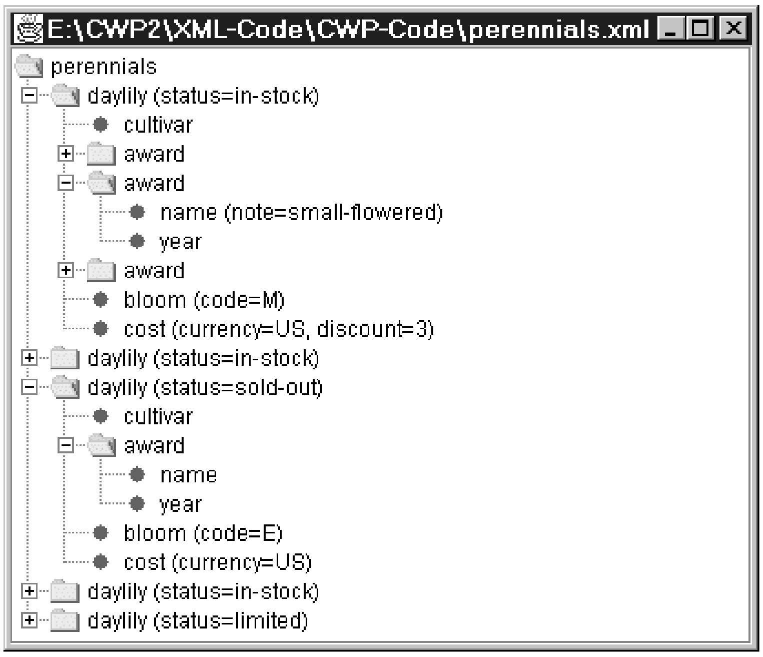


Figure 23-2. `JTree` representation of root node and top-level child elements of `perennials.xml` (Listing 23.4).


E:\CWP2\XML-Code\CWP-Code\perennials.xml

```
perennials
  daylily (status=in-stock)
  daylily (status=in-stock)
  daylily (status=sold-out)
  daylily (status=in-stock)
  daylily (status=limited)
```

Figure 23-3. `JTree` representation of `perennials.xml` with several nodes expanded.



```
perennials
  daylily (status=in-stock)
    cultivar
    award
    award
      name (note=small-flowered)
      year
    award
    bloom (code=M)
    cost (currency=US, discount=3)
  daylily (status=in-stock)
  daylily (status=sold-out)
    cultivar
    award
      name
      year
    bloom (code=E)
    cost (currency=US)
  daylily (status=in-stock)
  daylily (status=limited)
```

Note that because the XML file specifies a DTD, Xerces-J will attempt to parse the DTD even though no validation of the document is performed. If `perennials.dtd` is not available on-line, then you can place the DTD in a `dtds` subdirectory (below the directory containing `XMLTree`) and change the `DOCTYPE` in `perennials.xml` to

```
<!DOCTYPE perennials SYSTEM "dtds/perennials.dtd">
```

Listing 23.1 `XMLTree.java`

```
import java.awt.*;
import javax.swing.*;
import javax.swing.tree.*;
import java.io.*;
import org.w3c.dom.*;
import javax.xml.parsers.*;

/** Given a filename or a name and an input stream,
 *  this class generates a JTree representing the
 *  XML structure contained in the file or stream.
 *  Parses with DOM then copies the tree structure
 *  (minus text and comment nodes).
 */

public class XMLTree extends JTree {
  public XMLTree(String filename) throws IOException {
    this(filename, new FileInputStream(new File(filename)));
  }

  public XMLTree(String filename, InputStream in) {
    super(makeRootNode(in));
  }

  // This method needs to be static so that it can be called
  // from the call to the parent constructor (super), which
  // occurs before the object is really built.

  private static DefaultMutableTreeNode
                              makeRootNode(InputStream in) {
    try {
      // Use JAXP's DocumentBuilderFactory so that there
      // is no code here that is dependent on a particular
      // DOM parser. Use the system property
      // javax.xml.parsers.DocumentBuilderFactory (set either
      // from Java code or by using the -D option to "java").
      // or jre_dir/lib/jaxp.properties to specify this.
      DocumentBuilderFactory builderFactory =
        DocumentBuilderFactory.newInstance();
      DocumentBuilder builder =
        builderFactory.newDocumentBuilder();
      // Standard DOM code from hereon. The "parse"
      // method invokes the parser and returns a fully parsed
      // Document object. We'll then recursively descend the
      // tree and copy non-text nodes into JTree nodes.
      Document document = builder.parse(in);
      document.getDocumentElement().normalize();
      Element rootElement = document.getDocumentElement();
      DefaultMutableTreeNode rootTreeNode =
        buildTree(rootElement);
      return(rootTreeNode);
    } catch(Exception e) {
      String errorMessage =
        "Error making root node: " + e;
      System.err.println(errorMessage);
      e.printStackTrace();
      return(new DefaultMutableTreeNode(errorMessage));
    }
  }

  private static DefaultMutableTreeNode
                           buildTree(Element rootElement) {
    // Make a JTree node for the root, then make JTree
    // nodes for each child and add them to the root node.
    // The addChildren method is recursive.
    DefaultMutableTreeNode rootTreeNode =
      new DefaultMutableTreeNode(treeNodeLabel(rootElement));
    addChildren(rootTreeNode, rootElement);
    return(rootTreeNode);
  }

  private static void addChildren
                     (DefaultMutableTreeNode parentTreeNode,
                      Node parentXMLElement) {
    // Recursive method that finds all the child elements
    // and adds them to the parent node. We have two types
    // of nodes here: the ones corresponding to the actual
    // XML structure and the entries of the graphical JTree.
    // The convention is that nodes corresponding to the
    // graphical JTree will have the word "tree" in the
    // variable name. Thus, "childElement" is the child XML
    // element whereas "childTreeNode" is the JTree element.
    // This method just copies the non-text and non-comment
    // nodes from the XML structure to the JTree structure.

    NodeList childElements =
      parentXMLElement.getChildNodes();
    for(int i=0; i<childElements.getLength(); i++) {
      Node childElement = childElements.item(i);
      if (!(childElement instanceof Text ||
            childElement instanceof Comment)) {
        DefaultMutableTreeNode childTreeNode =
          new DefaultMutableTreeNode
            (treeNodeLabel(childElement));
        parentTreeNode.add(childTreeNode);
        addChildren(childTreeNode, childElement);
      }
    }
  }

  // If the XML element has no attributes, the JTree node
  // will just have the name of the XML element. If the
  // XML element has attributes, the names and values of the
  // attributes will be listed in parens after the XML
  // element name. For example:
  // XML Element: <blah>
  // JTree Node:  blah
  // XML Element: <blah foo="bar" baz="quux">
  // JTree Node:  blah (foo=bar, baz=quux)

  private static String treeNodeLabel(Node childElement) {
    NamedNodeMap elementAttributes =
      childElement.getAttributes();
    String treeNodeLabel = childElement.getNodeName();

    if (elementAttributes != null &&
        elementAttributes.getLength() > 0) {
      treeNodeLabel = treeNodeLabel + " (";
      int numAttributes = elementAttributes.getLength();
      for(int i=0; i<numAttributes; i++) {
        Node attribute = elementAttributes.item(i);
        if (i > 0) {
          treeNodeLabel = treeNodeLabel + ", ";
        }
        treeNodeLabel =
          treeNodeLabel + attribute.getNodeName() +
          "=" + attribute.getNodeValue();
      }
      treeNodeLabel = treeNodeLabel + ")";
    }
    return(treeNodeLabel);
  }
}
```

Listing 23.2 `XMLFrame.java`

```
import java.awt.*;
import javax.swing.*;
import java.io.*;

/** Invokes an XML parser on an XML document and displays
 *  the document in a JTree. Both the parser and the
 *  document can be specified by the user. The parser
 *  is specified by invoking the program with
 *  java -Djavax.xml.parsers.DocumentBuilderFactory=xxx XMLFrame
 *  If no parser is specified, the Apache Xerces parser is used.
 *  The XML document can be supplied on the command
 *  line, but if it is not given, a JFileChooser is used
 *  to interactively select the file of interest.
 */

public class XMLFrame extends JFrame {
  public static void main(String[] args) {
    String jaxpPropertyName =
      "javax.xml.parsers.DocumentBuilderFactory";

    // Pass the parser factory in on the command line with
    // -D to override the use of the Apache parser.
    if (System.getProperty(jaxpPropertyName) == null) {
      String apacheXercesPropertyValue =
        "org.apache.xerces.jaxp.DocumentBuilderFactoryImpl";
      System.setProperty(jaxpPropertyName,
                         apacheXercesPropertyValue);
    }
    String filename;
    if (args.length > 0) {
      filename = args[0];
    } else {
      String[] extensions = { "xml", "tld" };
      WindowUtilities.setNativeLookAndFeel();
      filename = ExtensionFileFilter.getFileName(".",
                                                 "XML Files",
                                                 extensions);
      if (filename == null) {
        filename = "test.xml";
      }
    }
    new XMLFrame(filename);
  }

  public XMLFrame(String filename) {
    try {
      WindowUtilities.setNativeLookAndFeel();
      JTree tree = new XMLTree(filename);
      JFrame frame = new JFrame(filename);
      frame.addWindowListener(new ExitListener());
      Container content = frame.getContentPane();
      content.add(new JScrollPane(tree));
      frame.pack();
      frame.setVisible(true);
    } catch(IOException ioe) {
      System.out.println("Error creating tree: " + ioe);
    }
  }
}
```

Listing 23.3 **`ExtensionFileFilter.java`**

```
import java.io.File;
import java.util.*;
import javax.swing.*;
import javax.swing.filechooser.FileFilter;

/** A FileFilter that lets you specify which file extensions
 *  will be displayed. Also includes a static getFileName
 *  method that users can call to pop up a JFileChooser for
 *  a set of file extensions.
 *  <P>
 *  Adapted from Sun SwingSet demo.
 */

public class ExtensionFileFilter extends FileFilter {
  public static final int LOAD = 0;
  public static final int SAVE = 1;
  private String description;
  private boolean allowDirectories;
  private Hashtable extensionsTable = new Hashtable();
  private boolean allowAll = false;

  public ExtensionFileFilter(boolean allowDirectories) {
    this.allowDirectories = allowDirectories;
  }

  public ExtensionFileFilter() {
    this(true);
  }


  public static String getFileName(String initialDirectory,
                                   String description,
                                   String extension) {
    String[] extensions = new String[]{ extension };
    return(getFileName(initialDirectory, description,
                       extensions, LOAD));
  }

  public static String getFileName(String initialDirectory,
                                   String description,
                                   String extension,
                                   int mode) {
    String[] extensions = new String[]{ extension };
    return(getFileName(initialDirectory, description,
                       extensions, mode));
  }

  public static String getFileName(String initialDirectory,
                                   String description,
                                   String[] extensions) {
    return(getFileName(initialDirectory, description,
                       extensions, LOAD));
  }


  /** Pops up a JFileChooser that lists files with the
   *  specified extensions. If the mode is SAVE, then the
   *  dialog will have a Save button; otherwise, the dialog
   *  will have an Open button. Returns a String corresponding
   *  to the file's pathname, or null if Cancel was selected.
   */

  public static String getFileName(String initialDirectory,
                                   String description,
                                   String[] extensions,
                                   int mode) {
    ExtensionFileFilter filter = new ExtensionFileFilter();
    filter.setDescription(description);
    for(int i=0; i<extensions.length; i++) {
      String extension = extensions[i];
      filter.addExtension(extension, true);
    }
    JFileChooser chooser =
      new JFileChooser(initialDirectory);
    chooser.setFileFilter(filter);
    int selectVal = (mode==SAVE) ? chooser.showSaveDialog(null)
                                 : chooser.showOpenDialog(null);
    if (selectVal == JFileChooser.APPROVE_OPTION) {
      String path = chooser.getSelectedFile().getAbsolutePath();
      return(path);
    } else {
      JOptionPane.showMessageDialog(null, "No file selected.");
      return(null);
    }
  }

  public void addExtension(String extension,
                           boolean caseInsensitive) {
```

```
    if (caseInsensitive) {
      extension = extension.toLowerCase();
    }

    if (!extensionsTable.containsKey(extension)) {
      extensionsTable.put(extension,
                          new Boolean(caseInsensitive));
      if (extension.equals("*") ||
          extension.equals("*.*") ||
          extension.equals(".*")) {
        allowAll = true;
      }
    }
  }

  public boolean accept(File file) {
    if (file.isDirectory()) {
      return(allowDirectories);
    }
    if (allowAll) {
      return(true);
    }
    String name = file.getName();
    int dotIndex = name.lastIndexOf('.');
    if ((dotIndex == -1) || (dotIndex == name.length() -1)) {
      return(false);
    }
    String extension = name.substring(dotIndex + 1);
    if (extensionsTable.containsKey(extension)) {
      return(true);
    }
    Enumeration keys = extensionsTable.keys();
    while(keys.hasMoreElements()) {
      String possibleExtension = (String)keys.nextElement();
      Boolean caseFlag =
        (Boolean)extensionsTable.get(possibleExtension);
      if ((caseFlag != null) &&
          (caseFlag.equals(Boolean.FALSE)) &&
          (possibleExtension.equalsIgnoreCase(extension))) {
        return(true);
      }
    }
    return(false);
  }

  public void setDescription(String description) {
    this.description = description;
  }
  public String getDescription() {
    return(description);
  }
}
```

Listing 23.4 `perennials.xml`

```xml
<?xml version="1.0" ?>
<!DOCTYPE perennials SYSTEM
  "http://archive.corewebprogramming.com/dtds/perennials.dtd">
<perennials>
  <daylily status="in-stock">
    <cultivar>Luxury Lace</cultivar>
    <award>
      <name>Stout Medal</name>
      <year>1965</year>
    </award>
    <award>
      <name note="small-flowered">Annie T. Giles</name>
      <year>1965</year>
    </award>
    <award>
      <name>Lenington All-American</name>
      <year>1970</year>
    </award>
    <bloom code="M">Midseason</bloom>
    <cost discount="3" currency="US">11.75</cost>
  </daylily>
  <daylily status="in-stock">
    <cultivar>Green Flutter</cultivar>
    <award>
      <name>Stout Medal</name>
      <year>1976</year>
    </award>
    <award>
      <name note="small-flowered">Annie T. Giles</name>
      <year>1970</year>
    </award>
    <bloom code="M">Midseason</bloom>
    <cost discount="3+" currency="US">7.50</cost>
  </daylily>
  <daylily status="sold-out">
    <cultivar>My Belle</cultivar>
    <award>
      <name>Stout Medal</name>
      <year>1984</year>
    </award>
    <bloom code="E">Early</bloom>
    <cost currency="US">12.00</cost>
  </daylily>
  <daylily status="in-stock">
    <cultivar>Stella De Oro</cultivar>
    <award>
      <name>Stout Medal</name>
      <year>1985</year>
    </award>
    <award>
```

```
      <name note="miniature">Donn Fishcer Memorial Cup</name>
      <year>1979</year>
    </award>
    <bloom code="E-L">Early to Late</bloom>
    <cost discount="10+" currency="US">5.00</cost>
  </daylily>
  <daylily status="limited">
    <cultivar>Brocaded Gown</cultivar>
    <award>
      <name>Stout Medal</name>
      <year>1989</year>
    </award>
    <bloom code="E">Early</bloom>
    <cost currency="US" discount="3+">14.50</cost>
  </daylily>
</perennials>
```

Listing 23.5 `perennials.dtd`

```
<?xml version="1.0" encoding="ISO-8859-1" ?>

<!ELEMENT perennials (daylily)*>

<!ELEMENT daylily (cultivar, award*, bloom, cost)+>
<!ATTLIST daylily
   status (in-stock | limited | sold-out) #REQUIRED>

<!ELEMENT cultivar (#PCDATA)>

<!ELEMENT award (name, year)>

<!ELEMENT name (#PCDATA)>
<!ATTLIST name
   note CDATA #IMPLIED>
<!ELEMENT year (#PCDATA)>

<!ELEMENT bloom (#PCDATA)>
<!ATTLIST bloom
   code (E | EM | M | ML | L | E-L) #REQUIRED>

<!ELEMENT cost (#PCDATA)>
<!ATTLIST cost
   discount CDATA #IMPLIED>
<!ATTLIST cost
   currency (US | UK | CAN) "US">
```

23.3 Parsing XML Documents with SAX 2.0

DOM processing is relatively straightforward since the DOM classes do all the "real" parsing—you just have to look through the parsed result for the data you want. However, DOM can be quite wasteful if you only care about a small part of the document. For example, suppose that you want to extract the first word from an XML document representing an entire dictionary. DOM would require you to parse and store the entire XML document (which could be huge in this case). With SAX, you need only store the parts you care about and can stop parsing whenever you want. On the other hand, SAX is a bit more work. The idea is that the system tells you when certain parsing events such as finding a start tag (`<language rating="good">`), an end tag (`</language>`), or a tag body (e.g., `Java` between the aforementioned start and end tags). You have to decide what to do when these events occur. Are you a JSP programmer? Does this process sound familiar? It should—SAX processing is very similar to the way you go about defining custom JSP tag libraries (Section 20.7).

Installation and Setup

SAX is not a standard part of either Java 2 Standard Edition or the servlet and JSP APIs. So, your first step is to download the appropriate classes and configure them for use in your programs. Here is a summary of what is required.

1. **Download a SAX-compliant parser.** The parser provides the Java classes that follow the SAX 2 API as specified by the WWW Consortium. You can obtain a list of XML parsers in Java at http://www.xml.com/pub/rg/Java_Parsers. We use the Apache Xerces-J parser in this book. See http://xml.apache.org/xerces-j/. This parser comes with the complete SAX API in Javadoc format.

2. **Download the Java API for XML Processing (JAXP).** This API provides a small layer on top of SAX that lets you plug in different vendor's parsers without making any changes to your basic code. See http://java.sun.com/xml/.

3. **Set your `CLASSPATH` to include the SAX classes.** In the case of Apache Xerces, you need to include `xerces_install_dir\xerces.jar`. For example, on Windows you would do

   ```
   set CLASSPATH=xerces_install_dir\xerces.jar;%CLASSPATH%
   ```

   If you wanted to use DOM from servlets and JSP, you would copy the appropriate JAR file to the server's `lib` directory (if supported), unpack the JAR file (using `jar -xvf`) into the server's `classes` directory, or explicitly change the server's `CLASSPATH`, usually by modifying the server startup script.

4. **Set your `CLASSPATH` to include the JAXP classes.** These classes are in `jaxp_install_dir/jaxp.jar`. For example, on Unix/Linux and the C shell, you would do

   ```
   setenv CLASSPATH jaxp_install_dir/jaxp.jar:$CLASSPATH
   ```

   For use from servlets and JSP, see the preceding step.

5. **Bookmark the SAX 2 and JAXP APIs.** You can browse the official API at http://www.megginson.com/SAX/Java/javadoc/, but the API that comes with Apache Xerces is easier to use because it is on your local system and is integrated with the DOM and JAXP APIs. More information on SAX can be found at http://www.megginson.com/SAX/.

Parsing

With SAX processing, there are two high-level tasks: creating a content handler and invoking the parser with the designated content handler. The following list summarizes the detailed steps needed to accomplish these tasks.

1. **Tell the system which parser you want to use.** This can be done in a number of ways: through the `javax.xml.parsers.SAXParserFactory` system property, through `jre_dir/lib/ jaxp.properties`, through the J2EE Services API and the class

specified in `META-INF/services/javax.xml.parsers.SAXParserFactory`, or with a system-dependent default parser. The system property is the easiest method. For example, the following code permits users to specify the parser on the command line with the `-D` option to `java`, and uses the Apache Xerces parser otherwise.

```
public static void main(String[] args) {
  String jaxpPropertyName =
    "javax.xml.parsers.SAXParserFactory";
  if (System.getProperty(jaxpPropertyName) == null) {
    String apacheXercesPropertyValue =
      "org.apache.xerces.jaxp.SAXParserFactoryImpl";
    System.setProperty(jaxpPropertyName,
                       apacheXercesPropertyValue);
  }
  ...
}
```

2. **Create a parser instance.** First make an instance of a parser factory, then use that to create a parser object.

```
SAXParserFactory factory = SAXParserFactory.newInstance();
SAXParser parser = factory.newSAXParser();
```

Note that you can use the `setNamespaceAware` and `setValidating` methods on the `SAXParserFactory` to make the parser namespace aware and validating, respectively.

3. **Create a content handler to respond to parsing events.** This handler is typically a subclass of `DefaultHandler`. You override any or all of the following placeholders
   - **startDocument, endDocument** Use these methods to respond to the start and end of the document; they take no arguments.

   - **startElement, endElement** Use these methods to respond to the start and end tags of an element. The `startElement` method takes four arguments: the namespace URI (a `String`; empty if no namespace), the namespace or prefix (a `String`; empty if no namespace), the fully qualified element name (a `String`; i.e., `"prefix:mainName"` if there is a namespace; `"mainName"` otherwise), and an `Attributes` object representing the attributes of the start tag. The `endElement` method takes the same arguments except for the attributes (since end tags are not permitted attributes).

   - **characters, ignoreableWhitespace** Use these methods to respond to the tag body. They take three arguments: a `char` array, a start index, and an end index. A common approach is to turn the relevant part of the character array into a `String` by passing all three arguments to the `String` constructor. Non-whitespace data is always reported to the `characters` method. Whitespace is always reported to the `ignoreableWhitespace` method a parser is run in validating mode, but can be reported to either method otherwise.

4. **Invoke the parser with the designated content handler.** You invoke the parser by calling the `parse` method, supplying an input stream, URI (represented as a string), or `org.xml.sax.InputSource` along with the content handler.

```
parser.parse(filename, handler);
```

The content handler does the rest.

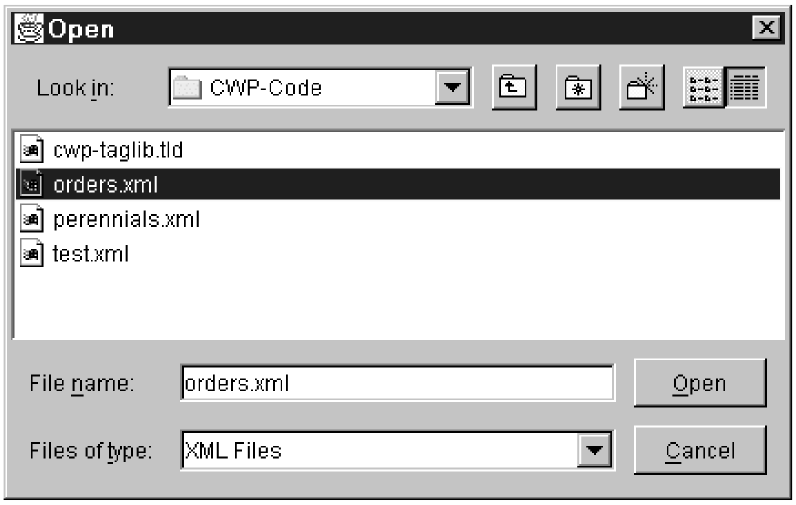
23.4 SAX Example 1: Printing the Outline of an XML Document

Listing 23.7 shows a content handler that responds to three parts of an XML document: start tags, end tags, and tag bodies. It overrides the `startElement`, `endElement`, and `characters` methods to accomplish this. The handler simply prints out the start element, end element, and first word of tag body, with two spaces of indentation for each nesting level. To accomplish this task, the content handler overrides the following three methods:

- **startElement** This method prints a message indicating that it found the start tag for the element name. Any attributes associated with the element are listed in parentheses. The method also puts spaces in front of the printout, as specified by the `indentation` variable (initially 0). Finally, it adds 2 to this variable.
- **endElement** This method subtracts 2 from the `indentation` variable and then prints a message indicating that it found the end tag for the element.
- **characters** This method prints the first word of the tag body, leaving the indentation level unchanged.

Listing 23.8 shows a program that lets the user specify a SAX-compliant parser and an XML file, then invokes the parser with the outline-printing content handler just described (and shown in Listing 23.7). Figure 23-4 shows the initial result, and Listing 23.6 shows the top part of the output when `orders.xml` (Listing 23.9) is selected.

Figure 23-4. Interactively selecting the `orders.xml` file.



File name: orders.xml

Files of type: XML Files

Listing 23.6 Partial output of `SAXPinter` applied to `orders.xml`

```
Start tag: orders
  Start tag: order
    Start tag: count
      37
    End tag: count
    Start tag: price
      49.99
    End tag: price
    Start tag: book
      Start tag: isbn
        0130897930
      End tag: isbn
      Start tag: title
        Core...
      End tag: title
      Start tag: authors
        Start tag: author
          Marty...
        End tag: author
        Start tag: author
          Larry...
        End tag: author
      End tag: authors
    End tag: book
  End tag: order
  Start tag: order
    Start tag: count
      1
    End tag: count
    Start tag: price
      9.95
    End tag: price
    Start tag: yacht
      Start tag: manufacturer
        Luxury...
      End tag: manufacturer
      Start tag: model
        M-1
      End tag: model
      Start tag: standardFeatures (oars=plastic, lifeVests=none)
        false
      End tag: standardFeatures
    End tag: yacht
  End tag: order
  ... (Rest of results omitted}
End tag: orders
```

Listing 23.7 `PrintHandler.java`

```
import org.xml.sax.*;
import org.xml.sax.helpers.*;
import java.util.StringTokenizer;

/** A SAX handler that prints out the start tags, end tags,
 *  and first word of tag body. Indents two spaces
 *  for each nesting level.
 */

public class PrintHandler extends DefaultHandler {
  private int indentation = 0;

  /** When you see a start tag, print it out and then
   *  increase indentation by two spaces. If the
   *  element has attributes, place them in parens
   *  after the element name.
   */

  public void startElement(String namespaceUri,
                           String localName,
                           String qualifiedName,
                           Attributes attributes)
      throws SAXException {
    indent(indentation);
    System.out.print("Start tag: " + qualifiedName);
    int numAttributes = attributes.getLength();
    // For <someTag> just print out "someTag". But for
    // <someTag att1="Val1" att2="Val2">, print out
    // "someTag (att1=Val1, att2=Val2).
    if (numAttributes > 0) {
      System.out.print(" (");
      for(int i=0; i<numAttributes; i++) {
        if (i>0) {
          System.out.print(", ");
        }
        System.out.print(attributes.getQName(i) + "=" +
                         attributes.getValue(i));
      }
      System.out.print(")");
    }
    System.out.println();
    indentation = indentation + 2;
  }

  /** When you see the end tag, print it out and decrease
   *  indentation level by 2.
   */

  public void endElement(String namespaceUri,
                         String localName,
                         String qualifiedName)
      throws SAXException {
    indentation = indentation - 2;
    indent(indentation);
    System.out.println("End tag: " + qualifiedName);
  }

  /** Print out the first word of each tag body. */

  public void characters(char[] chars,
                         int startIndex,
                         int endIndex) {
    String data = new String(chars, startIndex, endIndex);
    // Whitespace makes up default StringTokenizer delimeters
    StringTokenizer tok = new StringTokenizer(data);
    if (tok.hasMoreTokens()) {
      indent(indentation);
      System.out.print(tok.nextToken());
      if (tok.hasMoreTokens()) {
        System.out.println("...");
      } else {
        System.out.println();
      }
    }
  }

  private void indent(int indentation) {
    for(int i=0; i<indentation; i++) {
      System.out.print(" ");
    }
  }
}
```

Listing 23.8 **`SAXPrinter.java`**

```
import javax.xml.parsers.*;
import org.xml.sax.*;
import org.xml.sax.helpers.*;

/** A program that uses SAX to print out the start tags,
 *  end tags, and first word of tag body of an XML file.
 */

public class SAXPrinter {
  public static void main(String[] args) {
    String jaxpPropertyName =
      "javax.xml.parsers.SAXParserFactory";
    // Pass the parser factory in on the command line with
    // -D to override the use of the Apache parser.
    if (System.getProperty(jaxpPropertyName) == null) {
      String apacheXercesPropertyValue =
        "org.apache.xerces.jaxp.SAXParserFactoryImpl";
      System.setProperty(jaxpPropertyName,
                         apacheXercesPropertyValue);
    }
    String filename;
    if (args.length > 0) {
      filename = args[0];
    } else {
      String[] extensions = { "xml", "tld" };
      WindowUtilities.setNativeLookAndFeel();
      filename = ExtensionFileFilter.getFileName(".",
                                                  "XML Files",
                                                  extensions);
      if (filename == null) {
        filename = "test.xml";
      }
    }
    printOutline(filename);
    System.exit(0);
  }

  public static void printOutline(String filename) {
    DefaultHandler handler = new PrintHandler();
    SAXParserFactory factory = SAXParserFactory.newInstance();
    try {
      SAXParser parser = factory.newSAXParser();
      parser.parse(filename, handler);
    } catch(Exception e) {
      String errorMessage =
        "Error parsing " + filename + ": " + e;
      System.err.println(errorMessage);
      e.printStackTrace();
    }
  }
}
```

Listing 23.9 `orders.xml`

```
<?xml version="1.0" ?>
<orders>
  <order>
    <count>37</count>
    <price>49.99</price>
    <book>
      <isbn>0130897930</isbn>
      <title>Core Web Programming Second Edition</title>
      <authors>
        <author>Marty Hall</author>
        <author>Larry Brown</author>
      </authors>
    </book>
  </order>
  <order>
    <count>1</count>
    <price>9.95</price>
    <yacht>
      <manufacturer>Luxury Yachts, Inc.</manufacturer>
      <model>M-1</model>
      <standardFeatures oars="plastic"
                        lifeVests="none">
        false
      </standardFeatures>
    </yacht>
  </order>
  <order>
    <count>3</count>
    <price>22.22</price>
    <book>
      <isbn>B000059Z4H</isbn>
      <title>Harry Potter and the Order of the Phoenix</title>
      <authors>
        <author>J.K. Rowling</author>
      </authors>
    </book>
  </order>
  <order>
    <count>2</count>
    <price>10452689.01</price>
    <yacht>
      <manufacturer>We B Boats, Inc.</manufacturer>
      <model>236-A</model>
      <standardFeatures bowlingAlley="double"
                        tennisCourt="grass">
        true
      </standardFeatures>
    </yacht>
  </order>
  <order>
    <count>13</count>
    <price>49.99</price>
    <book>
      <isbn>0130897930</isbn>
      <title>Core Web Programming Second Edition</title>
      <authors>
        <author>Marty Hall</author>
        <author>Larry Brown</author>
      </authors>
    </book>
  </order>
</orders>
```

23.5 SAX Example 2: Counting Book Orders

One of the advantages of SAX over DOM is that SAX does not require you to process and store the entire document; you can quickly skip over the parts that do not interest you. The following example looks for sections of an XML file that look like this:

```
<orders>
  ...
  <count>23</count>
  <book>
    <isbn>0130897930</isbn>
    ...
  </book>
  ...
</orders>
```

The idea is that the program will count up how many copies of *Core Web Programming Second Edition* (you *did* recognize that ISBN number, right?) are contained in a set of orders. Thus, it can skip over most elements. Since SAX, unlike DOM, does not store anything automatically, we need to take care of storing the pieces of data that are of interest. The one difficulty in that regard is that the `isbn` element comes after the `count` element. So, we need to record every count temporarily but only add the temporary value to the running total when the ISBN number matches. To accomplish this task, the content handler (Listing 23.10) overrides the following four methods:

- **startElement** This method checks whether the name of the element is either `count` or `isbn`. If so, it sets a flag that tells the `characters` method to be on the lookout.
- **endElement** This method checks whether the name of the element is either `count` or `isbn`. If so, it turns off the flag that the `characters` method watches.
- **characters** If the `count` flag is set, this method parses the tag body as an `int` and records the result in a temporary location. If the `isbn` flag is set, the method reads the tag body and compares it to the ISBN number of the second edition of *Core Web Programming*. If this comparison results in a match, then the temporary count is added to the running count.
- **endDocument** This method prints out the running count. If the number of copies is less than 250 (a real slacker!), it urges the user to buy more copies in the future.

The `CountBooks` class (Listing 23.11) invokes a user-specifiable parser on an XML file with `CountHandler` as the parser's content handler. Figure 23-5 shows the initial result and Figure 23-6 shows the final result, after `orders.xml` (Listing 23.9) is used as input.

Figure 23-5. Interactively selecting the `orders.xml` file.

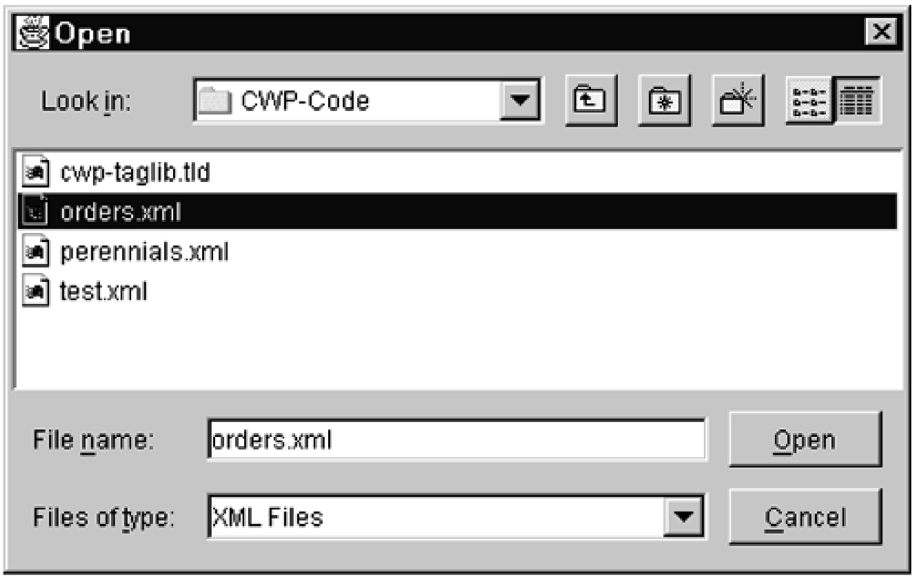
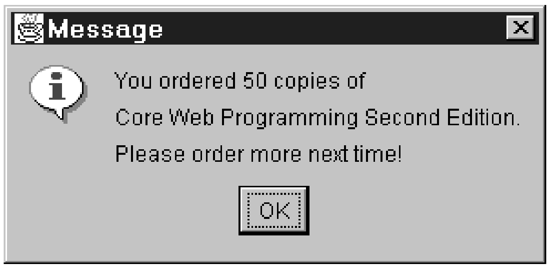


Figure 23-6. Result of running `CountBooks` on `orders.xml`.


Message

You ordered 50 copies of
Core Web Programming Second Edition.
Please order more next time!

Listing 23.10 `CountHandler.java`

```
import org.xml.sax.*;
import org.xml.sax.helpers.*;
import java.util.StringTokenizer;
import javax.swing.*;

/** A SAX parser handler that keeps track of the number
 *  of copies of Core Web Programming ordered. Entries
 *  that look like this will be recorded:
 *  <XMP>
 *    ...
 *    <count>23</count>
 *    <book>
 *      <isbn>0130897930</isbn>
 *      ...
 *    </book>
 *  </XMP>
 *  All other entries will be ignored -- different books,
 *  orders for yachts, things that are not even orders, etc.
 */

public class CountHandler extends DefaultHandler {
  private boolean collectCount = false;
  private boolean collectISBN = false;
  private int currentCount = 0;
  private int totalCount = 0;

  /** If you start the "count" or "isbn" elements,
   *  set a flag so that the characters method can check
   *  the value of the tag body.
   */

  public void startElement(String namespaceUri,
                           String localName,
                           String qualifiedName,
                           Attributes attributes)
      throws SAXException {
    if (qualifiedName.equals("count")) {
      collectCount = true;
      currentCount = 0;
    } else if (qualifiedName.equals("isbn")) {
      collectISBN = true;
    }
  }

  /** If you end the "count" or "isbn" elements,
   *  set a flag so that the characters method will no
   *  longer check the value of the tag body.
   */

  public void endElement(String namespaceUri,
                         String localName,
                         String qualifiedName)
      throws SAXException {
    if (qualifiedName.equals("count")) {
      collectCount = false;
    } else if (qualifiedName.equals("isbn")) {
      collectISBN = false;
    }
  }

  /** Since the "count" entry comes before the "book"
   *  entry (which contains "isbn"), we have to temporarily
   *  record all counts we see. Later, if we find a
   *  matching "isbn" entry, we will record that temporary
   *  count.
   */

  public void characters(char[] chars,
                         int startIndex,
                         int endIndex) {
    if (collectCount || collectISBN) {
      String dataString =
        new String(chars, startIndex, endIndex).trim();
      if (collectCount) {
        try {
          currentCount = Integer.parseInt(dataString);
        } catch(NumberFormatException nfe) {
          System.err.println("Ignoring malformed count: " +
                             dataString);
        }
      } else if (collectISBN) {
        if (dataString.equals("0130897930")) {
          totalCount = totalCount + currentCount;
        }
      }
    }
  }

  /** Report the total number of copies ordered.
   *  Gently chide underachievers.
   */

  public void endDocument() throws SAXException {
    String message =
      "You ordered " + totalCount + " copies of \n" +
      "Core Web Programming Second Edition.\n";
    if (totalCount < 250) {
      message = message + "Please order more next time!";
    } else {
      message = message + "Thanks for your order.";
    }
  JOptionPane.showMessageDialog(null, message);
  }
}
```

Listing 23.11 `CountBooks.java`

```
import javax.xml.parsers.*;
import org.xml.sax.*;
import org.xml.sax.helpers.*;

/** A program using SAX to keep track of the number
 *  of copies of Core Web Programming ordered. Entries
 *  that look like this will be recorded:<XMP>
 *    ...
 *    <count>23</count>
 *    <book>
 *      <isbn>0130897930</isbn>
 *      ...
 *    </book>
 *
 *  </XMP>All other entries will be ignored -- different books,
 *  orders for yachts, things that are not even orders, etc.
 */

public class CountBooks {
  public static void main(String[] args) {
    String jaxpPropertyName =
      "javax.xml.parsers.SAXParserFactory";
    // Pass the parser factory in on the command line with
    // -D to override the use of the Apache parser.
    if (System.getProperty(jaxpPropertyName) == null) {
      String apacheXercesPropertyValue =
        "org.apache.xerces.jaxp.SAXParserFactoryImpl";
      System.setProperty(jaxpPropertyName,
                         apacheXercesPropertyValue);
    }
    String filename;
    if (args.length > 0) {
      filename = args[0];
    } else {
      String[] extensions = { "xml" };
      WindowUtilities.setNativeLookAndFeel();
      filename = ExtensionFileFilter.getFileName(".",
                                                 "XML Files",
                                                 extensions);
      if (filename == null) {
        filename = "orders.xml";
      }
    }
    countBooks(filename);
    System.exit(0);
  }

  private static void countBooks(String filename) {
    DefaultHandler handler = new CountHandler();
    SAXParserFactory factory = SAXParserFactory.newInstance();
    try {
      SAXParser parser = factory.newSAXParser();
      parser.parse(filename, handler);
    } catch(Exception e) {
      String errorMessage =
        "Error parsing " + filename + ": " + e;
      System.err.println(errorMessage);
      e.printStackTrace();
    }
  }
}
```

23.6 Transforming XML with XSLT

XSLT is a language for transforming XML documents into HTML, XML, or other types of documents. When performing a transformation, an XSLT engine converts the XML document according to formatting rules and XPath addresses specified in an XML style sheet (XSL). The XPath information identifies the different parts of the XML document for processing, and the style sheet information identifies the layout of the output.

The benefit of XSLT is that you can define multiple style sheets for transforming a single XML document. For example, a database could return a query in an XML format, and depending on the client protocol, HTTP or WAP, a servlet could use different style sheets to convert the data into HTML or WML, respectively. As another example of an XSLT application, consider an e-commerce business order; the order could be sent to the supplier in an XML format and then processed by the recipient with XSLT, using different XSL documents to convert the original order into separate billing and shipping documents.

Specifications for XSLT, XSL, and XPath technologies are maintained by the WWW Consortium. These specifications are located at:

XSLT 1.0

http://www.w3.org/TR/xslt.html

XSL 1.0

http://www.w3.org/TR/xsl/

XPath 1.0

http://www.w3.org/TR/xpath.html

Upcoming specifications are summarized at http://www.w3.org/Style/XSL/. In addition, an excellent XSLT resource site, sponsored by GoXML, is located at http://www.xslt.com/.

Installation and Setup

XSLT is not a standard part of either Java 2 Standard Edition or the servlet and JSP APIs. So, your first step is to download the appropriate classes and configure them for use in your programs. Here is a summary of what is required:

1. **Download an XSLT-compliant transformer.** The transformer provides the Java classes that follow the XSLT 1.0 specification as specified by the WWW Consortium. You can obtain a list of XSLT parsers at http://www.w3.org/Style/XSL/ or http://www.xslt.com/xslt_tools_engines.htm. We use the Apache Xalan-J transformer in this book. See http://xml.apache.org/xalan-j/.

2. **Set your `CLASSPATH` to include the DOM and SAX classes.** XSLT builds upon DOM and

SAX for handling the document processing. In the case of Apache Xalan-J, you need to include `xerces.jar` in the `CLASSPATH`. See Section 23.1 (Parsing XML Documents with DOM Level 2) and Section 23.3 (Parsing XML Documents with SAX 2.0) for configuration of Apache Xerces-J. Note that `xerces.jar` is included in the Xalan-J installation directory.

3. **Set your `CLASSPATH` to include the XSLT classes.** With Xalan, these classes are in *`xalan_install_dir`*`\xalan.jar`. For example, for desktop application on Windows, you would do

   ```
   set CLASSPATH=xalan_install_dir\xalan.jar;
       %CLASSPATH%
   ```

   On Unix/Linux and the C shell, you would do

   ```
   setenv CLASSPATH xalan_install_dir/xalan.jar:
          $CLASSPATH
   ```

   If you wanted to use XSLT from servlets and JSP, you would copy the appropriate DOM, SAX, and XSLT JAR files to the server's `lib` directory (if supported), unpack the JAR files (using `jar -xvf`) into the server's classes directory, or explicitly change the server's `CLASSPATH`, usually by modifying the server's startup script.

4. **Bookmark the XSL 1.0 and XPath 1.0 specifications.** The official documentation for these two specifications can be found at http://www.w3.org/Style/XSL/.

5. **Bookmark the XSLT specification.** The official XSLT specification can be found at http://www.w3.org/TR/xslt.html. The XSLT specification is implemented in Apache Xalan through the Transformation API for XML (TrAX). The complete TrAX API comes with Xalan-J in Javadoc format and is also available on-line at http://xml.apache.org/xalan-j/apidocs/.

Translating

With XSLT processing, there are two high-level tasks, establishing an XSL template from which to build a transformer and invoking the transformer on the XML document. The following list summarizes the detailed steps needed to accomplish these tasks.

1. **Tell the system which parser you want to use for transformations.** This can be done in a number of ways: through the `javax.xml.transform.TransformFactory` system property, through the `jre_dir/lib/jaxp.properties`, through the J2EE Services API and the class specified in the `META-INF/services/javax.xml.transform.TransformFactory`, or with a system-dependent default processor. As XSLT depends on DOM and SAX, you can tell the system which DOM and SAX parser to use for processing the document. See Section 23.1 and Section 23.3 for information on configuring DOM and SAX parsers. By default, Apache Xalan-J uses the Apache Xerces-J DOM and SAX parsers.

2. **Establish a factory in which to create transformers.** Before processing an XML document, you first need to establish a `TransformerFactory`. The factory allows you to create different transformers for different style sheet templates.

   ```
   TransformerFactory factory =
     TransformerFactory.newInstance();
   ```

3. **Generate a transformer for a particular style sheet template.** For each style sheet you can generate a separate transformer to apply to multiple XML documents.

```
Source xsl = new StreamSource(xslStream);
Templates template = factory.newTemplates(xsl);
Transformer transformer = template.newTransformer();
```

Typically, the XSL source is a `StreamSource` object. You can easily convert an XSL document to a `StreamSource` through a `File`, `Reader`, `InputStream`, or URI (represented as a string) reference to the document.

4. **Invoke the transformer to process the source document.** You invoke the transformation by calling the `transform` method, supplying the XML source and a `Result` object to receive the transformed document.

```
Source xml = new StreamSource(xmlStream);
Result result = new StreamResult(outputStream);
tranformer.transform(xml, result);
```

Similar to the XSL source, the XML source is typically a `StreamSource` constructed from a `File`, `Reader`, `InputStream`, or URI. The transformed `StreamResult` can be a `File`, `Writer`, `OutputStream` or URI.

Listing 23.12 presents a class for preforming XSLT transformations of documents. The XML and XSL source documents can be either `Reader`s or `File`s, and the resulting transformed document can be a `Writer` or `File`. The advantage of handling the documents as `Reader`s and `Writer`s is that they can remain in memory and can easily be processed as strings by a `StringReader` or `CharArrayReader` for the source documents and a `StringWriter` or `CharArrayWriter` for the result document. For example, a servlet could receive a database query as an XML character stream, process the input using XSLT, and deliver the result as an HTML document to a browser client. At no time do the XML document and transformed result need to reside on disk.

Listing 23.12 `XslTransformer.java`

```
package cwp;

import javax.xml.transform.*;
import javax.xml.transform.stream.*;
import java.io.*;
import java.util.*;

/** Creates an XSLT transformer for processing an XML document.
 *  A new transformer, along with a style template are created
 *  for each document transformation. The XSLT, DOM, and
 *  SAX processors are based on system default parameters.
 */

public class XslTransformer {
  private TransformerFactory factory;

  public XslTransformer() {
    factory =  TransformerFactory.newInstance();
  }

  /** Transform an XML and XSL document as <code>Reader</code>s,
   *  placing the resulting transformed document in a
   *  <code>Writer</code>. Convenient for handling an XML
   *  document as a String (<code>StringReader</code>) residing
   *  in memory, not on disk. The output document could easily be
   *  handled as a String (<code>StringWriter</code>) or as a
   *  <code>JSPWriter</code> in a JavaServer page.
   */

  public void process(Reader xmlFile, Reader xslFile,
                      Writer output)
                throws TransformerException {
    process(new StreamSource(xmlFile),
            new StreamSource(xslFile),
            new StreamResult(output));
  }

  /** Transform an XML and XSL document as <code>File</code>s,
   *  placing the resulting transformed document in a
   *  <code>Writer</code>. The output document could easily
   *  be handled as a String (<code>StringWriter</code)> or as
   *  a <code>JSPWriter</code> in a JavaServer page.
   */

  public void process(File xmlFile, File xslFile,
                      Writer output)
                throws TransformerException {
    process(new StreamSource(xmlFile),
            new StreamSource(xslFile),
            new StreamResult(output));
  }

  /** Transform an XML <code>File</code> based on an XSL
   *  <code>File</code>, placing the resulting transformed
   *  document in a <code>OutputStream</code>. Convenient for
   *  handling the result as a <code>FileOutputStream</code> or
   *  <code>ByteArrayOutputStream</code>.
   */

  public void process(File xmlFile, File xslFile,
                      OutputStream out)
                 throws TransformerException {
    process(new StreamSource(xmlFile),
            new StreamSource(xslFile),
            new StreamResult(out));
  }

  /** Transform an XML source using XSLT based on a new template
   *  for the source XSL document. The resulting transformed
   *  document is placed in the passed in <code>Result</code>
   *  object.
   */

  public void process(Source xml, Source xsl, Result result)
                throws TransformerException {
```

```
    try {
      Templates template = factory.newTemplates(xsl);
      Transformer transformer = template.newTransformer();
      transformer.transform(xml, result);
    } catch(TransformerConfigurationException tce) {
        throw new TransformerException(
                    tce.getMessageAndLocation());
    } catch (TransformerException te) {
      throw new TransformerException(
                  te.getMessageAndLocation());
    }
  }
}
```

23.7 XSLT Example 1: XSLT Document Editor

Listing 23.13 shows a simple Swing document editor that presents three tabbed panes: one for an XML document, one for an XSL style sheet, and one for a resulting XSLT-transformed document. Both the XML and XSL document panes are editable, so after you load the XML and XSL files from disk you can edit the documents directly. Each tabbed pane contains a scrollable `DocumentPane` that inherits from a `JEditorPane` (see Listing 23.14). The XML and XSL panes are treated as plain text, and the XSLT pane is treated as HTML. If an XML file and XSL file are loaded, selecting the XSLT tab will invoke an `XslTransformer` (Listing 23.12) to process the XML file by using the style sheet, and present the results as HTML in the XSLT document pane.

Listing 23.13 `XsltExample.java`

```
import javax.xml.transform.*;
import java.awt.*;
import java.awt.event.*;
import javax.swing.*;
import javax.swing.event.*;
import java.io.*;
import cwp.XslTransformer;

/** A document editor to process XML and XSL text using
 *  XSLT and presenting the results as HTML. Three tabbed panes
 *  are presented:  an editable text pane for the XML document,
 *  an editable text pane for the XSL style sheet, and a non-
 *  editable HTML pane for the HTML result. If an XML and XSL
 *  file are loaded, then selecting the XSLT tab will perform
 *  the transformation and present the results. If there is
 *  a problem processing the XML or XSL document, then a
 *  message box is popped up describing the problem.
 */

public class XsltExample extends JFrame
                         implements ChangeListener {
  private static final int XML  = 0;
  private static final int XSL  = 1;
  private static final int XSLT = 2;
  private static final String DEFAULT_TITLE = "XSLT Example";
  private static final String[] tabTitles =
                                  { "XML", "XSL", "XSLT" };
  private static final String[] extensions =
                                  { "xml", "xsl", "html" };
  private Action openAction, saveAction, exitAction;
  private JTabbedPane tabbedPane;
  private DocumentPane[] documents;
  private XslTransformer transformer;

  public XsltExample() {
    super(DEFAULT_TITLE);
    transformer = new XslTransformer();
    WindowUtilities.setNativeLookAndFeel();
    Container content = getContentPane();
    content.setBackground(SystemColor.control);

    // Set up menus
    JMenuBar menubar = new JMenuBar();
    openAction = new OpenAction();
    saveAction = new SaveAction();
    exitAction = new ExitAction();
    JMenu fileMenu = new JMenu("File");
    fileMenu.add(openAction);
    fileMenu.add(saveAction);
    fileMenu.add(exitAction);
    menubar.add(fileMenu);
    setJMenuBar(menubar);

    // Set up tabbed panes
    tabbedPane = new JTabbedPane();
    documents = new DocumentPane[3];
    for(int i=0; i<3; i++) {
      documents[i] = new DocumentPane();
      JPanel panel = new JPanel();
      JScrollPane scrollPane = new JScrollPane(documents[i]);
      panel.add(scrollPane);
      tabbedPane.add(tabTitles[i], scrollPane);
    }
    documents[XSLT].setContentType(DocumentPane.HTML);
    // JEditorPane has a bug, whereas the setText method does
    // not properly recognize an HTML document that has a META
    // element containing a CONTENT-TYPE, unless the EditorKit
    // is first created through setPage. Xalan automatically
    // adds a META CONTENT-TYPE to the document. Thus,
    // preload a document containing a META CONTENT-TYPE.
    documents[XSLT].loadFile("XSLT-Instructions.html");
    documents[XSLT].setEditable(false);
    tabbedPane.addChangeListener(this);
    content.add(tabbedPane, BorderLayout.CENTER);

    setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    setSize(450, 350);
    setVisible(true);
```

```
}

/** Checks to see which tabbed pane was selected by the
 *  user. If the XML and XSL panes hold a document, then
 *  selecting the XSLT tab will perform the transformation.
 */

public void stateChanged(ChangeEvent event) {
  int index = tabbedPane.getSelectedIndex();
  switch (index) {
    case XSLT: if (documents[XML].isLoaded() &&
                   documents[XSL].isLoaded()) {
                 doTransform();
               }
    case XML:
    case XSL:  updateMenuAndTitle(index);
               break;
    default:
  }
}

/** Retrieve the documents in the XML and XSL pages
 *  as text (String), pipe into a StringReader, and
 *  perform the XSLT transformation. If an exception
 *  occurs, present the problem in a message dialog.
 */

private void doTransform() {
  StringWriter strWriter = new StringWriter();
  try {
    Reader xmlInput =
      new StringReader(documents[XML].getText());
    Reader xslInput =
      new StringReader(documents[XSL].getText());
    transformer = new XslTransformer();
    transformer.process(xmlInput, xslInput, strWriter);
  } catch(TransformerException te) {
    JOptionPane.showMessageDialog(this,
                  "Error: " + te.getMessage());
  }
  documents[XSLT].setText(strWriter.toString());
}

/** Update the title of the application to present
 *  the name of the file loaded into the selected
 *  tabbed pane. Also, update the menu options (Save,
 *  Load) based on which tab is selected.
 */

private void updateMenuAndTitle(int index) {
  if ((index > -1) && (index < documents.length)) {
    saveAction.setEnabled(documents[index].isLoaded());
```

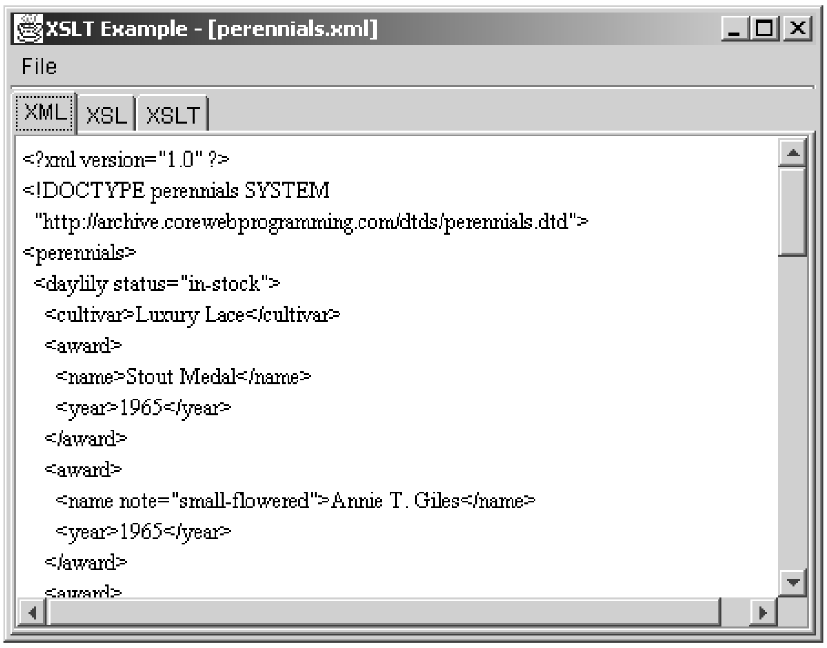
```
      openAction.setEnabled(documents[index].isEditable());
      String title = DEFAULT_TITLE;
      String filename = documents[index].getFilename();
      if (filename.length() > 0) {
        title += " - [" + filename + "]";
      }
      setTitle(title);
    }
  }

  /** Open a file dialog to either load a new file to or save
   *  the existing file in the present document pane.
   */

  private void updateDocument(int mode) {
    int index = tabbedPane.getSelectedIndex();
    String description = tabTitles[index] + " Files";
    String filename = ExtensionFileFilter.getFileName(".",
                                            description,
                                            extensions[index],
                                            mode);
    if (filename != null) {
      if (mode==ExtensionFileFilter.SAVE) {
        documents[index].saveFile(filename);
      } else {
        documents[index].loadFile(filename);
      }
      updateMenuAndTitle(index);
    }
  }

  public static void main(String[] args) {
    new XsltExample();
  }

  // Open menu action to load a new file into a
  // document when selected.
  class OpenAction extends AbstractAction {
    public OpenAction() {
      super("Open ...");
    }
    public void actionPerformed(ActionEvent event) {
      updateDocument(ExtensionFileFilter.LOAD);
    }
  }

  // Save menu action to save the document in the
  // selected pane to a file.
  class SaveAction extends AbstractAction {
    public SaveAction() {
      super("Save");
      setEnabled(false);
    }
    public void actionPerformed(ActionEvent event) {
      updateDocument(ExtensionFileFilter.SAVE);
    }
  }

  // Exit menu action to close the application.
  class ExitAction extends AbstractAction {
    public ExitAction() {
      super("Exit");
    }
    public void actionPerformed(ActionEvent event) {
      System.exit(0);
    }
  }
}
```

Listing 23.14 `DocumentPane.java`

```
import java.awt.*;
import java.awt.event.*;
import javax.swing.*;
import java.io.*;
import java.net.*;

/** A JEditorPane with support for loading and saving the
 *  document. The document should be one of two
 *  types: "text/plain" (default) or "text/html".
 */

public class DocumentPane extends JEditorPane {
  public static final String TEXT = "text/plain";
  public static final String HTML = "text/html";

  private boolean loaded = false;
  private String filename = "";

  /** Set the current page displayed in the editor pane,
   *  replacing the existing document.
   */

  public void setPage(URL url) {
    loaded = false;
    try {
      super.setPage(url);
      File file = new File(getPage().toString());
      setFilename(file.getName());
      loaded = true;
    } catch (IOException ioe) {
      System.err.println("Unable to set page: " + url);
    }
  }
  /** Set the text in the document page, replace the exiting
   *  document.
   */

  public void setText(String text) {
    super.setText(text);
    setFilename("");
    loaded = true;
  }

  /** Load a file into the editor pane.
   *
   *  Note that the setPage method of JEditorPane checks the
   *  URL of the currently loaded page against the URL of the
   *  new page to laod.  If the two URLs are the same, then
   *  the page is <b>not</b> reloaded.
   */

  public void loadFile(String filename) {
    try {
      File file = new File(filename);
      setPage(file.toURL());
    } catch (IOException mue) {
      System.err.println("Unable to load file: " + filename);
    }
  }

  public void saveFile(String filename) {
    try {
      File file = new File(filename);
      FileWriter writer = new FileWriter(file);
      writer.write(getText());
      writer.close();
      setFilename(file.getName());
    } catch (IOException ioe) {
      System.err.println("Unable to save file: " + filename);
    }
  }

  /** Return the name of the file loaded into the editor pane. */

  public String getFilename() {
    return(filename);
  }

  /** Set the filename of the document. */

  public void setFilename(String filename) {
    this.filename = filename;
  }
  /** Return true if a document is loaded into the editor
   *  page, either through <code>setPage</code> or
   *  <code>setText</code>.
   */

  public boolean isLoaded() {
    return(loaded);
  }
}
```

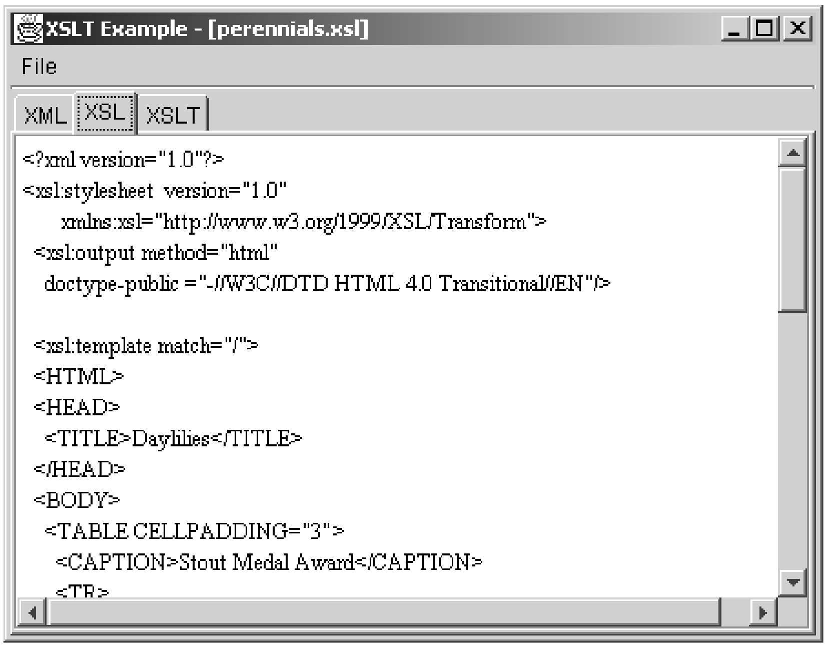
The results for the `XsltExample` are shown in Figure 23-7 through Figure 23-9. Specifically, the result for the XML document pane with the loaded file, `perennials.xml` (Listing 23.4), is shown in Figure 23-7. The XSL document pane with the loaded file, `perennials.xsl` (Listing 23.15), is shown in Figure 23-8. Finally, the XSLT transformation of the XML document is presented in Figure 23-8. For this example, all daylilies awarded a Stout Medal are selected from the XML file and listed in an HTML `TABLE`. For each daylily matching the criteria, the year of hybridization, cultivar name, bloom season, and cost are presented in the table.

Figure 23-7. Presentation of XML tabbed pane in `XsltExample` with `perennials.xml` (Listing 23.4) loaded.



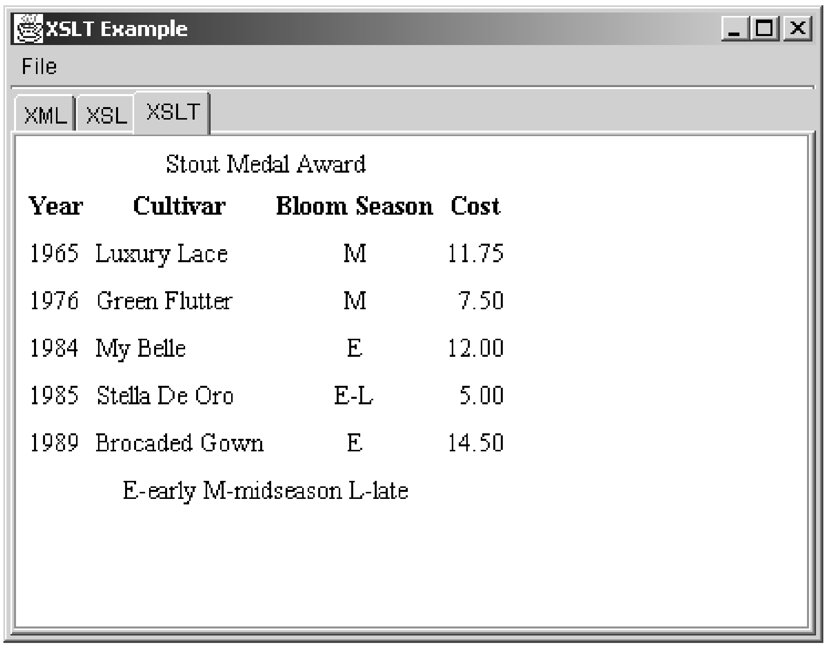
```
<?xml version="1.0" ?>
<!DOCTYPE perennials SYSTEM
  "http://archive.corewebprogramming.com/dtds/perennials.dtd">
<perennials>
  <daylily status="in-stock">
    <cultivar>Luxury Lace</cultivar>
    <award>
      <name>Stout Medal</name>
      <year>1965</year>
    </award>
    <award>
      <name note="small-flowered">Annie T. Giles</name>
      <year>1965</year>
    </award>
    <award>
```

Figure 23-8. Presentation of XSL tabbed pane in `XsltExample` with `perennials.xsl` (Listing 23.15) loaded.



```
<?xml version="1.0"?>
<xsl:stylesheet  version="1.0"
    xmlns:xsl="http://www.w3.org/1999/XSL/Transform">
 <xsl:output method="html"
  doctype-public ="-//W3C//DTD HTML 4.0 Transitional//EN"/>

 <xsl:template match="/">
 <HTML>
 <HEAD>
  <TITLE>Daylilies</TITLE>
 </HEAD>
 <BODY>
  <TABLE CELLPADDING="3">
   <CAPTION>Stout Medal Award</CAPTION>
   <TR>
```

Figure 23-9. Result of XSLT transformation of `perennials.xml` (Listing 23.4) and `perennials.xsl` (Listing 23.15).



Stout Medal Award

Year	Cultivar	Bloom Season	Cost
1965	Luxury Lace	M	11.75
1976	Green Flutter	M	7.50
1984	My Belle	E	12.00
1985	Stella De Oro	E-L	5.00
1989	Brocaded Gown	E	14.50

E-early M-midseason L-late

Note that for Apache Xalan-J to perform the XSLT transformation, the DTD, `perennials.dtd`, must be accessible on-line from http://archive.corewebprogramming.com/dtds/. If you would like to test this example locally, place the file, `perennials.dtd`, in a `dtds` subdirectory below the XML file, and change the `DOCTYPE` statement from

```
<!DOCTYPE perennials SYSTEM
  "http://archive.corewebprogramming.com/dtds/perennials.dtd">
```

to

```
<!DOCTYPE perennials SYSTEM "dtds/perennials.dtd">
```

Note that in the XSL file, if you include a `doctype-public` attribute for the `xsl:output` element, then Xalan will include a `DOCTYPE` statement for the first line of the output document.

Core Approach

Include a `doctype-public` attribute in the `xsl:output` element to produce a `DOCTYPE` statement in the transformed output.

Listing 23.15 `perennials.xsl`

```
<?xml version="1.0"?>
<xsl:stylesheet version="1.0"
  xmlns:xsl="http://www.w3.org/1999/XSL/Transform">
  <xsl:output method="html"
    doctype-public ="-//W3C//DTD HTML 4.0 Transitional//EN"/>

  <xsl:template match="/">
  <HTML>
  <HEAD>
    <TITLE>Daylilies</TITLE>
  </HEAD>
  <BODY>
    <TABLE CELLPADDING="3">
      <CAPTION>Stout Medal Award</CAPTION>
      <TR>
        <TH>Year</TH>
        <TH>Cultivar</TH>
        <TH>Bloom Season</TH>
        <TH>Cost</TH>
      </TR>
      <!-- Select daylilies awarded a Stout Medal. -->
      <xsl:apply-templates
         select="/perennials/daylily[award/id='Stout Medal']"/>
      <TR>
        <TD COLSPAN="4" ALIGN="CENTER">
           E-early M-midseason L-late</TD>
      </TR>
    </TABLE>
  </BODY>
  </HTML>
  </xsl:template>
  <xsl:template match="daylily">
    <TR>
      <TD><xsl:value-of select="award/year"/></TD>
      <TD><xsl:value-of select="cultivar"/></TD>
      <!-- Select the bloom code. -->
      <TD ALIGN="CENTER"><xsl:value-of select="bloom/@code"/></TD>
      <TD ALIGN="RIGHT"><xsl:value-of select="cost"/></TD>
   </TR>
  </xsl:template>

</xsl:stylesheet>
```

23.8 XSLT Example 2: Custom JSP Tag

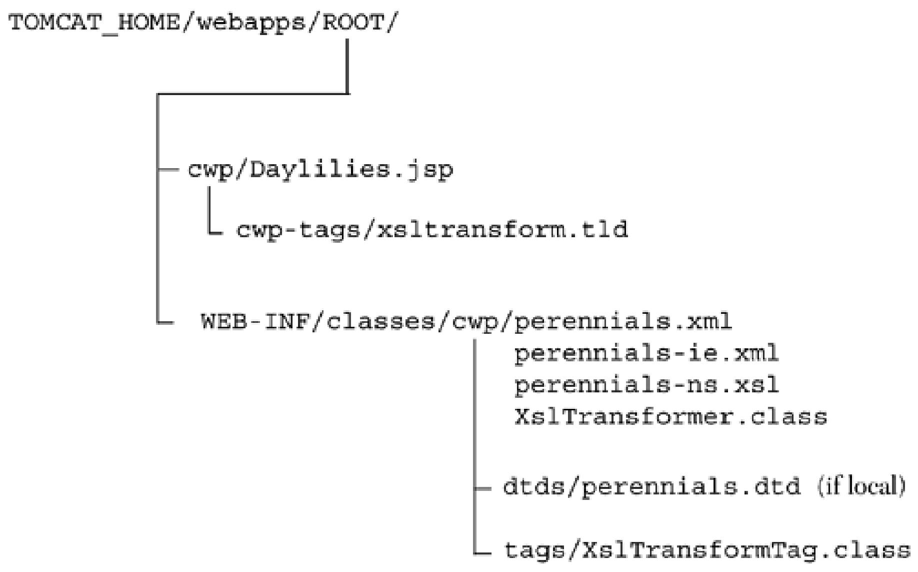
In this example, a custom JSP tag is used along with XSLT to output a listing of Stout Medal daylilies in an HTML table, formatted specifically for the client's browser type. Netscape 4.7 and earlier do not support the HTML 4.0 elements: `THEAD`, `TBODY`, and `TFOOT`. However, these three elements are supported by Internet Explorer 4.x and later (see Section 2.4, "Tables," for details on these elements). Thus, in this example, two separate style sheets are used to process the XML file, `perennials.xml` (Listing 23.4), and depending on which client browser accesses the JavaServer Page, `Daylilies.jsp` (Listing 23.18), the correct style sheet is applied. The first XSL document, `perennials-ie.xsl` (Listing 23.16) formats the daylilies in a table suitable for Internet Explorer by using `THEAD`, `TBODY`, and `TFOOT` elements, and the second XSL document, `perennials-ns.xsl` (Listing 23.17) formats the daylilies in a basic table suitable for Netscape.

The Tag Library Descriptor (TLD) for the custom JSP tag, `xsltransform`, used in `Daylilies.jsp`, is presented in `xsltransform.tld` (Listing 23.19). The tag class for this custom tag is `cwp.tags.XslTransformTag`. Three attributes are defined for the tag: `xml`, the source XML file (required), `xslie`, the XSL style sheet targeting Internet Explorer, and `xslns` (required), the XSL style sheet targeting Netscape. The `xslns` style sheet is required because this is the default style sheet applied if the client browser is not Internet Explorer. For additional information on custom tags, see Section 20.7 (Defining Custom JSP Tags).

The tag class, `XslTransformTag`, is shown in Listing 23.20. The `doStartTag` method builds the `File` objects for the XML and XSL document, where the XSL document applied for the style sheet is determined by the `User-Agent` header in the HTTP request. After the source files are determined, the XSLT transform is performed with `XslTransformer` (Listing 23.12) and the result is sent to the `JspWriter`.

This example requires numerous files that must be located in the proper directories on the server to run correctly. In Figure 23-10, we illustrate where to place the files on a Tomcat server. If the DTD, `perennials.dtd`, is not accessible on-line from http://www.corewebprogramming.com/dtds/, then place the DTD file in a `dtds` subdirectory as illustrated and modify the `DOCTYPE` to

Figure 23-10. Location of files for custom JSP tag example on Tomcat.

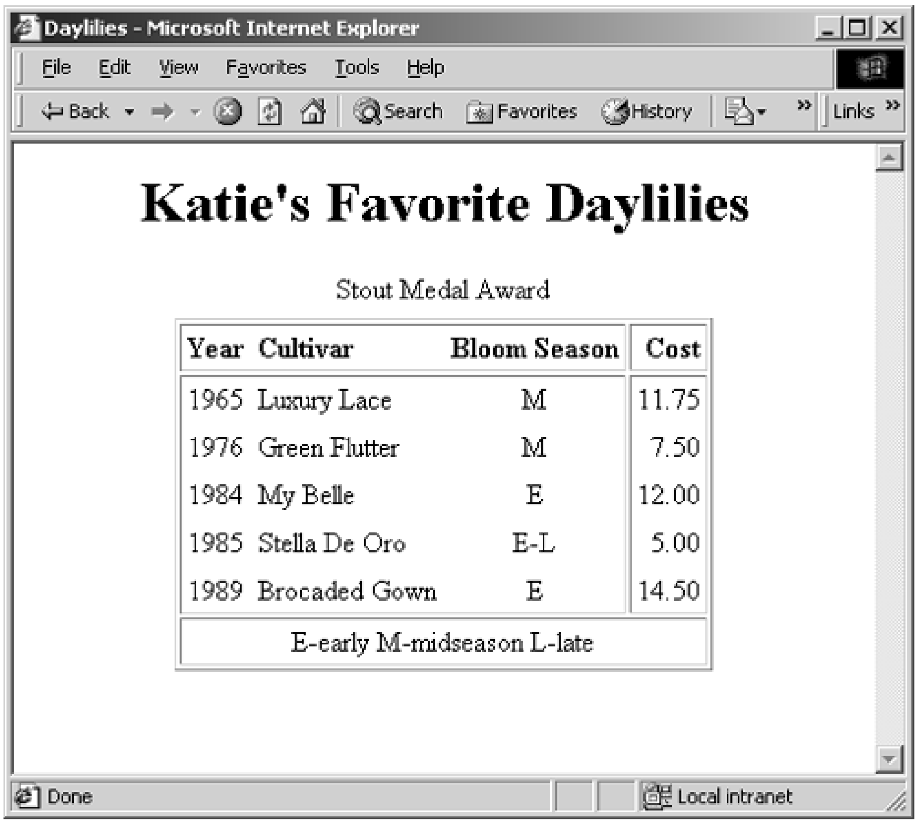

TOMCAT_HOME/webapps/ROOT/
cwp/Daylilies.jsp
cwp-tags/xsltransform.tld
WEB-INF/classes/cwp/perennials.xml
perennials-ie.xml
perennials-ns.xsl
XslTransformer.class
dtds/perennials.dtd (if local)
tags/XslTransformTag.class

```
<!DOCTYPE perennials SYSTEM "dtds/perennials.dtd">
```

The result for Internet Explorer 5.0 on Windows 2000 is shown in Figure 23-11 and the result for Netscape 4.7 on Windows 98 is shown in Figure 23-12.

Figure 23-11. Transformation of `perennials.xml` through a custom JSP tag for Internet

Explorer 5.0 on Windows 2000.

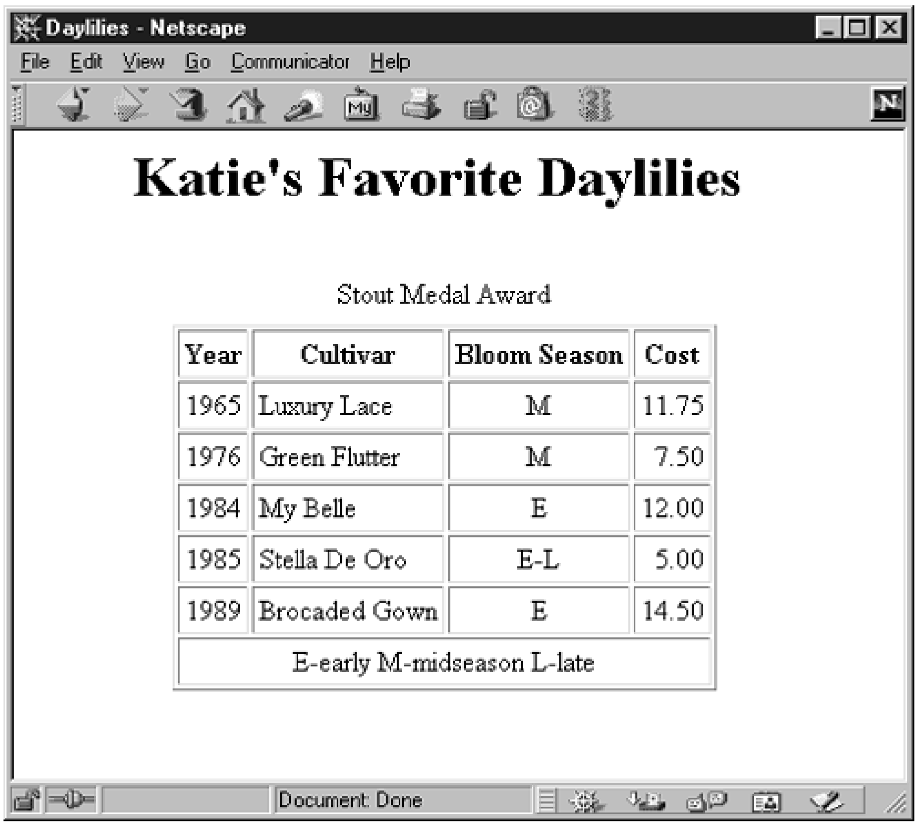

Daylilies - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites History Links
Done
Local intranet

Katie's Favorite Daylilies

Stout Medal Award

Year	Cultivar	Bloom Season	Cost
1965	Luxury Lace	M	11.75
1976	Green Flutter	M	7.50
1984	My Belle	E	12.00
1985	Stella De Oro	E-L	5.00
1989	Brocaded Gown	E	14.50
E-early M-midseason L-late			

Figure 23-12. Transformation of `perennials.xml` through a custom JSP tag on Netscape 4.7 on Windows 98.



Katie's Favorite Daylilies

Stout Medal Award

Year	Cultivar	Bloom Season	Cost
1965	Luxury Lace	M	11.75
1976	Green Flutter	M	7.50
1984	My Belle	E	12.00
1985	Stella De Oro	E-L	5.00
1989	Brocaded Gown	E	14.50
E-early M-midseason L-late			

Listing 23.16 `perennials-ie.xsl`

```
<?xml version="1.0"?>
<!-- Style sheet using THEAD, TBODY, and TFOOT elements. -->
<!-- Suitable for Internet Explorer 4.x and later.       -->
<xsl:stylesheet
    xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
    version="1.0">
  <xsl:output method="html"/>
  <xsl:template match="/">
    <TABLE CELLPADDING="3" RULES="GROUPS" ALIGN="CENTER">
      <CAPTION>Stout Medal Award</CAPTION>
      <COLGROUP>
        <COL ALIGN="CENTER"/>
        <COL ALIGN="LEFT"/>
        <COL ALIGN="CENTER"/>
      </COLGROUP>
      <COLGROUP ALIGN="RIGHT"/>
      <THEAD>
        <TR>
          <TH>Year</TH>
          <TH>Cultivar</TH>
          <TH>Bloom Season</TH>
          <TH>Cost</TH>
        </TR>
      </THEAD>
      <TBODY>
        <!-- Select daylilies awarded Stout Medal. -->
        <xsl:apply-templates
          select="/perennials/daylily[award/id='Stout Medal']"/>
      </TBODY>
      <TFOOT>
        <TR>
          <TD COLSPAN="4">E-early M-midseason L-late</TD>
        </TR>
      </TFOOT>
    </TABLE>
  </xsl:template>
  <xsl:template match="daylily">
    <TR>
      <TD><xsl:value-of select="award/year"/></TD>
      <TD><xsl:value-of select="cultivar"/></TD>
      <!-- Select the bloom code. -->
      <TD><xsl:value-of select="bloom/@code"/></TD>
      <TD><xsl:value-of select="cost"/></TD>
   </TR>
  </xsl:template>
</xsl:stylesheet>
```

Listing 23.17 **perennials-ns.xsl**

```
<?xml version="1.0"?>
<!-- Style sheet using a basic TABLE elements.      -->
<!-- Suitable for Netscape.                         -->
```

```
<xsl:stylesheet version="1.0"
    xmlns:xsl="http://www.w3.org/1999/XSL/Transform">
  <xsl:output method="html"/>
  <xsl:template match="/">
    <TABLE CELLPADDING="3" BORDER="1" ALIGN="CENTER">
      <CAPTION>Stout Medal Award</CAPTION>
      <TR>
        <TH>Year</TH>
        <TH>Cultivar</TH>
        <TH>Bloom Season</TH>
        <TH>Cost</TH>
      </TR>
      <!-- Select daylilies awarded Stout Medal. -->
      <xsl:apply-templates
        select="/perennials/daylily[award/id='Stout Medal']"/>
      <TR>
        <TD COLSPAN="4" ALIGN="CENTER">
          E-early M-midseason L-late</TD>
      </TR>
    </TABLE>
  </xsl:template>
  <xsl:template match="daylily">
    <TR>
      <TD><xsl:value-of select="award/year"/></TD>
      <TD><xsl:value-of select="cultivar"/></TD>
      <!-- Select the bloom code. -->
      <TD ALIGN="CENTER"><xsl:value-of select="bloom/@code"/></TD>
      <TD ALIGN="RIGHT"><xsl:value-of select="cost"/></TD>
   </TR>
  </xsl:template>
</xsl:stylesheet>
```

Listing 23.18 Daylilies.jsp

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.0 Transitional//EN">
<html>
<head>
  <title>Daylilies</title>
</head>
<body>
<%@ taglib uri="cwp-tags/xsltransform.tld" prefix="cwp" %>

<H1 ALIGN="CENTER">Katie's Favorite Daylilies
<p>
<cwp:xsltransform xml='perennials.xml'
                  xslie='perennials-ie.xsl'
                  xslns='perennials-ns.xsl'
/>

</body>
</html>
```

Listing 23.19 **`xsltransform.tld`**

```
<?xml version="1.0" encoding="ISO-8859-1" ?>
<!DOCTYPE taglib
  PUBLIC "-//Sun Microsystems, Inc.//DTD JSP Tag Library 1.1//EN"
  "http://java.sun.com/j2ee/dtds/web-jsptaglibrary_1_1.dtd">

<taglib>
  <tlibversion>1.0</tlibversion>
  <jspversion>1.1</jspversion>
  <shortname>cwp</shortname>
  <urn></urn>
  <info>
    A tag library from Core Web Programming,
    http://www.corewebprogramming.com/.
  </info>

  <tag>
    <name>xsltransform</name>
    <tagclass>cwp.tags.XslTransformTag</tagclass>
    <info>Applies xslt transform based on browser type.</info>
    <attribute>
      <name>xml</name>
      <required>yes</required>
    </attribute>
    <attribute>
      <name>xslie</name>
      <required>false</required>
    </attribute>
    <attribute>
      <name>xslns</name>
      <required>true</required>
    </attribute>
  </tag>
</taglib>
```

Listing 23.20 **`XslTransformTag.java`**

```
package cwp.tags;

import java.io.*;
import javax.servlet.*;
import javax.servlet.jsp.*;
import javax.servlet.http.*;
import javax.servlet.jsp.tagext.*;
import javax.xml.transform.*;
import cwp.XslTransformer;

/** A tag that translates an XML document to HTML using XSLT.
 *  Depending on the client browser type, either an XSL style
 *  targeting Internet Explorer or Netscape (default) is
 *  applied.
 */

public class XslTransformTag extends TagSupport {
  private static final String FS =
    System.getProperty("file.separator");
  private static final int IE = 1;
  private static final int NS = 2;
  private String xml, xslie, xslns;
  public void setXml(String xml) {
    this.xml = xml;
  }

  public String getXml() {
    return(xml);
  }

  public void setXslie(String xslie) {
    this.xslie = xslie;
  }

  public String getXslie() {
    return(xslie);
  }

  public void setXslns(String xslns) {
    this.xslns = xslns;
  }

  public String getXslns() {
    return(xslns);
  }

  public int doStartTag() throws JspException {
    // Determine the path to XML and XSL source files.
    // The path of SERVLET_HOME/WEB-INF/classes/cwp/ is
    // assumed for the location of the source files.
    String FS = System.getProperty("file.separator");
    ServletContext context = pageContext.getServletContext();
    String path = context.getRealPath(FS) + "WEB-INF" + FS +
                  "classes" + FS + "cwp" + FS;

    HttpServletRequest request =
      (HttpServletRequest)pageContext.getRequest();

    // Use either IE or NS style sheet depending on
    // browser type.
    File xslFile = null;
    if ((browserType(request) == IE) && (getXslie() != null)) {
      xslFile = new File(path + getXslie());
    } else {
      xslFile = new File(path + getXslns());
    }
    File xmlFile = new File(path + getXml());
    try {
      JspWriter out = pageContext.getOut();
      XslTransformer transformer = new XslTransformer();
      transformer.process(xmlFile, xslFile, out);
    }
    catch(TransformerException tx) {
      context.log("XslTransformTag: " + tx.getMessage());
    }
    return(SKIP_BODY);
  }

  // Determine the browser type based on the User-Agent
  // HTTP request header.
  private int browserType(HttpServletRequest request) {
    int type = NS;
    String userAgent = request.getHeader("User-Agent");
    if ((userAgent != null) &&
        (userAgent.indexOf("IE") >=0)) {
      type = IE;
    }
    return(type);
  }
}
```

23.9 Summary

Wow! This wraps up the section on server-side programming. Now you know how to process XML documents by using DOM, SAX, and XSLT. You also know how to write servlets and JavaServer Pages, perform HTTP tunneling, and communicate with databases by using JDBC. No doubt you've already started to put these technologies to use in new and exciting Web applications. No doubt your boss is impressed (or are *you* the boss now?).

In the next section we move back to the client side and discuss JavaScript, an interpreted language that runs in the browser. JavaScript can be applied in a variety of ways to make Web pages more flexible and dynamic, but one of the major applications is to check the format of HTML form data *before* it is submitted to the server.

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