XSLT – eXtensible Stylesheet Language Transformations

Unit-II

XSL

- XSL = eXtensible Stylesheet Language
- XSL consists of
  - XPath (navigation in documents)
  - XSLT (T for *transformations)*
  - XSLFO (FO for *formatting objects)*

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<catalog>
    <cd country="UK">
      <title>Dark Side of the Moon</title>
      <artist>Pink Floyd</artist>
      <price>10.90</price>
    </cd>
    <cd country="UK">
        <title>Space Oddity</title>
        <artist>David Bowie</artist>
        <price>9.90</price>
    </cd>
    <cd country="USA">
        <title>Aretha: Lady Soul</title>
        <artist>Aretha Franklin</artist>
        <price>9.90</price>
   </cd>
</catalog>
```

XSLT Stylesheet

- An XSLT stylesheet is a program that transforms an XML document into another XML document
- For example:
  - Transforming XML to XHTML (HTML that conforms to XML syntax)
  - Transforming an XML document to WML (a format of XML that cellular phones can display)

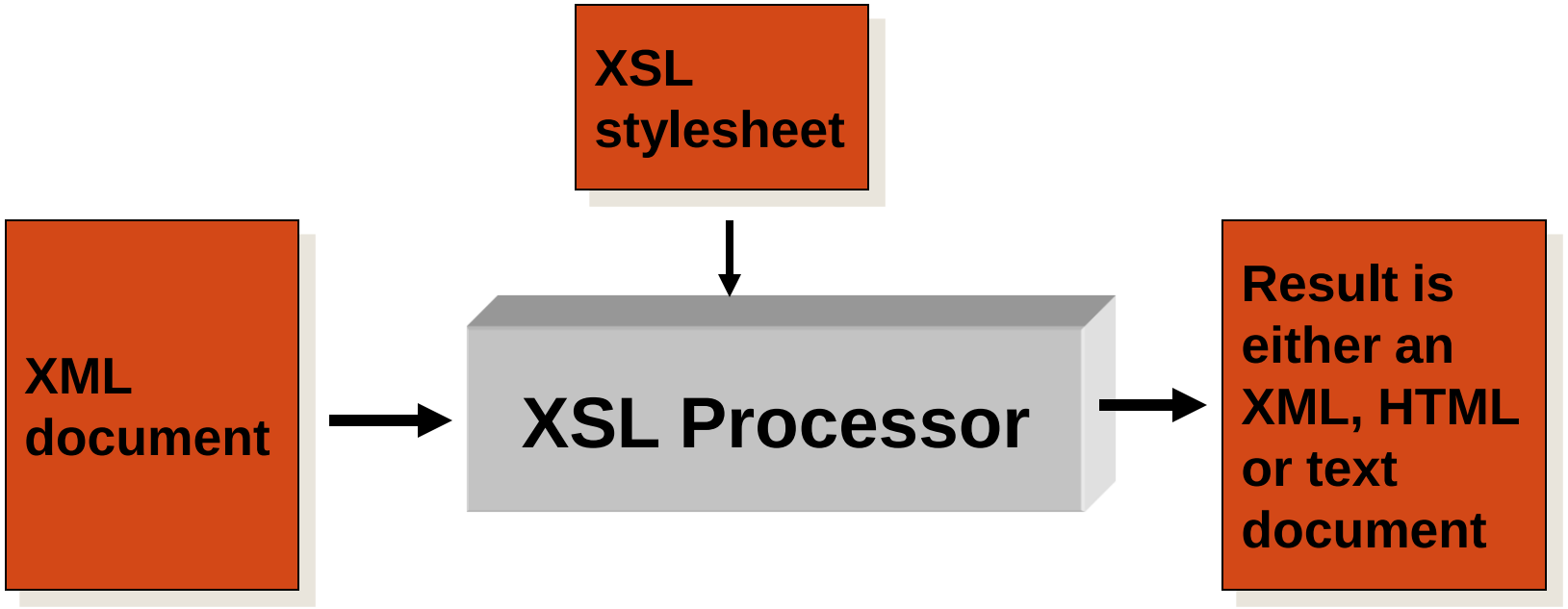
A Few Things About XSL

- XSL is a high-level, functional language
- An XSL style sheet is a valid XML document
  - Valid with respect to the XSL namespace
- Therefore, commands in XSL are *XSL elements*

Applying XSLT Stylesheets to XML Documents

- There are three ways of applying an XSLT stylesheet to an XML document
  - Directly applying an *XSLT processor* to the XML document and the XSLT stylesheet
  - Calling an XSLT processor from within a (Java) program
  - Adding to the XML document a link to the XSL stylesheet and letting the browser do the transformation

Using an XSL Processor

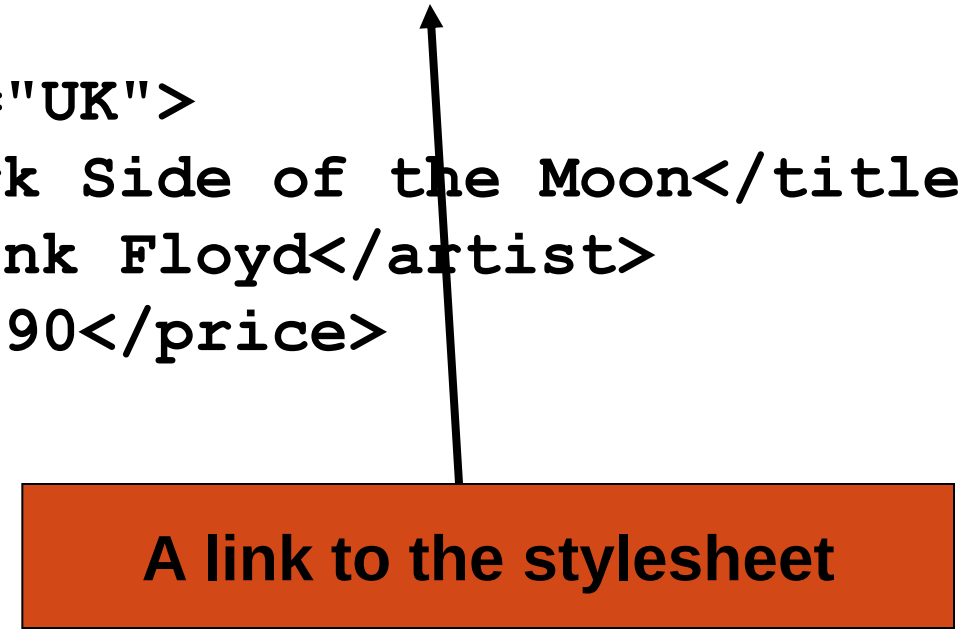



```
java org.apache.xalan.xslt.Process
     -IN myXmlFile.xml -XSL myXslFile.xsl
     -OUT myOutputFile.html
```

Directly applying the Xalan XSL processor

Letting a Browser Perform the Transformation

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<?xml-stylesheet type="text/xsl"
 href="catalog.xsl"?>
<catalog>
    <cd country="UK">
      <title>Dark Side of the Moon</title>
      <artist>Pink Floyd</artist>
      <price>10.90</price>
    </cd>

     ...
</catalog>
```



The Root of the XSL Document

- The Root of the XSL document should be one of the following lines:

```
<xsl:stylesheet version="1.0"
xmlns:xsl="http://www.w3.org/1999/XSL/Transform">
```

```
<xsl:transform version="1.0"
xmlns:xsl="http://www.w3.org/1999/XSL/Transform">
```

The namespace allows the XSL processor to distinguish between XSL tags and tags of the result document

How Does XSLT Work?

- An XSL stylesheet is a collection of *templates* that are applied to *source nodes* (i.e., nodes of the given XML document)
- Each template has a *match* attribute that specifies to which source nodes the template can be applied
- The *current* source node is *processed* by applying a template that matches this node
- Processing always starts at the root (/)

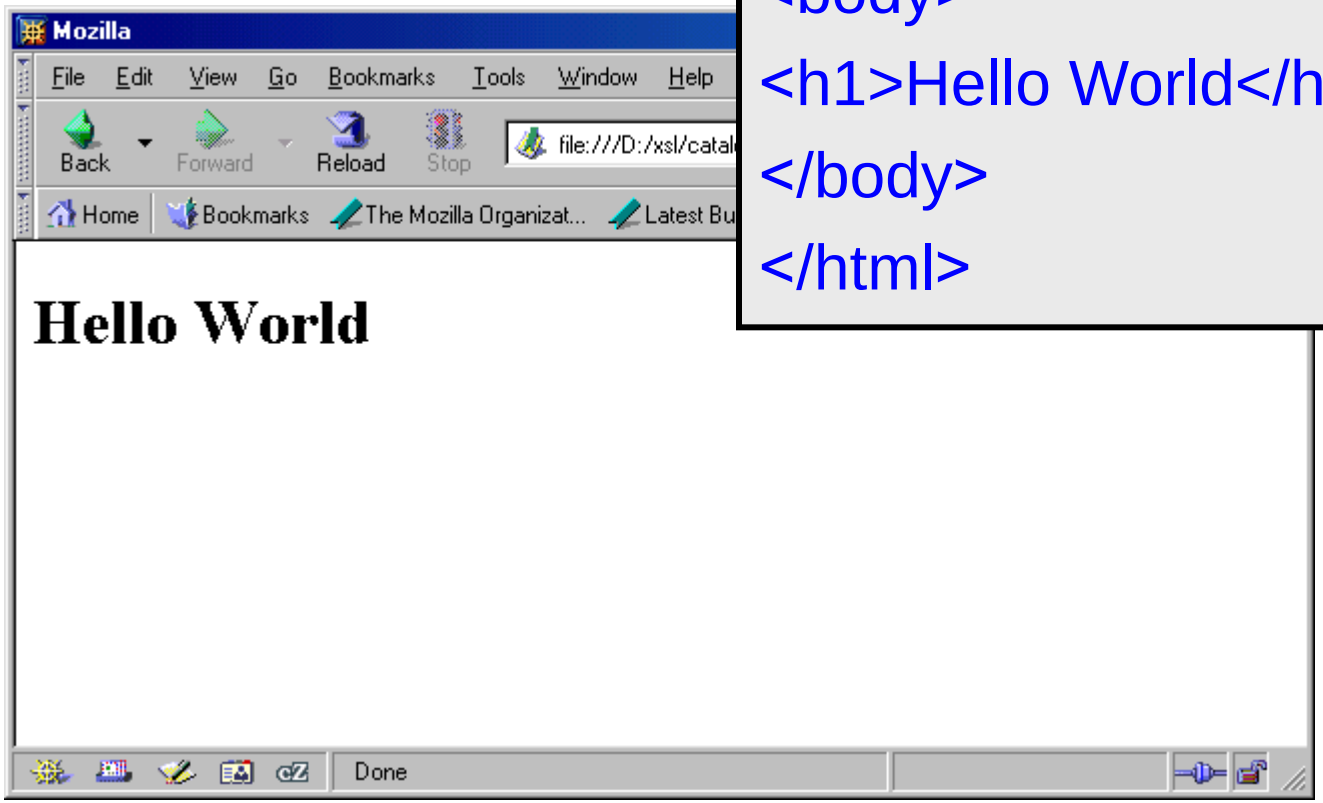
Templates

- A template has the form

```
<xsl:template match="pattern">
  …
</xsl:template>
```

- The content of a template consists of
  - XML elements and text that are copied to the result
  - XSL elements that are actually instructions
- The pattern syntax is a subset of XPath

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<xsl:stylesheet version="1.0"
xmlns:xsl="http://www.w3.org/1999/XSL/
Transform">

<xsl:template match="/">
 <html>
 <body>
   <h1>Hello World</h1>
 </body>
 </html>
</xsl:template>

</xsl:stylesheet>
```




```
<html>
<body>
<h1>Hello World</h1>
</body>
</html>
```

Applying a browser to catalog.xml
(catalog.xml has a link to catalog.xsl)

The Element <xsl:apply-templates>

- Processing starts by applying a template that matches the root (/)
  - If the given XSL stylesheet does not have a template that matches the root, then one is inserted by default
- The XSL stylesheet must specify explicitly whether templates should be applied to descendants of the root
- It is done by putting inside a template the instruction:

```
<xsl:apply-templates select="xpath"/>
```

- Without the select attribute, this instruction processes all the children of the current node

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<xsl:stylesheet version="1.0"
xmlns:xsl="http://www.w3.org/1999/XSL/Transform">

<xsl:template match="/">
 <html>
  <body>
  <xsl:apply-templates select="catalog/cd"/>
  </body>
 </html>
</xsl:template>
<xsl:template match="cd">
    <h2>A CD!</h2>
</xsl:template>

</xsl:stylesheet>
```

```
<html>
 <body>
  <h2>A CD!</h2>
  <h2>A CD!</h2>
  <h2>A CD!</h2>
 </body>
</html>
```

Default Templates

- XSL provides implicit built-in templates that match every element and text nodes

```
<xsl:template match="/ | *">
        <xsl:apply-templates/>
</xsl:template>

<xsl:template match="text()">
        <xsl:value-of select="."/>
</xsl:template>
```

- Templates we write always override these built-in templates (when they match)

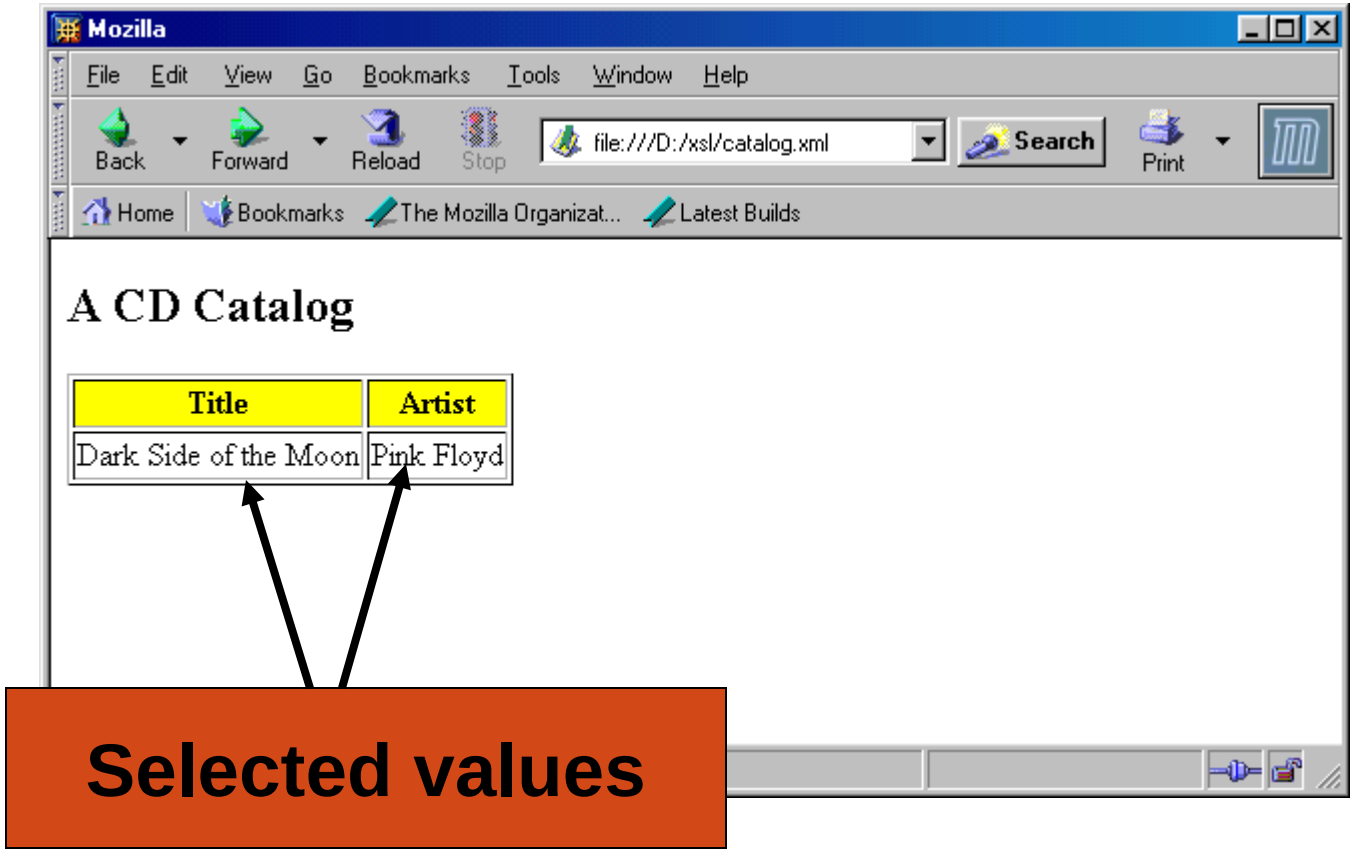
The Most Frequently Used Elements of XSL

- <xsl:value-of select="*xpath-expression*"/>
  - This element extracts the value of a node from the nodelist located by *xpath-expression*
- <xsl:for-each select="*xpath-expression*"/>
  - This element loops over all the nodes in the nodelist located by *xpath-expression*
- <xsl:if test="*xpath-expression*"/>,
- <xsl:if test="*xpath-expression=value*"/>, etc.
  - This element is for conditional processing

The <xsl:value-of> Element

<xsl:value-of select="*xpath-expression*"/>

- The XSL element <xsl:value-of> can be used to extract the value of an element that is selected from the source XML document
- The extracted value is added to the output stream
- The selected element is located by an XPath expression that appears as the value of the *select* attribute


Mozilla
File Edit View Go Bookmarks Tools Window Help
Back Forward Reload Stop
file:///D:/xsl/catalog.xml
Search
Print
Home Bookmarks The Mozilla Organizat... Latest Builds
A CD Catalog
Title
Artist
Dark Side of the Moon
Pink Floyd
Selected values

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<xsl:stylesheet version="1.0"
xmlns:xsl="http://www.w3.org/1999/XSL/
Transform">
```

```
<xsl:template match="/">
 <html>
 <body>
   <h2>A CD Catalog</h2>
   <table border="1">
     <tr bgcolor="yellow">
       <th>Title</th>
       <th>Artist</th>
     </tr>
```

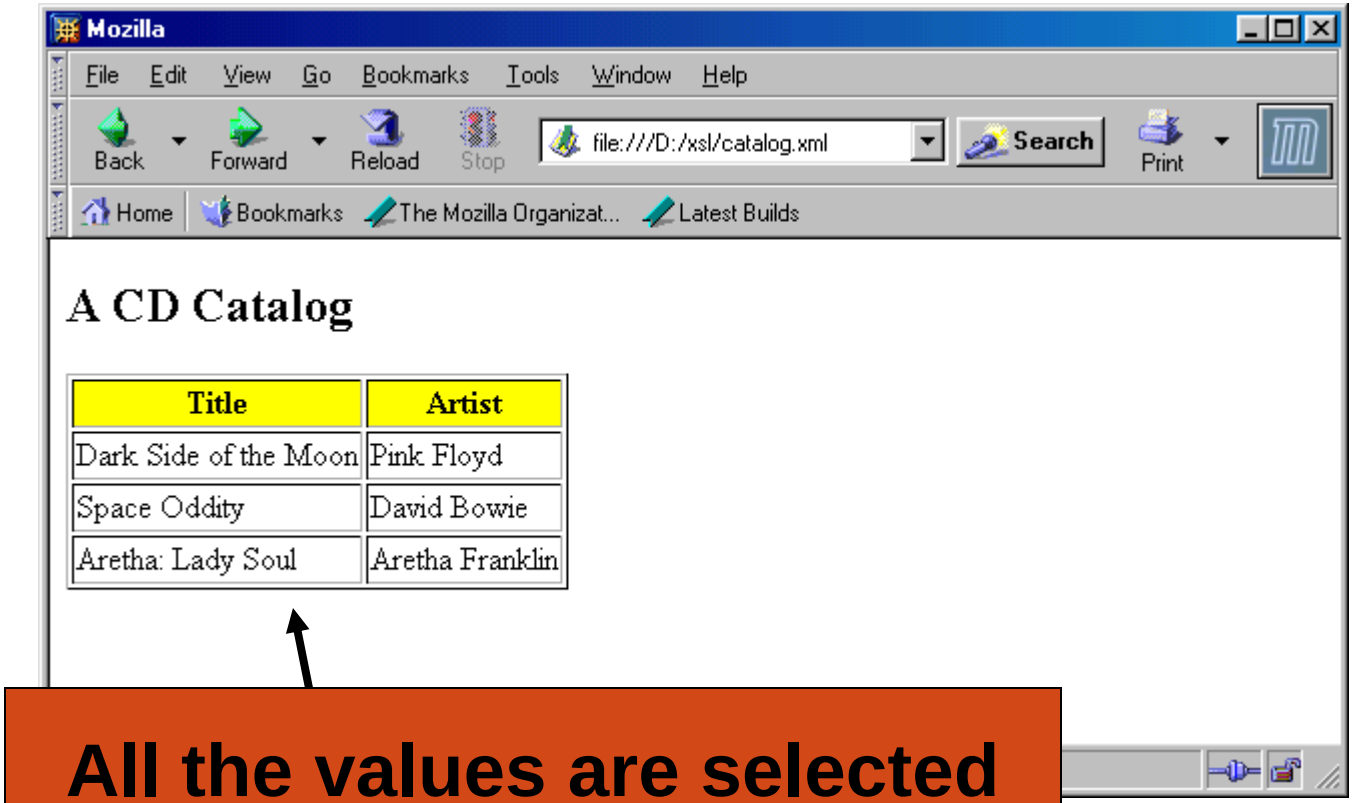
```
<tr>
      <td><xsl:value-of
          select="catalog/cd/title"/>
      </td>
      <td><xsl:value-of
          select="catalog/cd/artist"/>
      </td>
    </tr>
  </table>
 </body>
 </html>
</xsl:template>

</xsl:stylesheet>
```

Note that only the first matched element is retrieved for each <xsl:value of>

The <xsl:for-each> Element

<xsl:for-each select="*xpath-expression*"/>

- The <xsl:for-each> element loops over all the nodes in the nodelist of the XPath expression that appears as the value of the *select* attribute
- The value of each node can be extracted by an <xsl:value-of> element



All the values are selected

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<xsl:stylesheet version="1.0"
xmlns:xsl="http://www.w3.org/1999/XSL/
Transform">

<xsl:template match="/">
 <html>
 <body>
   <h2>A CD Catalog</h2>
   <table border="1">
     <tr bgcolor="yellow">
       <th>Title</th>
       <th>Artist</th>
     </tr>
```

As in the previous example

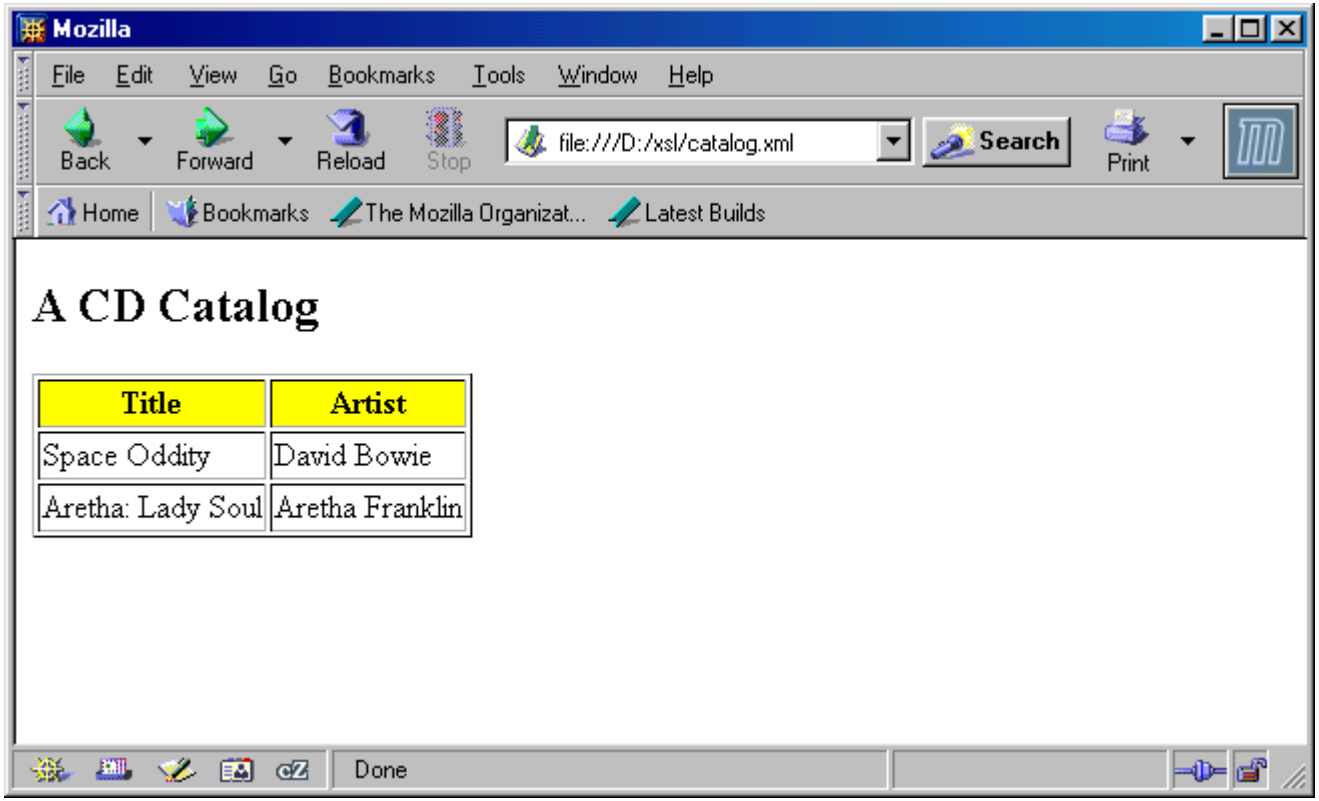
```
      <xsl:for-each select="catalog/cd">
      <tr>
        <td><xsl:value-of select="title"/>
        </td>
        <td><xsl:value-of select="artist"/>
        </td>
      </tr>
      </xsl:for-each>
    </table>
  </body>
  </html>
</xsl:template>

</xsl:stylesheet>
```

Note that all the /catalog/cd elements are retrieved

Consider the following change in the select attribute:

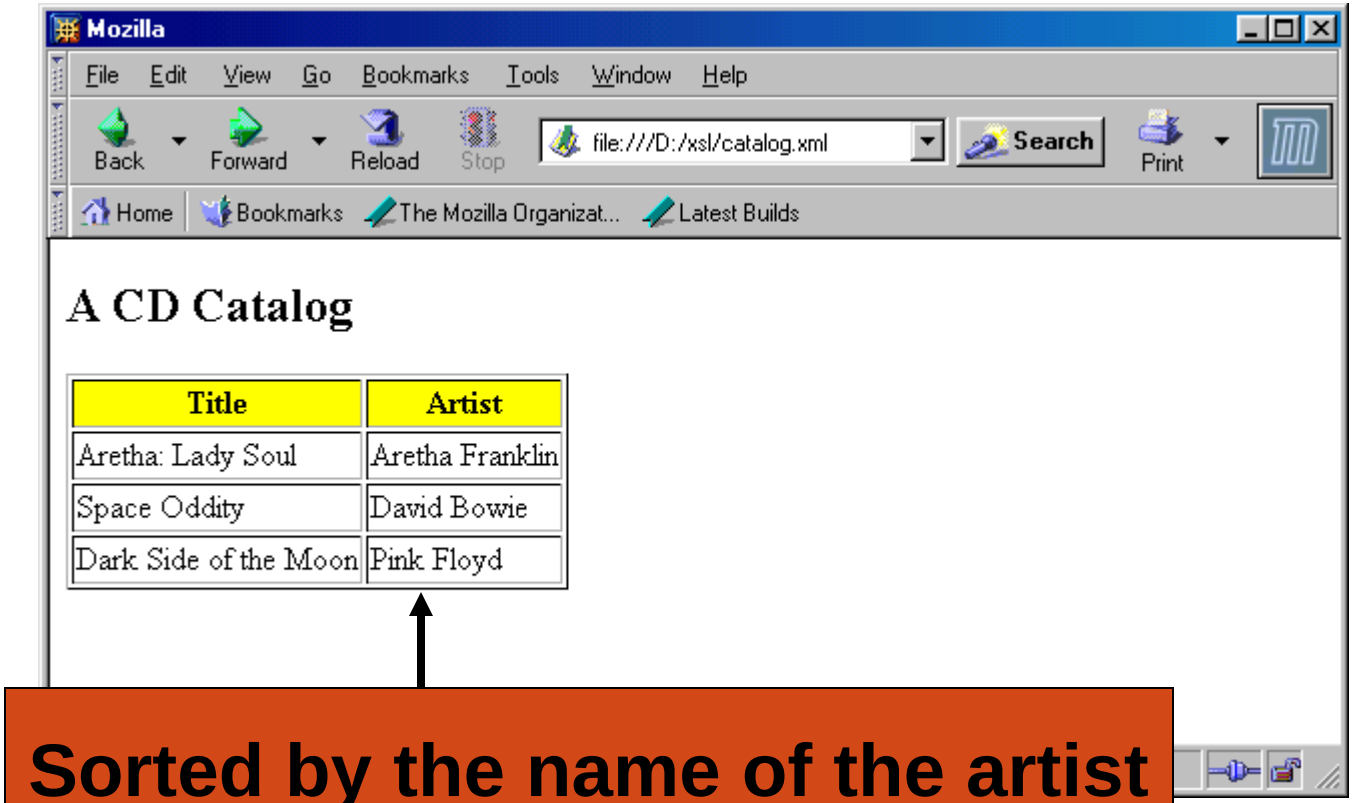
```
      <xsl:for-each
          select="catalog/cd[price&lt;10]">
      <tr>
        <td><xsl:value-of select="title"/>
        </td>
        <td><xsl:value-of select="artist"/>
        </td>
      </tr>
      </xsl:for-each>
    </table>
  </body>
  </html>
</xsl:template>

</xsl:stylesheet>
```

Only elements that satisfy /catalog/cd[price<10] are retrieved


Mozilla
File Edit View Go Bookmarks Tools Window Help
Back Forward Reload Stop
file:///D:/xsl/catalog.xml
Search
Print
Home Bookmarks The Mozilla Organizat... Latest Builds
A CD Catalog
Title
Artist
Space Oddity
David Bowie
Aretha: Lady Soul
Aretha Franklin
Done

The <xsl:sort> Element

- The **<xsl:sort>** element is used to sort the list of nodes that are looped over by the **<xsl:for-each>** element
- Thus, the **<xsl:sort>** must appear inside the **<xsl:for-each>** element
- The looping is done in sorted order



Sorted by the name of the artist

```
      <xsl:for-each select="catalog/cd">
      <xsl:sort select="artist"/>
      <tr>
        <td><xsl:value-of select="title"/>
        </td>
        <td><xsl:value-of select="artist"/>
        </td>
      </tr>
      </xsl:for-each>
    </table>
  </body>
  </html>
</xsl:template>

</xsl:stylesheet>
```

The /catalog/cd elements are sorted according to the value of the artist element

The <xsl:if> Element

- The **<xsl:if>** element is used for conditional processing
- The condition appears as the value of the *test* attribute, for example:

```
<xsl:if test="price &gt; 10">
  some output ...
</xsl:if>
```

- The elements inside the **<xsl:if>** element are processed if the condition is true

Note

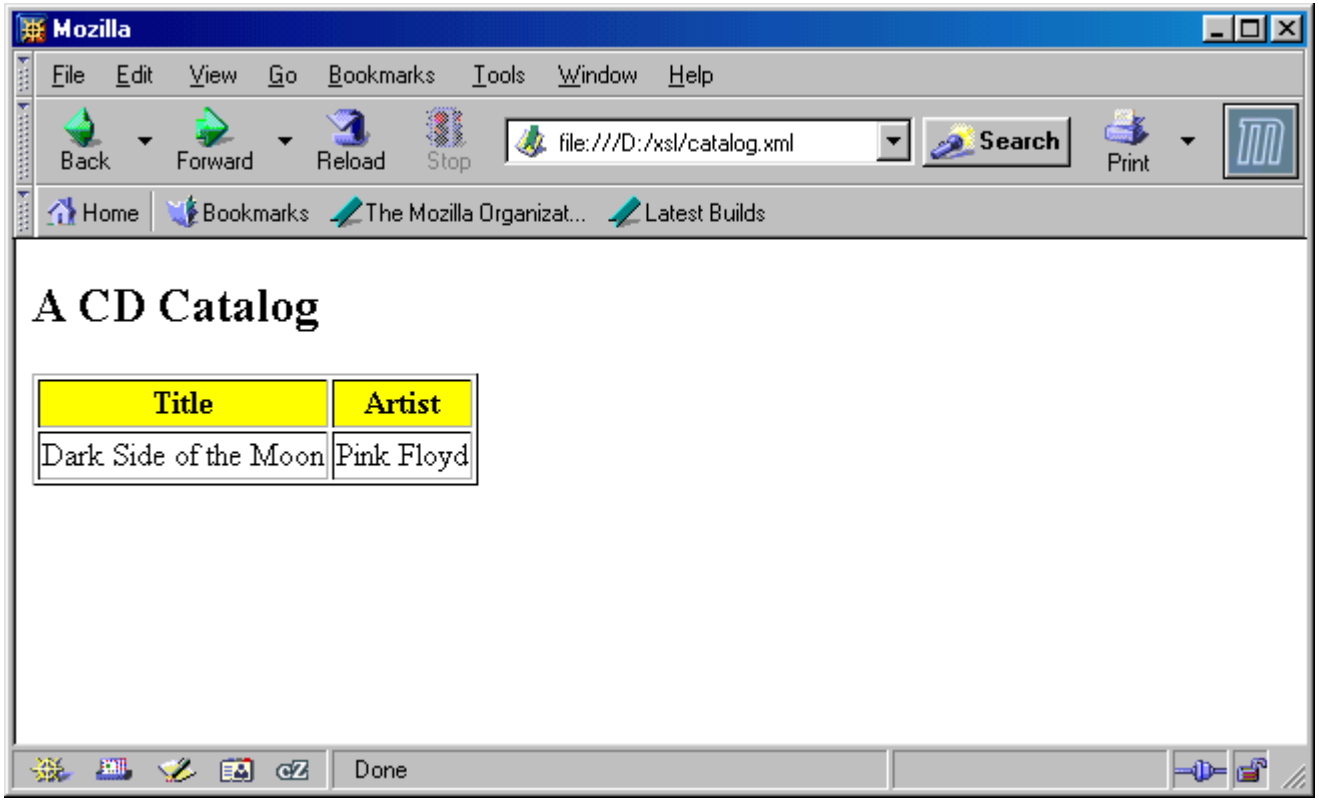
- Processing the inside elements means
  - Copying them into the output stream if they are not XSL elements, and
  - Evaluating them if they are XSL elements
- If the value of the test attribute is just an XPath expression (i.e., without any comparison), then the test is satisfied if the nodelist of this XPath expression is not empty

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<xsl:stylesheet version="1.0"
xmlns:xsl="http://www.w3.org/1999/XSL/
Transform">

<xsl:template match="/">
 <html>
 <body>
   <h2>A CD Catalog</h2>
   <table border="1">
     <tr bgcolor="yellow">
       <th>Title</th>
       <th>Artist</th>
     </tr>
```

As in the previous examples

```
      <xsl:for-each select="catalog/cd">
      <xsl:if test="price &gt; 10">
      <tr>
        <td><xsl:value-of select="title"/>
        </td>
        <td><xsl:value-of select="artist"/>
        </td>
      </tr>
      </xsl:if>
      </xsl:for-each>
    </table>
  </body>
  </html>
</xsl:template>

</xsl:stylesheet>
```

Only /catalog/cd with price>10 are retrieved


Mozilla
File Edit View Go Bookmarks Tools Window Help
Back Forward Reload Stop
file:///D:/xsl/catalog.xml
Search
Print
Home Bookmarks The Mozilla Organizat... Latest Builds
A CD Catalog
Title
Artist
Dark Side of the Moon
Pink Floyd
Done

The <xsl:choose> Element

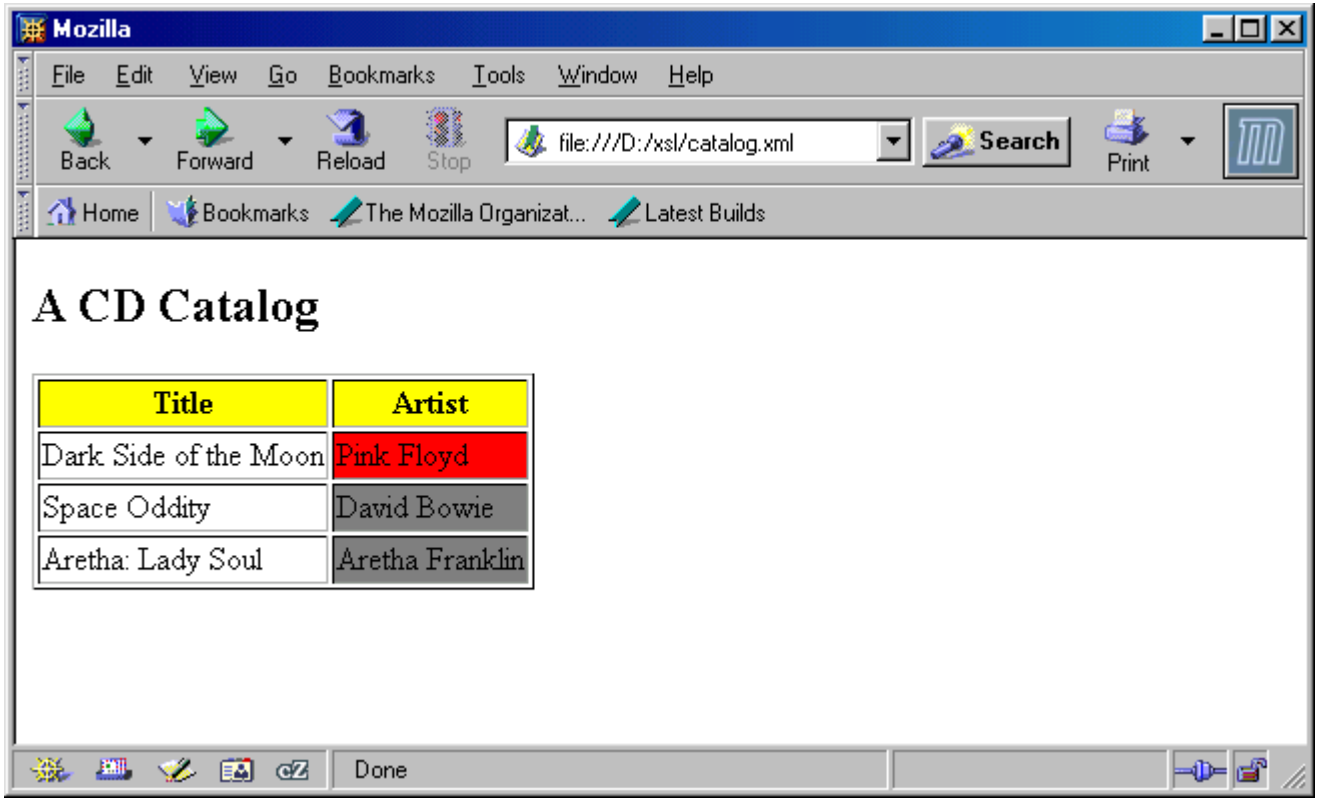
- The **<xsl:choose>** element is used in conjunction with **<xsl:when>** and **<xsl:otherwise>** to express test with multiple conditions
- There can be many **<xsl:when>** inside an **<xsl:choose>** element, but there should be a single **<xsl:otherwise>** inside an **<xsl:choose>** element

Using <xsl:choose>

- To insert a conditional choose against the content of the XML file, simply add the **<xsl:choose>**, **<xsl:when>**, and **<xsl:otherwise>** elements to your XSL document like this:

```
<xsl:choose>
   <xsl:when test="price &gt; 10">
      ... some code ...
   </xsl:when>
   <xsl:otherwise>
      ... some code ....
   </xsl:otherwise>
</xsl:choose>
```

```
<xsl:for-each select="catalog/cd"><tr>
  <td><xsl:value-of select="title"/></td>
    <xsl:choose>
      <xsl:when test="price &gt; 10">
        <td bgcolor="red">
          <xsl:value-of select="artist"/></td>
        </xsl:when>
        <xsl:when
            test="price&gt;9 and price&lt;=10">
          <td bgcolor="gray">
          <xsl:value-of select="artist"/></td>
        </xsl:when>
        <xsl:otherwise>
          <td><xsl:value-of select="artist"/></td>
        </xsl:otherwise>
    </xsl:choose></tr>
</xsl:for-each>
```


Mozilla
File Edit View Go Bookmarks Tools Window Help
Back Forward Reload Stop
file:///D:/xsl/catalog.xml
Search
Print
Home Bookmarks The Mozilla Organizat... Latest Builds
A CD Catalog
Title
Artist
Dark Side of the Moon
Pink Floyd
Space Oddity
David Bowie
Aretha: Lady Soul
Aretha Franklin
Done

Applying Templates Recursively

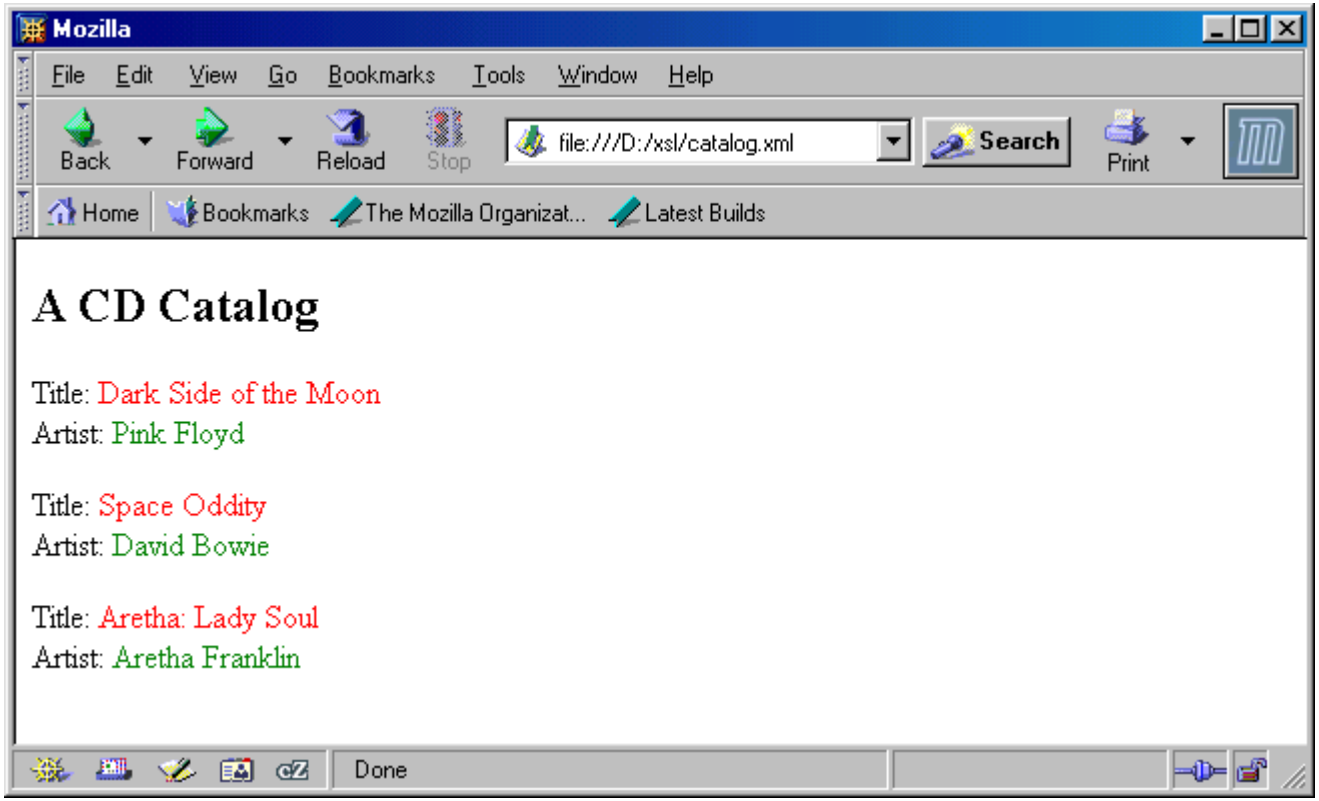
- The following example shows how to apply templates recursively
- Generally, it is possible (but not in this example) that more than one template matches the current source node

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<xsl:stylesheet version="1.0"
xmlns:xsl="http://www.w3.org/1999/XSL/
Transform">

<xsl:template match="/">
  <html>
  <body>
  <h2>A CD Catalog</h2>
    <xsl:apply-templates/>
  </body>
  </html>
</xsl:template>
```


```
<xsl:template match="cd">
  <p>
  <xsl:apply-templates select="title"/>
  <xsl:apply-templates select="artist"/>
  </p>
</xsl:template>
```

```
<xsl:template match="title">
  Title: <span style="color:red">
  <xsl:value-of select="."/></span>
  <br />
</xsl:template>
```


```
<xsl:template match="artist">
  Artist: <span style="color:green">
  <xsl:value-of select="."/></span>
  <br />
</xsl:template>

</xsl:stylesheet>
```



Mozilla
File Edit View Go Bookmarks Tools Window Help
Back Forward Reload Stop
file:///D:/xsl/catalog.xml
Search
Print
Home Bookmarks The Mozilla Organizat... Latest Builds
A CD Catalog
Title: Dark Side of the Moon
Artist: Pink Floyd
Title: Space Oddity
Artist: David Bowie
Title: Aretha: Lady Soul
Artist: Aretha Franklin
Done

Is Recursive Application of Templates Really Needed?

- The output of the previous example can also be generated by an XSL stylesheet that uses only one template that matches the root (and does not use the element **`<xsl:apply-templates>`**)
- However, some tasks can only be done by applying templates recursively
  - This typically happens when the structure of the source XML document is not known

For example

- Suppose that we want to write an XSL stylesheet that generates an exact copy of the source XML document
  - It is rather easy to do it when the structure of the source XML document is known

```
<?xml version="1.0"?>
<xsl:stylesheet xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
                version="1.0">

    <xsl:output method="xml"/>

    <xsl:template match="*">
        <xsl:element name="{name(.)}">
            <xsl:for-each select="@*">
                <xsl:attribute name="{name(.)}">
                    <xsl:value-of select="."/>
                </xsl:attribute>
            </xsl:for-each>
            <xsl:apply-templates/>
        </xsl:element>
    </xsl:template>

</xsl:stylesheet>
```

Identity Transformation Stylesheet

The <xsl:output> Element

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<xsl:stylesheet version="1.0"
xmlns:xsl="http://www.w3.org/1999/XSL/
Transform">
<xsl:output method="xml" version="1.0"
encoding="iso-8859-1" indent="yes"/>

......

</xsl:stylesheet>
```

Tells in what format the output should be: xml/html/text

Some Other XSL Elements

- The <xsl:text> element allows to insert free text in the output
- The <xsl:copy-of> element creates a copy of the current node
- The <xsl:comment> element is used to create a comment node in the result tree

<xsl:text>

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<xsl:stylesheet version="1.0"
   xmlns:xsl="http://www.w3.org/1999/XSL/Transform">

<xsl:template match="/">
 <html>
 <body>
  <h2>My CD Collection</h2>
  <p>Titles:
  <xsl:for-each select="catalog/cd">
   <xsl:value-of select="title"/>
   <xsl:if test="position() &lt; last()-1">
    <xsl:text>, </xsl:text>
   </xsl:if>
   <xsl:if test="position()=last()-1">
    <xsl:text>, and </xsl:text>
   </xsl:if>
```

<xsl:text> (cont'd)

```
<xsl:if test="position()=last()">
      <xsl:text>!</xsl:text>
    </xsl:if>
  </xsl:for-each>
  </p>
 </body>
 </html>
</xsl:template>

</xsl:stylesheet>
```

<xsl:copy-of>

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<xsl:stylesheet version="1.0" xmlns:xsl="http://www.w3.org/1999/XSL/Transform">
  <xsl:variable name="header">
      <tr bgcolor="#9acd32">
        <th align="left">Title</th>
        <th align="left">Artist</th>
      </tr>
  </xsl:variable>
  <xsl:template match="/">
      <html>
        <body>
          <h2>My CD Collection</h2>
          <table border="1">
            <xsl:copy-of select="$header"/>
            <xsl:for-each select="catalog/cd">
```

<xsl:copy-of> (cont'd)

```
    <tr>
        <td>
        <xsl:value-of select="title"/>
        </td>
        <td>
        <xsl:value-of select="artist"/>
        </td>
    </tr>
</xsl:for-each>
</table>
</body>
</html>
</xsl:template>
</xsl:stylesheet>
```