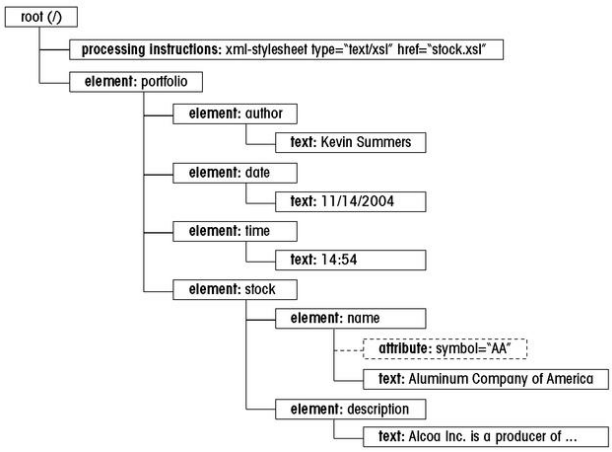
Enterprise Systems and Architecture

CMPU4025

XSL

RECALL



RECALL - CREATING THE ROOT TEMPLATE

- A **template** is a collection of elements that define how a particular section of the source document should be transformed in the result document
- The **root template** sets up the initial code for the result document

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RECALL - CREATING A TEMPLATE

To create a template, the syntax is:

```
<xsl:template match="node">
   XSLT and Literal Result Elements
</xsl:template>
```

where node is either the name of a node from the source document's node tree, or an XPath expression that points to a node in the tree

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WORKING WITH TEMPLATES – Using the ***<xsl:apply-templates>*** element

To apply a template in the result document, use the XSLT element

– **<xsl:apply-templates** select="*XPath Expression*" />

where *XPath Expression* indicates the node template to be applied

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CREATING TEMPLATE EXAMPLE

```
<xsl:template match="/">
<html>
<head>
<title>Stock Information</title>
<link href="stock.css" rel="stylesheet" type="text/css" />
</head>
<body>
<div id="datetime"><b>Last Updated: </b>
   <xsl:apply-templates select="portfolio/date" /> at
   <xsl:value-of select="portfolio/time" />
</div>
<h1 class="title">Hardin Financial</h1>
<h2 class="title">Stock Information</h2>
<xsl:apply-templates select="portfolio/stock/name" />
</body>
</html>
</xsl:template>

<xsl:template match="name">
<h3 class="name">
   <xsl:value-of select="." />
</h3>
</xsl:template>

</xsl:stylesheet>
```

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SORTING NODES

- By default, nodes are processed in document order, by their appearance in the document
- To specify a different order, XSLT provides the **<xsl:sort>** element
- This element can be used with either the **<xsl:apply-templates>** or the **<xsl:for-each>** element

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SORTING NODES

The <xsl:sort> element contains several attributes to control how the XSLT process sorts the nodes in the source document

- The *select* attribute determines the criteria under which the context node is sorted
- The *data-type* attribute indicates the type of data (number, text)
- The *order* attribute indicates the direction of the sorting (ascending or descending)

```
<xsl:apply-templates select="day".
        <xsl:sort data-type="number" order="descending" />
</xsl:apply-templates>
```

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CREATING CONDITIONAL NODES

- XSLT supports two kinds of conditional elements:
  - <xsl:if>
  - <xsl:choose>
- To apply a format only if a particular condition is met , use the <xsl:if> element
- To test for multiple conditions and display different outcomes, use the <xsl:choose> element

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CREATING CONDITIONAL NODES EXAMPLE

```
<xsl:template match="today">
<table class="today">
<tr>
   <th class="today">Current</th>
   <th class="today">Open</th>
   <th class="today">High</th>
   <th class="today">Low</th>
   <th class="today">Volume</th>
</tr>
<tr>
   <td class="number">
   <xsl:choose>
      <xsl:when test="@current &lt; @open">
         <img src="down.gif" />
      </xsl:when>
      <xsl:when test="@current > @open">
         <img src="up.gif" />
      </xsl:when>
      <xsl:otherwise>
         <img src="same.gif" />
      </xsl:otherwise>
   </xsl:choose>
      <xsl:value-of select="@current" />
   </td>
   <td class="number"><xsl:value-of select="@open" /></td>
   <td class="number"><xsl:value-of select="@high" /></td>
   <td class="number"><xsl:value-of select="@low" /></td>
   <td class="number"><xsl:value-of select="@vol" /></td>
</tr>
</table>
</xsl:template>
```

node (element) to process

operator (see next slide)

All the html elements are literals

attributes of the element

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USING COMPARISON OPERATORS AND FUNCTIONS

OPERATOR	DESCRIPTION	EXAMPLE
=	Tests whether two values are equal to each other	@symbol = "AA"
!=	Tests whether two values are unequal	@symbol != "AA"
<	Tests whether one value is less than another	day < 5
<=	Tests whether one value is less than or equal to another	day <= 5
>	Tests whether one value is greater than another	day > 1
>=	Tests whether one value is greater than or equal to another	day >= 1

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WORKING WITH PREDICATES

- *Predicates* are XPath expressions that test for a condition and create subsets of nodes that fulfill that condition
- The predicate can also indicate the position of the node in the node tree
- To select a specific position in the source document, use the *position()* function combined with any XPath expression

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ADDING PREDICATES TO THE ROOT TEMPLATE EXAMPLE

```
<xsl:template match="/">
<html>
<head>
<title>Stock Information</title>
<link href="stock.css" rel="stylesheet" type="text/css" />
</head>
<body>
<div id="datetime"><b>Last Updated: </b>
   <xsl:apply-templates select="portfolio/date" /> at
   <xsl:value-of select="portfolio/time" />
</div>
<h1 class="title">Hardin Financial</h1>
<h2 class="title">Stock Information</h2>
<h2 class="category">Industrials</h2>
<xsl:apply-templates select="portfolio/stock[category='Industrials']">
   <xsl:sort select="name" />
</xsl:apply-templates>

<h2 class="category">Utilities</h2>
<xsl:apply-templates select="portfolio/stock[category='Utilities']">
   <xsl:sort select="name" />
</xsl:apply-templates>

<h2 class="category">Transportation</h2>
<xsl:apply-templates select="portfolio/stock[category='Transportation']">
   <xsl:sort select="name" />
</xsl:apply-templates>
</body>
</html>
</xsl:template>
```

Test for condition

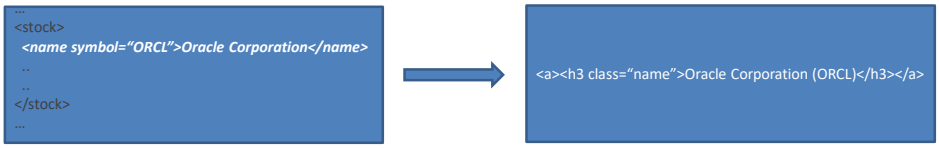
CREATING ELEMENTS AND ATTRIBUTES

- To create an element, XSLT uses the **<xsl:element>** tag
- The **name** attribute assigns a name to the element
- The **namespace** attribute provides a namespace
- The **use-attribute-sets** provides a list of attribute-sets

CREATING AN ELEMENT

- To create the <a> element in the result document, use the <xsl:element> tag

```
<xsl:template match="name">
<xsl:element name="a">
<h3 class="name">
   <xsl:value-of select="." />
   (<xsl:value-of select="@symbol" />)
</h3>
</xsl:element>
</xsl:template>
```



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CREATING AN ATTRIBUTE

- Attributes are created in XSLT by using the **<xsl:attribute>** element
- The **name** attribute specifies the name of the attribute
- The **namespace** attribute indicates the namespace

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CREATING AN ATTRIBUTE

- To add the **href** attribute to the **<a>** tag, use the <xsl:attribute> element

```
<xsl:template match="name">
<xsl:element name="a">
<xsl:attribute name="href">
   <xsl:value-of select="../link" />
</xsl:attribute>
<h3 class="name">
   <xsl:value-of select="." />
   (<xsl:value-of select="@symbol" />)
</h3>
</xsl:element>
</xsl:template>
```

```
...
<stock>
  <name symbol="ORCL">Oracle Corporation</name>
  <link>http://theWebAddress</link>
  ..
</stock>
...
```

```
<a href="http://theWebAddress">
  <h3 class="name">Oracle Corporation (ORCL)</h3>
</a>
```

CREATING COMMENTS AND PROCESSING INSTRUCTIONS

- The **<xsl:comment>** element creates the comment
- You can create a processing instruction by using the **<xsl:processing-instruction>** element
- If you want to add a processing instruction to attach the result document to the *style.css* sheet, use the following code:

```
<xsl:processing-instruction name="xml-style sheet">
        href="styles.css" type="text/css"
</xsl:processing-instruction>
```

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Summary so far…

- Extensible Style sheet Language,or XSL, is composed of three parts: XSL-FO, XSLT, and XPath
- **XPath** language is used to reference a node
- **Templates** are used to format sections of the XML document and transform XML data into a variety of formats
- Nodes can be **sorted** in either alphabetical or numerical order
- **Comparison** elements allow changing the contents of the result document based on the values of the nodes in the source document
- **Predicates** are used to create subsets of the source document's node tree
- You can **insert new elements and attributes** in the transformed document

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<xsl:number>

- Used to determine the integer position of the current node in the **source**. It is also used to format a number.
- Attributes:
  - **value**=expression: any XPath expression that evaluates to a number
  - **count**=pattern: specifies which nodes to count
  - **format**=pattern: pattern indicates number format
  - **grouping-size, grouping-separator**: indicate how digits are grouped and separator character

XPath Function – position()

```
<xsl:for-each select="catalog/cd">
    <xsl:number value="position()" format="1" />
    <xsl:value-of select="title" /><br />
</xsl:for-each>
```

Output the current numeric position of the current node in the result document

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WORKING WITH **XPATH FUNCTIONS**

- Used to calculate numerical values or manipulate text strings
- Numerical functions:

Figure 7-7 XPATH NUMERIC FUNCTIONS

FUNCTION	DESCRIPTION
ceiling(*number*)	Rounds *number* up to the nearest integer
count(*node_set*)	Counts the number of nodes in *node_set*
floor(*number*)	Rounds *number* down to the nearest integer
last(*node_set*)	Returns the index of the last node in *node_set*
position()	Returns the position of the context node within the processed node set
round(*number*)	Rounds *number* to the nearest integer
sum(*node_set*)	Calculates the sum of the values of *node_set*

XPATH TEXT FUNCTIONS

Figure 7-14 XPATH TEXT STRING FUNCTIONS

FUNCTION	DESCRIPTION
concat(*string1*, *string2*, *string3*, ...)	Combines *string1*, *string2*, *string3*, ... into a single text string
contains(*string1*, *string2*)	Returns the value true if *string1* contains the text string, *string2* and false if otherwise
starts-with(*string1*, *string2*)	Returns the value true if *string1* begins with the characters defined in *string2* and false if otherwise
string(*object*)	Converts *object* to a text string. If *object* is not specified, the string() function returns the string value of the context node.
string-length(*string*)	Returns the length of *string*. If *string* is not specified, the string-length() function returns the length of the string value of the context node.
substring(*string*, *start*, *length*)	Returns a substring from *string*, starting with the character in the *start* position and continuing for *length* characters. If no length is specified, the substring goes to the end of the original text string.
substring-after(*string1*, *string2*)	Returns a substring of *string1* that occurs after the characters defined in *string2*
substring-before(*string1*, *string2*)	Returns a substring of *string1* that occurs before the characters defined in *string2*

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WORKING WITH MATHEMATICAL OPERATORS

Six operators:

Figure 7-15 XPATH MATHEMATICAL OPERATORS

OPERATOR	DESCRIPTION	EXAMPLE
+	Adds two numbers together	3 + 5
–	Subtracts one number from another	5 – 3
*	Multiplies two numbers together	5 * 3
div	Divides one number by another	15 divided by 3
mod	Provides the remainder after performing a division of one number by another	15 mod 3
–	Negates a single number	–2

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FORMATTING NUMBERS

- XPath function format-number
- Syntax: format-number(value, format)
- Example: format-number(56823.847, “#,##0.00”) displays 56,823.85

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NUMBER FORMAT SYMBOLS

Figure 7-18 NUMBER FORMAT SYMBOLS

SYMBOL	DESCRIPTION
#	Placeholder that displays an optional number of digits in the formatted number and is usually used as the leftmost symbol in the number format
0	Placeholder that displays required digits in the formatted number
.	Separates the integer digits from the fractional digits
,	Separates groups of digits in the number
;	Separates the pattern for positive numbers from the pattern for negative numbers
–	Shows the location of the minus symbol for negative numbers
%	Multiplies the number by 100 and displays the number as a percentage
‰	Multiplies the number by 1000 and displays the number as a per-mille value

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<XSL:DECIMAL-FORMAT>

- Holds decimal formatting information
- Controls separator characters such as . and ,
- Can be named or default if un-named
- Named decimal format passed as argument to format-number

<xsl:decimal-format name="euro" decimal-separator="," grouping-separator="."/>

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<XSL:DECIMAL-FORMAT> ATTRIBUTES

Figure 7-19 ATTRIBUTES OF THE <XSL:DECIMAL-FORMAT> ELEMENT

ATTRIBUTE	DESCRIPTION
name	Name of the decimal format. If you omit a name, the numbering scheme becomes the default format for the document.
decimal-separator	Character used to separate the integer and fractional parts of the number. The default is ".".
grouping-separator	Character used to separate groups of digits. The default is ",".
infinity	Text string used to represent infinite values. The default is "infinity".
minus-sign	Character used to represent negative values. The default is "-".
NaN	Text used to represent entries which are not numbers. The default is "NaN".
percent	Character used to represent numbers as percentages. The default is "%".
per-mille	Character used to represent numbers in parts per 1000. The default is "0/00".
zero-digit	Character used to indicate a required digit in the number format pattern. The default is "0".
digit	Character used to indicate an optional digit in the number format pattern. The default is "#".
pattern-separator	Character used to separate positive number patterns from negative number patterns in the number format. The default is ";".

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INSERTING ATTRIBUTE VALUES

- E.g. ***XSLT expression*** inserted into HTML attribute value
- Syntax: <*tag attribute*="{*XSLT expression*}" >

  Example: *<td rowspan="{count(../../Items/Item)}">*

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WORKING WITH TEXT NODES AND WHITE SPACE

White space:

- Space devoid of any printable character
- Space, tab, new line, carriage return

Adjacent <xsl:value-of> elements will have results combined to eliminate white space

<xsl:text> can be used to create white space:

- Syntax: *<xsl:text>Text</xsl:text>*
- Can only contain literal text

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WHITE SPACE ENTITIES

Space -

Tab - 	

New line -

Carriage return -

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CONTROLLING WHITESPACE

Stripping space:

- Remove text nodes from the result document that contain *only* white space
- Syntax: *<xsl:strip-space elements="pattern">*
- Use * as pattern to match all nodes

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CONTROLLING WHITESPACE

Preserving space:

- Make sure that text nodes that contain only white space are not deleted
- Syntax: *<xsl:preserve-space elements="pattern">*
- Use * as pattern to match all nodes

Normalize space:

- Remove leading and trailing spaces
- Syntax: *normalize-space(text)*

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USING VARIABLES

- User-defined name that stores a particular value or object
- Types:
  - XPath
    - number
    - text string
    - node set
    - Boolean
  - Non XPath
    - result tree fragment

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USING VARIABLES

- Syntax: *<xsl:variable name="name" select="value"/>*

  Example: *<xsl:variable name="Months" select="12" />*
- Names are case-sensitive
- Value only set once upon declaration
- Enclose text strings in single-quotes

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USING VARIABLES

- Value can be XPath expression
- Boolean type:
  - Set value to expression that is true or false
- Result tree fragment type:
  - Syntax:

```
<xsl:variable name="Logo">
        <img src="logo.gif" width="300" height="100" />
</xsl:variable>
```

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REFERENCING VARIABLES

- Syntax: *$variable-name*

  Example: *$Months*

- Referencing tree fragments:
  - Do not use $variable-name
  - Use <xsl:copy> or <xsl:copy-of> to reference value

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COPYING

<xsl:copy>

- Syntax: *<xsl:copy />*
- Shallow copy: only node itself is copied

<xsl:copy-of>

- Syntax: *<xsl:copy-of select="expression"/>*
- Deep copy: node and descendants are copied

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VARIABLE SCOPE

Global:

- Can be referenced from anywhere within the style sheet
- Must be declared at the top level of the style sheet, as a direct child of the <xsl:stylesheet> element
- Must have a unique variable name

Local:

- Referenced only within template
- Can share name with other local or global variable

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USING PARAMETERS

Similar to variables, but:

- Value can be changed after it is declared
- Can be set outside of scope

Syntax: *<xsl:param name="name" select="value"/>*

- Example: *<xsl:param name="Filter" select="'C103'" />*

To reference: *$param-name*

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SETTING PARAMETER VALUES EXTERNALLY

Depends on XSLT processor

Some work by appending parameter value to url

Command line processors allow external parameter setting:

- MSXML
- Saxon

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TEMPLATE PARAMETERS

Local in scope

Created inside <xsl:template> element

To pass parameter to template

- place <xsl:with-param> element in <xsl:apply-templates> element
- Syntax: *<xsl:with-param name="name" select="value"/>*
- No error if calling param name does not match template param name

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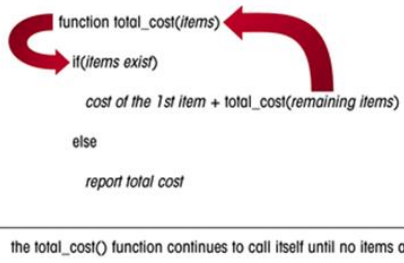
TEMPLATE PARAMETERS

```
<xsl:template name="print_grade">
   <xsl:param name="target_grade" />
   <xsl:param name="list" />
    …
    <h1><xsl:value-of select="$target_grade" /></h1>
    ….
</xsl:template>
```

RECURSION in XSL

- Recursion in functional programming
- Function calls itself



the total_cost() function continues to call itself until no items are left

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WRITING A RECURSIVE TEMPLATE

- Templates that call themselves, usually passing along a new parameter value with each call
- Needs to have a stopping condition
  - Expressed in an if statement or a choose statement
  - If missing, will call itself without end

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WRITING A RECURSIVE TEMPLATE

Syntax with <xsl:if>:

```
<xsl:template name="template_name">
  <xsl:param name="param_name" select="default_value" />
  ...
  <xsl:if test="no_stopping_condition">
  ...
    <xsl:call-template name="template_name">
      <xsl:with-param name="param_name" select="new_value" />
    </xsl:call-template>
  ...
  </xsl:if>
</xsl:template>
```

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WRITING A RECURSIVE TEMPLATE

Syntax with <xsl:choose>

```
<xsl:template name="template_name">
  <xsl:param name="param_name" select="default_value" />
  ...
  <xsl:choose>
  <xsl:when test="stopping_condition">
  ...
  </xsl:when>
  <xsl:otherwise>
  ...
    <xsl:call-template name="template_name">
    <xsl:with-param name="param_name" select="new_value" />
    </xsl:call-template>
  ...
  </xsl:otherwise>
  </xsl:choose>
</xsl:template>
```

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RECURSIVE TEMPLATE

```
<xsl:template name="total_cost">
   <xsl:param name="list" />
   <xsl:param name="total" select="0" />
   <xsl:choose>
      <xsl:when test="$list">
         <xsl:variable name="first" select="$list[1]" />
         <xsl:call-template name="total_cost">
            <xsl:with-param name="list" select="$list[position() > 1]" />
            <xsl:with-param name="total"
                 select="$first/@Qty * $first/@Price + $total" />
         </xsl:call-template>
      </xsl:when>
      <xsl:otherwise>
         <xsl:value-of select="format-number($total, '$#,#00.00')" />
      </xsl:otherwise>
   </xsl:choose>
</xsl:template>
```

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Executing XML validation and Transformation in **Java**

- Up to now – we've used a browser to do most of the work
  - Viewing raw XML – using browser view
  - Executing Javascript to validate an XML file against a schema file (XSD file)
  - Using the built in browser functionality
    - ✓XML parsing
    - ✓XSL Transformations

Executing XML validation and Transformation in **Java**

- Next we will consider these functions from a Java development perspective
- In Java – we can load, parse, validate and transform XML
- To do this we require code libraries to help us achieve it (up to now, we relied on the browser)
- Java API: Java API for XML Processing (JAXP)
- Java comes with bundled classes to help with this *(Xerces for xml / Xalan for xslt)*

Java Code to load an XML File

```
//Load xml file...
File file = new File("shipment.xml");
DocumentBuilderFactory dbf =
   DocumentBuilderFactory.newInstance();
DocumentBuilder db = dbf.newDocumentBuilder();
Document doc = db.parse(file);
```

Java Code to load an XML Schema (XSD file)

```
//Load xml schema and create a validator for it...
SchemaFactory factory =
   SchemaFactory.newInstance(XMLConstants.W3C_XML_SCHEMA_NS_URI);

Schema schema = factory.newSchema(new File("shipment.xsd"));
Validator validator = schema.newValidator();
```

Java Code to validate an XML file against its schema (XSD file)

```
//Validate the xml file against the schema...
validator.validate(new DOMSource(doc));
System.out.println("Success...");
```

Final Code to load and validate an XML file

```
try{

    //Load the xml schema and create a validator for it...
    SchemaFactory factory =
    SchemaFactory.newInstance(XMLConstants.W3C_XML_SCHEMA_NS_URI);
    Schema schema = factory.newSchema(new File("shipment.xsd"));
    Validator validator = schema.newValidator();

    //Load the xml file...
    File file = new File("shipment.xml");
    DocumentBuilderFactory dbf = DocumentBuilderFactory.newInstance();
    DocumentBuilder db = dbf.newDocumentBuilder();
    Document doc = db.parse(file);

    //Validate the xml file against the schema...
    validator.validate(new DOMSource(doc));
    System.out.println("Success...");
}
    catch (Exception e){
    System.out.println(e.getMessage());
}
```

Java Code to transform an XML file using an XSLT Stylesheet (XSL file)

```
//Transform the xml to html...
 TransformerFactory tFactory = TransformerFactory.newInstance();

 Transformer transformer =
         tFactory.newTransformer( new StreamSource("shipment.xsl"));

 transformer.transform( new StreamSource("shipment.xml"),
         new StreamResult(new FileOutputStream("shipment.html")) );

System.out.println("** The output is written to shipment.html **");
```

Labs

XML, XSD, XSLT, Messaging (JMS)

Enterprise Applications Integration

Lab sessions over the coming weeks

- XSLT - Intro labs
- XSLT – More Advanced
- XSLT - Using Java and XSLT
- Messaging (JMS) - setup / illustration
- XML / XSD / XSL / JMS / Java working together