Lecture 29: XSLT

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Software Methods and Tools
CSCI 3308 - Fall Semester, 2004

Today's Lecture

- Introduce XSLT
  - background
  - concepts
  - examples
- XSLT stands for XML Stylesheet Language, Transformations

Transformations

- XSLT was developed as part of the XML stylesheet standards effort
- What's a stylesheet?
  - A stylesheet is a device for specifying presentation information independent of content
  - For instance, in Microsoft Word, you can specify that a "heading" should appear in 36pt Times bold font with double spacing above and below
    - Then all headings will appear that way, no matter what the heading actually "says"

Stylesheets in HTML

- The Web already has a stylesheet language called "cascading stylesheets" or CSS
- This mechanism allows formatting information to be associated with HTML tags, such as <h1> or <p> without using <font> or <b> tags
- In the last lecture, we asked the question, if CNN switched to using XML in their webpage, how would they associate formatting information with a tag such as <headline>?

XSLT

- The answer is with the XML Stylesheet Language, Transformations (XSLT)
  - As the name suggests, XSLT is part of the XSL Specification
  - This part specifies mechanisms for transforming XML to other structures
    - XML->XML
    - XML->HTML
    - XML->PDF

XSLT

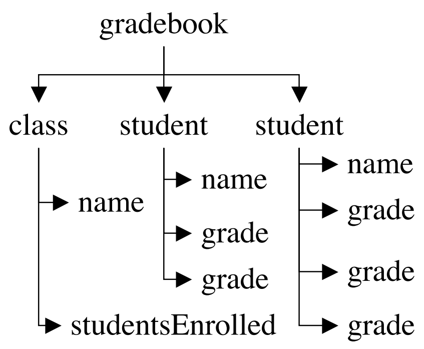
- XSLT is often used to transform XML documents into XHTML and CSS
  - XHTML and CSS are the current standard for presenting structured / styled information on the Web
    - See <http://www.csszengarden.com/> for details

Background

- To understand XSLT, you must view XML documents as tree structures
  - XSLT provides rules to transform one tree into another tree
  - It traverses the source tree in an order dictated by the stylesheet and creates the destination tree using the rules of the stylesheet

Example of viewing XML as a tree

```
<!DOCTYPE gradebook [
        <!ELEMENT gradebook (class, student*)>
        <!ELEMENT class (name, studentsEnrolled)>
        <!ATTLIST class semester CDATA #REQUIRED>
        <!ELEMENT name (#PCDATA)>
        <!ELEMENT studentsEnrolled (#PCDATA)>
        <!ELEMENT student (name, grade*)>
        <!ELEMENT grade (#PCDATA)>
        <!ATTLIST grade name CDATA #REQUIRED>
]>
```



Background: XPath

- XSLT uses a separate standard, called XPath, to help select nodes in an XML document
- For instance…
  - gradebook/student/grade
  - …is an XPath expression that selects all “grade” nodes in the example on the previous slide
- XPath can even select attributes…for example..
  - gradebook/student/grade[@name=“hw3”]
  - …will select only those grade nodes that have a value of “hw3” for their name attribute

More XPath examples

- //grade
  - “start at the root node and find all grade nodes”
- gradebook/student[2]
  - “select the second student node under gradebook”
- For more information on XPath see
  - < http://www.w3.org/TR/xpath>
- You will need to know how to create “simple” XPath expressions (like the ones shown above) to complete lab 10

XSLT, the details

- XSLT transforms XML documents using stylesheets that are themselves XML documents
- All XSLT stylesheets have the following form

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

      …templates and transformation rules go here…

</xsl:stylesheet>
```

  - You can use this template when writing your own XSL Stylesheet in Lab 10

Stylesheets

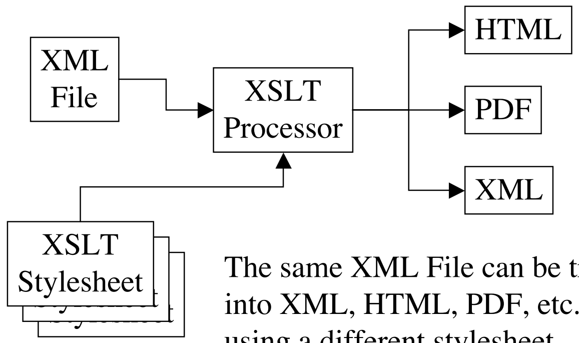
- Stylesheets consist of templates that “match” nodes of the source XML tree (i.e. document)
  - Each template then specifies what should be created in the destination tree (or document)
  - A template looks like this:

```
<xsl:template match="/">
<html>
    <head>
        <title>Grade Book</title>
    </head>
    <xsl:apply-templates/>
</html>
</xsl:template>
```

The tag is called “xsl:template” and it has an attribute called “match” that takes an XPath expression

If a node matches this expression (in this case the root note) then the associated text appears in the destination document (except for the “xsl:apply-templates” part)

XSLT Architecture



The same XML File can be transformed into XML, HTML, PDF, etc. just by using a different stylesheet

More Details

- Stylesheet processing
  - XSLT processor is handed a document and a stylesheet
  - It starts a (breadth-first) traversal at the root node and checks to see if there is a template match
    - If so, it applies the template and looks for an “xsl:apply-templates” element
      - If such an element exists, it continues the traversal
      - if no such element exists, the traversal stops
    - If not, it traverses down the tree looking for a template match with some other node of the tree

XSL:apply-templates

- The apply-templates tag determines if an XSLT processor continues traversing a document once a template match has occurred
- The apply-templates tag can contain an attribute called “select” which can specify the specific children to continue traversing using an XPath expression
  - <xsl:apply-templates/>
    - All children traversed
  - <xsl:apply-templates select=“grade[@name=‘HW4’]”>
    - All grade nodes with a name attribute equal to “HW4” traversed (any other nodes skipped during the subsequent traversal)

Processing in XSLT stylesheets

- XSLT is very powerful
  - We cannot cover the entire standard
  - So, the following slides cover only a small subset of the tags that can be placed in an XSLT stylesheet
  - For a good reference on XSLT see:
    - <http://www.zvon.org/xxl/XSLTreference/Output/index.html>

Repetition

```
<xsl:for-each select = “item”>
    Do something here ...
</xsl:for-each>
```

- Again, the select attribute is an XPath expression that selects the nodes to iterate over

Repetition Example

```
<xsl:template match="/">
<html>
    <head>
        <title>Grade Book</title>
    </head>
    <body>
    <ul>
    <xsl:for-each select=“student/grade”>
        <li>Grade: <xsl:value-of select="."/></li>
    </xsl:for-each>
    </ul>
    </body>
</html>
</xsl:template>
```

Example Explained

- This example creates a simple HTML file that contains a list of all the grades received by students in the gradebook
  - Note: It did not list student names for each set of grades but it could have easily done so.
  - The “student/grade” XPath expression in the for-each select attribute skipped past the student nodes and selected only grade nodes
  - The value-of element pulled the value of the grade element (e.g. the grade) into the HTML file
  - The resulting HTML file is shown on the next slide

Generated HTML File

```
<html>
    <head>
        <title>Grade Book</title>
    </head>
    <body>
    <ul>
        <li>Grade: 10<li>
        <li>Grade: 7<li>
        <li>Grade: 6<li>
        <li>Grade: 10<li>
        … more grades here ...
    </ul>
    </body>
</html>
```

- In the browser, this file would look like this:
- Grade Book
  - Grade: 10
  - Grade: 7
  - Grade: 6
  - Grade: 10
- e.g. a bulleted list of grades

Additional Tags

- <xsl:value-of select=“.”>
  - Used to pull the values of XML tags out of XML files, e.g. the part that appears between the begin and close tags
  - <grade>10</grade> -> places 10 in destination document
- <xsl:if test=“position()=last()”>
  - A tag for doing processing conditionally
  - value of test is again an XPath expression
  - This particular XPath expression determines if the current node is the last child of the parent node

Additional Tags

```
<xsl:choose>
  <xsl:when
      test = “position()=last()”>
      Do something for last element
  </xsl:when>
  <xsl:when
      test = “position()=first()”>
      Do something for first element
  </xsl:when>
  <xsl:otherwise>
    Do something for other elements
  </xsl:otherwise>
</xsl:choose>
```

Additional Tags

- <xsl:sort data-type=“” select=“” order=“”>
  - Used to sort the results of a select statement of another XSLT tag
  - The select attribute of xsl:sort is used to indicate which field of the selected nodes is used to perform the sort
  - Appears within an <xsl:apply-templates> tag
  - data-type can have the value “text” or “number”; text is the default
  - order can have the value “ascending” or “descending”; ascending is the default
- <xsl:apply-templates select=“//student”>
  - <xsl:sort select=“name”/>
- </xsl:apply-templates>
- This selects all student nodes, sorts them by name, and then applies templates to them

More information

- http://www.xslt.com/
  - General Information
- http://www.w3.org/TR/xslt/
  - XSLT specification
- http://xml.apache.org/xalan/
  - Powerful XSLT stylesheet processor
    - You will be using Xalan in Lab 10