XML and Databases

Lecture 11
XSLT – Stylesheets and Transforms

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Outline

1. eXtensible Stylesheet Language Transformations (XSLT)
2. Templates: (match pattern → action)
3. Default Templates
4. Conflict Resolution
5. Modes and Variables

XML

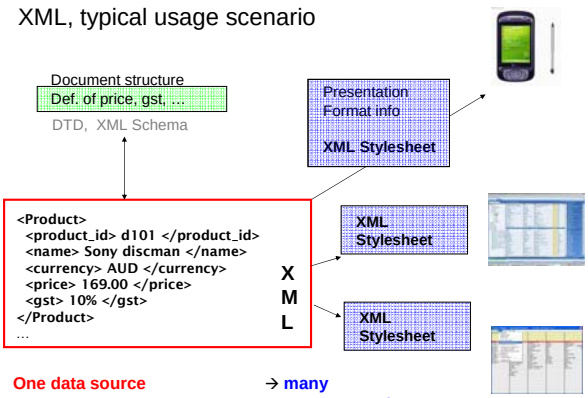
→ General data format

→ Includes no formatting information
(other than linebreaks etc in text nodes)

Data Model (XPath)

→ Seven types of nodes
(doc, elem, text, attr, ns, com, pi)

XML, typical usage scenario



One data source

→ **many** (dynamic gen.) **views**

XML

→ General data format

→ Includes no formatting information

Usage Idea

→ Store data *once*, in most general format
(free tech writers from bothering with layout issues)

→ Reuse fragments of the data (same contents; looks different depending on the context)

E.g. different output formats (size, device)
style tailored to reader's preference
style tailored to adhere w. corporate/web site identity

1. eXtensible Stylesheet Language

"stylesheet" = recipe how to *display* your XML data

e.g. "display titles of books in bold, large font"
"display authors of books in italic, medium size"
etc.

→ Choose an output format (e.g. XHTML, HTML, text, PDF, etc.)

→ Transform the XML:
- add formatting information
- rearrange data
- sorting
- delete certain parts, copy others

etc

Example Transformations

- XML to HTML— for old browsers
- XML to LaTeX—for TeX layout
- XML to SVG—graphs, charts, trees
- XML to tab-delimited—for db/stat packages
- XML to plain-text—occasionally useful
- XML to FO—*XSL formatting objects* (mostly used to generate PDF)

This slide and some examples in the end are taken from
David G. Durand's *"Introduction to XSLT"*
http://www.cs.brown.edu/~dgd/xslt-tutorial.ppt

1. eXtensible Stylesheet Language

- XSLT takes
  - a "source" XML document
  - a transform (XSLT program)
- XSLT applies templates to matched nodes
  - may delete or include the rest
  - may process in document or tree or any order
- XSLT generates
  a "result" XML or text document

1. eXtensible Stylesheet Language

XSL -- developed by W3C , quite old!

XSL Transformations (XSLT)
Version 1.0
W3C Recommendation 16 November 1999

→ XSL Transformations are written in XML themselves.
Element name prefix "xsl:" indicates an XSLT specific command

→ functional programming style
→ pattern matching as basic construct

XSL Stylesheets

Template: pattern → action

- An **XSL stylesheet** defines a set of **templates** ("tree patterns and actions").

  Each template ...
  1. **matches** specific elements in the XML doc tree, and then
  2. **constructs** the contribution that the elements make to the transformed tree.
- XSL is **an application of XML** itself:
  - Each XSL stylesheet is an XML document,
  - elements with a **name prefix**[34] `xsl:` are part of the XSLT language,
  - non-"`xsl:`" elements are used to construct the transformed tree.

[34] More correctly: elements in the **namespace** `http://www.w3.org/1999/XSL/Transform`. For details on namespaces, see `http://www.w3.org/TR/REC-xml-names`.

Example: Transform text markup into HTML style paragraph and emphasis tags:

style.xsl

```
1  <?xml version="1.0"?>
2  <xsl:stylesheet xmlns:xsl="http://www.w3.org/1999/XSL/Transform" version="1.0">
3
4  <xsl:template match="para">
5    <p><xsl:apply-templates/></p>
6  </xsl:template>
7
8  <xsl:template match="emphasis">
9    <i><xsl:apply-templates/></i>
10 </xsl:template>
11
12 </xsl:stylesheet>
```

input.xml

```
1  <?xml version="1.0"?>
2  <para>This is a <emphasis>test</emphasis>.</para>
```

output.xml

```
1  <?xml version="1.0" encoding="UTF-8"?>
2  <p>This is a <i>test</i>.</p>
```

Seems implementation dependent..
`xsltproc` doesn't generate it.

N.B. Note how XSLT acts like a **tree transformer** in this simple example.

XSLT templates

```
<xsl:template match="e">
  cons
</xsl:template>
```

- *e* is an **XPath expression**,
  selecting the nodes in the document tree XSLT will apply the template to,
- *cons* is the **result constructor**,
  describing the transformation result that the XSLT processor will produce for the nodes selected by *e*.

N.B. "`xsl:`" elements in *cons* will be interpreted by the XSLT processor.

element and *text*-child nodes!

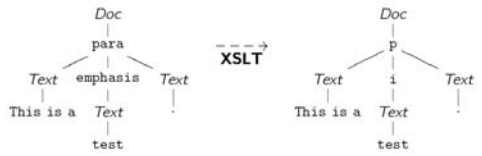
`<xsl:apply-templates/>` applies the template matching process **recursively to all child nodes** of the matched node.

What goes in a template?

- Literal XML to output
- "Pull" references to other content
- Instructions to generate more output
  - Setting and using variables
  - Invoking other templates like macros
  - Manually constructed XML output
  - Conditional instructions (if, choose, etc.)
  - Auto-numbering hacks

Applying the template . . .

The actual tree transformation in our previous example goes like this:



Something else must be going on here:

1. The *Text* nodes have *automatically* been copied into the result tree.
2. How could the `para` and `emphasis` elements match anyway? (The XPath patterns for both templates used *relative* paths expressions.)

Default templates

Each XSLT stylesheet contains two **default templates** which

1. **copy Text and Attr (attribute) nodes** into the result tree:

```
<xsl:template match="text()|@*">
    <xsl:value-of select="self::node()"/>
</xsl:template>
```

2. **recursively drive the matching process**, starting from the document root:

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

Generates an output root node.

generates the string value of the first node selected by "e"

`<xsl:value-of select="e"/>` ~~copies those nodes into the result tree~~ that are reachable by the XPath expression *e* (context node is the matched node).

The default templates may be **overridden**.

Overriding default XSLT templates

What would be the effect of applying the following XSLT stylesheet?

style.xsl

```
1  <?xml version="1.0"?>
2  <xsl:stylesheet xmlns:xsl="http://www.w3.org/1999/XSL/Transform" version="1.0">
3
4  <xsl:template match="text()">foo</xsl:template>
5
6  <xsl:template match="para">
7    <p><xsl:apply-templates/></p>
8  </xsl:template>
9
10 <xsl:template match="emphasis">
11   <i><xsl:apply-templates/></i>
12 </xsl:template>
13
14 </xsl:stylesheet>
```

More XSLT defaults

XSLT contains the following additional default template. Explain its effect.

```
<xsl:template match="processing-instruction()|comment()"/>
```


Overriding default XSLT templates

What would be the effect of applying the following XSLT stylesheet?

style.xsl

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1  <?xml version="1.0"?>
2  <xsl:stylesheet xmlns:xsl="http://www.w3.org/1999/XSL/Transform" version="1.0">
3
4  <xsl:template match="text()">foo</xsl:template>
5
6  <xsl:template match="para">
7    <p><xsl:apply-templates/></p>
8  </xsl:template>
9
10 <xsl:template match="emphasis">
11   <i><xsl:apply-templates/></i>
12 </xsl:template>
13
14 </xsl:stylesheet>
```

every text node becomes "foo"

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Overriding default XSLT templates

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4  <xsl:template match="text()">foo</xsl:template>
5
6  <xsl:template match="para">
7    <p><xsl:apply-templates/></p>
8  </xsl:template>
9
10 <xsl:template match="emphasis">
11   <i><xsl:apply-templates/></i>
12 </xsl:template>
13
14 </xsl:stylesheet>
```

every text node becomes "foo"

```
<?xml version="1.0"?>
<?php sql (SELECT * FROM ) ?>
<!-- a comment -->
<para>This is a <emphasis>test</emphasis>.</para>
```

Are deleted!!

More XSLT defaults

XSLT contains the following additional default template. Explain its effect.

```
<xsl:template match="processing-instruction()|comment()"/>
```

Overriding default XSLT templates

What would be the effect of applying the following XSLT stylesheet?

style.xsl

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

<xsl:template match="text()">foo</xsl:template>

<xsl:template match="para">
  <p><xsl:apply-templates/></p>
</xsl:template>

<xsl:template match="emphasis">
  <i><xsl:apply-templates/></i>
</xsl:template>

</xsl:stylesheet>
```

every text node becomes “foo”

```
<?xml version="1.0"?>
<?php sql (SELECT * FROM ) ?>
<!-- a comment -->
<para>This is a <emphasis>test</emphasis>.</para>
```

```
<?xml version="1.0"?>
<p>foo<i>foo</i>foo</p>
```

Are deleted!!

More XSLT defaults

XSLT contains the following additional default template. Explain its effect.

```
<xsl:template match="processing-instruction()|comment()"/>
```


Question

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

<xsl:template match="emphasis">
<i>TEXT<xsl:apply-templates select="@*|node()"/>TEXT2</i>
</xsl:template>

<xsl:template match="node()">
<xsl:copy><xsl:apply-templates/></xsl:copy>
</xsl:template>

</xsl:stylesheet>
```

Which default rules are overridden through this match expression?

Question

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

<xsl:template match="emphasis">
<i>TEXT<xsl:apply-templates select="@*|node()"/>TEXT2</i>
</xsl:template>

<xsl:template match="node()">
<xsl:copy><xsl:apply-templates/></xsl:copy>
</xsl:template>

</xsl:stylesheet>
```

Which default rules are overridden through this match expression?

```
<?xml version="1.0"?>
<?php sql (SELECT * FROM ) ?>
<!-- a comment -->
<a h="99">
  <para>This is a <emphasis u="m" f="a"><u>t</u>est</emphasis>.</para>
</a>
```

What is the output, if above XSLT transformation is applied?

7.6.1 Generating Text with xsl:value-of

The **xsl:value-of element** is instantiated to create a text node in the result tree. The required select attribute is an expression; this expression is evaluated and the resulting object is converted to a string as if by a call to the **string** function. The string specifies the string-value of the created text node. If the string is empty, no text node will be created.

The created text node will be merged with any adjacent text nodes.

The xsl:copy-of element can be used to copy a node-set over to the result tree without converting it to a string.
See [11.3 Using Values of Variables and Parameters with xsl:copy-of].

Running the empty stylesheet

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

On this document

```
<?xml version="1.0"?>
<?php sql (SELECT * FROM ) ?>
<!-- a comment -->
<a h="99">
  <para size="5pt">This is a <emphasis>test</emphasis>.</para>
</a>
```

```
smaneth@comqu:~/xslt$ xsltproc empty.xslt 1.xml
<?xml version="1.0"?>

  This is a test.

smaneth@comqu:~/xslt$
```

Not XML, of course…
Root node is generated by default root-rule.

Intermediate summary

XSLT Instruction	Effect
`<xsl:template match="e">` *cons* `</xsl:template>`	Replace nodes matching path expression *e* by *cons*.
`<xsl:apply-templates [select="e"]/>`	Initiate template matching for those nodes returned by path expression *e* (default: path `e child::node()`).
`<xsl:value-of select="e"/>`	Returns the (*string value*[35] of the) result of XPath expression *e*.

[35] Read: The *string value* of an XML element node is the concatenation of the contents of all *Text* nodes in the subtree below that element (in document order).

The string-values of a PI or comment nodes are their "contents".

```
<?xml version="1.0"?>
<?php sql (SELECT * FROM ) ?>
<!-- a comment -->
<a h="99">
  <para>This is a <emphasis u="m" f="a"><u>t</u>est</emphasis>.</para>
</a>
```

```
<?xml version="1.0"?>
<xsl:stylesheet xmlns:xsl=...>

<xsl:template match="node()">
<xsl:value-of select="self::node()"/>
</xsl:template>

</xsl:stylesheet>
```

```
<?xml version="1.0"?>
sql (SELECT * FROM )  a comment
  This is a test.
```


7.5 Copying

The **xsl:copy** element provides an easy way of copying the current node.
Instantiating the **xsl:copy** element creates a copy of the current node.
The namespace nodes of the current node are automatically copied as well, but the attributes and children of the node are **not** automatically copied.

```
<xsl:template match="@*|node()">
  <xsl:copy>
  <xsl:apply-templates select="@*|node()"/>
</xsl:copy> </xsl:template>
```

← Identity transformation
Copies all nodes
as is into the output.

```
<?xml version="1.0"?>
<?php sql (SELECT * FROM ) ?>
<!-- a comment -->
<para at1="val1">This is a <emphasis>test</emphasis>.</para>
```

White-space deleted.
Why?

```
<?xml version="1.0"?>
<?php sql (SELECT * FROM ) ?><!-- a comment -->
<para at1="val1">This is a <emphasis>test</emphasis>.</para>
```


7.5 Copying

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<xsl:template match="@*|node()">
  <xsl:copy>
  <xsl:apply-templates select="@*|node()"/>
</xsl:copy> </xsl:template>
```

← Identity transformation
Copies all nodes
as is into the output.

```
<?xml version="1.0"?>
<?php sql (SELECT * FROM ) ?>
<!-- a comment -->
<para at1="val1">This is a <emphasis>test</emphasis>.</para>
```

White-space deleted.
Why?

```
<?xml version="1.0"?>
<?php sql (SELECT * FROM ) ?><!-- a comment -->
<para at1="val1">This is a <emphasis>test</emphasis>.</para>
```

Impl. dependant…
→ root-node has NO text children!

Question

Do **not** override default @-rule.

```
<xsl:template match="@*|node()">
  <xsl:copy>
  <xsl:apply-templates select="@*|node()"/>
</xsl:copy> </xsl:template>
```

```
<?xml version="1.0"?>
<page number="1"><p at1="val1">This is a <i em="blah">test</i>.</p></page>
```

What is the result??

Question

Do **not** override default @-rule.

```
<xsl:template match="@*|node()">
  <xsl:copy>
  <xsl:apply-templates select="@*|node()"/>
</xsl:copy> </xsl:template>
```

```
<?xml version="1.0"?>
<page number="1"><p at1="val1">This is a <i em="blah">test</i>.</p></page>
```

What is the result??

```
<?xml version="1.0"?>
<page>1<p>val1This is a <i>blahtest</i>.</p></page>
```


No attribute nodes are ever translated…
→ They all disappear in the output.

```
<xsl:template match="@*|node()">
  <xsl:copy>
  <xsl:apply-templates select="@*|node()"/>
</xsl:copy> </xsl:template>
```

```
<?xml version="1.0"?>
<page number="1"><p at1="val1">This is a <i em="blah">test</i>.</p></page>
```

What is the result??

```
<?xml version="1.0"?>
<page><p>This is a <i>test</i>.</p></page>
```

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

<xsl:template match="@*|node()">
  <xsl:copy>
    <xsl:apply-templates select="@*|node()"/>
  </xsl:copy>
</xsl:template>

<xsl:template match="para">
<p><xsl:apply-templates/></p>
</xsl:template>

<xsl:template match="emphasis">
<i><xsl:apply-templates/></i>
</xsl:template>

</xsl:stylesheet>
```

This style sheet copies *all input nodes* into the output. ALSO comment & PI nodes!

It only changes:
"para" elements
into "p" elements and
"emphasis" elements
into "i" elements.

```
<?xml version="1.0"?>
<para a="1">This is a <emphasis b="2">test</emphasis>.</para>
```

```
<?xml version="1.0"?>
<p a="1">This is a <i b="2">test</i>.</p>
```

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We can use XSLT to generate formatted answers to queries. E.g., of a simple XPath expression

```
<xsl:stylesheet version="1.0"
              xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
                  xmlns="http://www.w3.org/TR/xhtml1/strict">
<xsl:template match="/">
<html>
  <head>
    <title>Expense Report Summary</title>
  </head>
  <body>
    <p>Total Amount: <xsl:value-of select="expense-report/total"/></p>
  </body>
</html>
</xsl:template>
</xsl:stylesheet>
```

Thus: XSLT can be used as a query language for XML!

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Of course, instead of translating XML to HTML we can also translate **to XML** again.

```
<xsl:stylesheet version="1.0"
              xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
                  xmlns="http://www.w3.org/TR/xhtml1/strict">
<xsl:template match="/">
<report>
    <title>Expense Report Summary</title>
    <amount><xsl:value-of select="expense-report/total"/></amount>
</report>
</xsl:template>
</xsl:stylesheet>
```

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

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

<xsl:template match="para">
<p><xsl:apply-templates/></p>
</xsl:template>

<xsl:template match="emphasis">
<i><xsl:apply-templates select="self::node()"/></i>
</xsl:template>

</xsl:stylesheet>
```

What happens if this template is applied??

34

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

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

<xsl:template match="para">
<p><xsl:apply-templates/></p>
</xsl:template>

<xsl:template match="emphasis">
<i><xsl:apply-templates select="self::node()"/></i>
</xsl:template>

</xsl:stylesheet>
```

```
smaneth@ComQu-Desktop:~/xslt$ xsltproc 1.xslt 2.xml
runtime error: file 1.xslt line 13 element in
xsltApplyXSLTTemplate: A potential infinite template recursion was detected.
You can adjust xsltMaxDepth (--maxdepth) in order to raise the maximum number of
 nested template calls and variables/params (currently set to 3000).
Templates:
#0 name emphasis
#1 name emphasis
```

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Example: Dilbert comic strips . . .

Transform a DilbertML document into an HTML representation that reflects the comic strip's story:

- From the `prolog`, generate the HTML header, title, heading, copyright information.
- From `characters`, generate an unordered HTML list (`ul`) of all featured comic characters.
- For all `panels`, reproduce the `scene` as well as all spoken `bubbles`, indicating who is speaking to whom (if available).

Note:
`<xsl:if test="p"/>` *cons* `</xsl:if>` reproduces *cons* in the result tree, if the XPath predicate *p* evaluates to true.[36]

[36] Remember from XPath: an empty node sequence is interpreted as false, a non-empty sequence as true.

dilbert.xsl

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

<!-- Generate document head and body, insert prolog information -->
<xsl:template match="/">
   <html>
     <head>
       <title>
         <xsl:value-of select="/strip/prolog/series"/>
       </title>
     </head>
     <body>
       <h1> <xsl:value-of select="/strip/prolog/series"/>
       </h1>
       <p>A comic series by
          <xsl:value-of select="/strip/prolog/author"/>,
          copyright (C)
          <xsl:value-of select="/strip/@year"/> by
          <xsl:value-of select="/strip/@copyright"/>
       </p>
       <xsl:apply-templates/>
     </body>
```



```
   </html>
</xsl:template>

<!-- The next 2 templates generate the
     "Featured Characters" bullet list -->
<xsl:template match="characters">
   <h2> Featured Characters </h2>
   <ul>
     <xsl:apply-templates/>
   </ul>
</xsl:template>

<xsl:template match="character">
   <li> <xsl:value-of select="."/> </li>
</xsl:template>

<!-- Reproduce the panel and the scene it displays -->
<xsl:template match="panel">
  <h3> Panel <xsl:value-of select="@no"/> </h3>
  <p> <xsl:value-of select="scene"/> </p>
  <xsl:apply-templates select="bubbles"/>
</xsl:template>
```



```
<!-- Reproduce spoken text, indicating tone and
     who is speaking to whom -->
<xsl:template match="bubble">
  <p> <xsl:value-of select="id(@speaker)"/> speaking
      <xsl:if test="@to">
        to <xsl:value-of select="id(@to)"/>
      </xsl:if>
      <xsl:if test="@tone">
        (<xsl:value-of select="@tone"/>)
      </xsl:if>
      :<br/>
      <em>
         <xsl:value-of select="."/>
      </em>
  </p>
</xsl:template>

<!-- Suppress all other text/attributes -->
<xsl:template match="text()|@*"/>

</xsl:stylesheet>
```


dilbert.html

```
<html>
<head> <title>Dilbert</title> </head>
<body>
  <h1>Dilbert</h1>
  <p>A comic series by Scott Adams, copyright
    (C) 2000 by United Feature Syndicate </p>
  <h2> Featured Characters </h2>
  <ul>
    <li>The Pointy-Haired Boss</li>
    <li>Dilbert, The Engineer</li>
    <li>Wally</li>
    <li>Alice, The Technical Writer</li>
  </ul>
  <h3> Panel 1</h3>
  <p>Pointy-Haired Boss pointing to presentation slide.
  </p>
  <p>The Pointy-Haired Boss speaking : <br>
    <em>Speed is the key to success.</em>
  </p>
  <h3> Panel 2</h3>
  <p>Wally, Dilbert, and Alice sitting at conference table.
  </p>
  <p>Dilbert, The Engineer speaking
```



```
     to The Pointy-Haired Boss : <br>
    <em>Is it ok to do things wrong if
        we're really, really fast?</em>
  </p>
  <h3> Panel 3</h3>
  <p>Wally turning to Dilbert, angrily.
  </p>
  <p>The Pointy-Haired Boss speaking
     to Dilbert, The Engineer : <br>
    <em>Um... No.</em>
  </p>
  <p>Wally speaking
     to Dilbert, The Engineer (angry) : <br>
    <em>Now I'm all confused.  Thank you very much.</em>
  </p>
</body>
</html>
```


Screenshot of Mozilla rendering file `dilbert.html`:

Conflict Resolution and Modes in XSLT

- Note that for each node visited by the XSLT processor (cf. default template ②), **more than one template might yield a match**.
- XSLT assigns a **priority** to each template. The more specific the template pattern, the higher the priority:

`<xsl:template match="e"> cons </xsl:template>`

Pattern e	Priority
*	−0.5
ns:*	−0.25
element/attribute name	0
any other XPath expression	0.5

- **Example**:
  Priority of `author` is 0, priority of `/strip/prolog/author` is 0.5.
- Alternatively, make priority explicit: `<xsl:template priority="p" ...>`. (any real number)

Delete all nested <list>s

```
<xsl:template match="list/list"
   priority="2">
   <!-- deleted nested list -->
</xsl:template>

<xsl:template match="list"
   priority="1">
   <list><xsl:apply-templates/></list>
</xsl:template>
```

What if there are no priorities?

```
<d>
<list>text1
<list>
blah
</list>
</list>
<list>
next
</list>
</d>
```

→

```
<?xml version="1.0"?>
<list>text1
</list>
<list>
next
</list>
```


Delete all nested <list>s

```
<xsl:template match="//list/list">
   <!-- deleted nested list -->
</xsl:template>

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

And now?

What if there are no priorities?

```
<d>
<list>text1
<list>
blah
</list>
</list>
<list>
next
</list>
</d>
```

→

```
<?xml version="1.0"?>
<list>text1
</list>
<list>
next
</list>
```


Delete all nested <list>s

Does NOT generate a comment node!

→ use `<xsl:comment>..</xsl:comment>`

```
<xsl:template match="//list/list">
   <!-- deleted nested list -->
</xsl:template>

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

What if there are no priorities?

```
<d>
<list>text1
<list>
blah
</list>
</list>
<list>
next
</list>
</d>
```

→

```
<?xml version="1.0"?>
<list>text1
</list>
<list>
next
</list>
```


Question

How do you remove book//author/first elements, but keep everything else in the XML?

Question

How do you remove book//author/first elements, but keep everything else in the XML?

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

<xsl:template match="book//author/first" priority="5">
</xsl:template>

<xsl:template match="@*|node()">
  <xsl:copy>
    <xsl:apply-templates select="@*|node()"/>
  </xsl:copy>
</xsl:template>

</xsl:stylesheet>
```

```
<bib>
<book>
<author>
<first>
Jeffrey
</first>
<last>
Ullman
</last>
</author>
<title>
blah2
</title>
</book>
</bib>
```

→

```
<bib>
<book>
<author>

<last>
Ullman
</last>
</author>
<title>
blah2
</title>
</book>
</bib>
```

Context

Quite often, an XSLT stylesheet wants to be **context-aware**.

- Since the XSLT priority mechanism is *not* dynamic, this can cause problems.

Example: Transform the following XML document (sectioned text with cross references) into XHTML:

self-ref.xml

```
<section id="intro">
   <title>Introduction</title>
   <para> This section is self-referential: <xref to="intro"/>. </para>
</section>
```

We want to generate XHTML code that looks somewhat like this:

self-ref.html

```
<h1>Introduction</h1>
<p> This section is self-referential: <em>Introduction</em>. </p>
```

The section title needs to be processed twice, once to produce the heading and once to produce the cross reference.

The "obvious" XSLT stylesheet produces erroneous output:

buggy-self-ref.xsl

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

<xsl:template match="title">
  <h1><xsl:apply-templates/></h1>
</xsl:template>

<xsl:template match="para">
  <p><xsl:apply-templates/></p>
</xsl:template>

<xsl:template match="xref">
   <xsl:apply-templates select="id(@to)/title"/>
</xsl:template>

</xsl:stylesheet>
```

buggy-output.html

```
  <h1>Introduction</h1>
  <p> This section is self-referential: <h1>Introduction</h1>. </p>
```


XSLT modes

- We need to make the processing of the `title` element aware of the context (or **mode**) it is used in: inside an `xref` or not.
- This is a job for **XSLT modes**.
  - In `<xsl:apply-templates>` switch to a certain `mode` *m* depending on the context:

    `<xsl:apply-templates mode="m" .../>`
  - After mode switching, only `<xsl:template>` instructions with a `mode` attribute of value *m* will match:

    `<xsl:template mode="m" .../>`
  - As soon as `<xsl:apply-templates mode="m" .../>` has finished matching nodes, the previous mode (if any) is restored.

self-ref.xsl

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

<xsl:template match="title">
  <h1><xsl:apply-templates/></h1>
</xsl:template>

<xsl:template match="title" mode="ref">
  <em><xsl:apply-templates/></em>
</xsl:template>
   .
   .
   .
<xsl:template match="xref">
   <xsl:apply-templates select="id(@to)/title" mode="ref"/>
</xsl:template>

</xsl:stylesheet>
```

output.html

```
  <h1>Introduction</h1>
  <p> This section is self-referential: <em>Introduction</em>. </p>
```


More on XSLT

XSLT Instruction	Effect
`xsl:choose`, `xsl:when`	switch statement (ala C)
`xsl:call-template`	explicitly invoke a (named) template
`xsl:for-each`	replicate result construction for a sequence of nodes
`xsl:import`	import instructions from another stylesheet
`xsl:output`	influence XSLT processor's output behaviour
`xsl:variable`	set/read variables

- For a complete XSLT reference, refer to W3C `http://www.w3.org/TR/xslt`
- Apache's Cocoon is an XSLT-enabled web server (see `http://xml.apache.org/cocoon/`).

Question

Assume the XML input has precisely one element node with name AA and one element node with name BB (independent).

Can you give an XSL transform which *exchanges the first subtree of AA with the last subtree of BB*?

Variables & Parameters

A variable-binding element can specify the value of the variable in three alternative ways.

(1) If the variable-binding element has a **select attribute**, then the value of the attribute must be an expression and the value of the variable is the object that results from evaluating the expression. In this case, the content must be empty.

(2) If the variable-binding element does **not have a select attribute** and has non-empty content (i.e. the variable-binding element has one or more child nodes), then the content of the variable-binding element specifies the value. The content of the variable-binding element is a template, which is instantiated to give the value of the variable. The value is a result tree fragment equivalent to a node-set containing just a single root node having as children the sequence of nodes produced by instantiating the template.

(3) If the variable-binding element has **empty content and does not have a select attribute**, then the value of the variable is an empty string.

Thus

```
<xsl:variable name="x"/>     is equivalent to  (empty string)
<xsl:variable name="x" select="''"/>
```

NOTE: When a variable is used to select nodes by position, be careful not to do:

```
<xsl:variable name="n">2</xsl:variable>
 ...
<xsl:value-of select="item[$n]"/>
```

In filter → "true"

This will output the value of the first item element, because the variable n will be bound to a result tree fragment, not a number. Instead, do either

```
<xsl:variable name="n" select="2"/>
 ...
<xsl:value-of select="item[$n]"/>
```

or

```
<xsl:variable name="n">2</xsl:variable>
 ...
<xsl:value-of select="item[position()=$n]"/>
```

NOTE: One convenient way to specify the empty node-set as the default value of a parameter is:

```
<xsl:param name="x" select="/.."/>
```


This example declares a global variable para-font-size, which it references in an attribute value template.

```
<xsl:variable name="para-font-size">12pt</xsl:variable>
.
.

<xsl:template match="para">
    <fo:block font-size="{$para-font-size}">
        <xsl:apply-templates/>
    </fo:block>
</xsl:template>
```


<xsl:number>

- *Used to generate auto-numbering*
-

```
<xsl:number
  level="single|multiple|any"
  count="pattern" -- which nodes count?
  from="pattern"  -- starting point
  value="number-expr" -- force value
  format="s"      -- (not covering)
  lang="lg"       -- lang to use
  letter-value="alphabetic|traditional"
  grouping-separator="char" -- 1,000
  grouping-size="number"    -- 3 in EN
/>
```

Numbering example

```
<xsl:template select="list">
 <xsl:element name="toplist">
   <xsl:attribute name="marker">
     <xsl:number level="single"/>
     <!--count defaults to siblings-->
   </xsl:attribute>
 </xsl:element>
</xsl:template>
```

'multiple' -- gathers up sibling numbers of ancestors

```
<xsl:number level="multiple"
 format="1.1.1" count="chap|sec|ssec"/>
```

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

<xsl:template match="@*|node()">
  <xsl:copy>
  <xsl:number level="multiple" count="*"/>
    <xsl:apply-templates select="@*|node()"/>
  </xsl:copy>
</xsl:template>

</xsl:stylesheet>
```

```
<c>
<c>
<AA>
<a1/>
<a2/>
<a3><u/></a3>
</AA>
</c>
<b>
<BB>
<b1/>
<b2/>
<b3/>
</BB>
</b>
</c>
```

→

```
<?xml version="1.0"?>
<c>1
<c>1.1
<AA>1.1.1
<a1>1.1.1.1</a1>
<a2>1.1.1.2</a2>
<a3>1.1.1.3<u>1.1.1.3.1</u></a3>
</AA>
</c>
<b>1.2
<BB>1.2.1
<b1>1.2.1.1</b1>
<b2>1.2.1.2</b2>
<b3>1.2.1.3</b3>
</BB>
</b>
</c>
```

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

<xsl:template match="@*|node()">
  <xsl:copy>
  <xsl:number level="multiple" count="a1|AA|a3|u"/>
    <xsl:apply-templates select="@*|node()"/>
  </xsl:copy>
</xsl:template>

</xsl:stylesheet>
```

```
<c>
<c>
<AA>
<a1/>
<a2/>
<a3><u/></a3>
</AA>
</c>
<b>
<BB>
<b1/>
<b2/>
<b3/>
</BB>
</b>
</c>
```

```
<c>
<c>
<AA>1
<a1>1.1</a1>
<a2>1</a2>
<a3>1.2<u>1.2.1</u></a3>
</AA>
</c>
<b>
<BB>
<b1></b1>
<b2></b2>
<b3></b3>
</BB>
</b>
</c>
```



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

<xsl:template match="@*|node()">
  <xsl:copy>
  <xsl:number level="multiple" count="a1|AA|a3|u"/>
    <xsl:apply-templates select="@*|node()"/>
  </xsl:copy>
</xsl:template>

</xsl:stylesheet>
```

Insert

|c

What will be the result??

```
<c>
<c>
<AA>
<a1/>
<a2/>
<a3><u/></a3>
</AA>
</c>
<b>
<BB>
<b1/>
<b2/>
<b3/>
</BB>
</b>
</c>
```

```
<c>1
<c>1. 1
<AA>1. 1.1
<a1>1. 1.1.1</a1>
<a2>1. 1.1</a2>
<a3>1. 1.1.2<u>1. 1.1.2.1</u></a3>
</AA>
</c>
<b>1
<BB>1
<b1>1</b1>
<b2>1</b2>
<b3>1</b3>
</BB>
</b>
</c>
```


END
Lecture 11