Web Technologies and Applications

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CMPUT 499: SGML to XML

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Course Content

• Introduction	• Databases & WWW
• Internet and WWW	• **SGML / XML**
• Protocols	• Managing servers
• HTML and beyond	• Search Engines
• Animation & WWW	• Web Mining
• Java Script	• CORBA
• Dynamic Pages	• Security Issues
• Perl Intro.	• Selected Topics
• Java Applets	• Projects

Objectives of Lecture 11

SGML to XML

- Introduce the Extensible Markup Language XML and discuss its use.
- Understand the parsing of XML documents and how XML can be translated to HTML for display
- See examples of XML

Outline of Lecture 11

- Brief Overview of SGML and the Origin of XML
- Introduction to XML
- Examples of XML Documents
- Syntax and Document Type Definition
- Parsing XML
- Displaying XML: Style (XSL) & Transformation (XSLT)
- Examples and Case Study

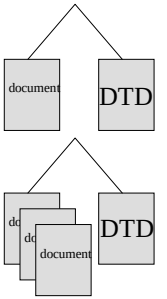
Brief Overview of SGML & the Origin of XML

- SGML stands for Standard Generalized Markup Language
- SGML is a meta language, a language for defining other languages.
- It was developed in the 1970s and was used by large corporations for representing content of large documents.

- SGML is very flexible and provides a set of features for describing content of small documents such as short memos, or very long and complex documents such as technical manuals in several printed volumes.

SGML, What is it for?

- Separation: Syntax rules + content
- Many sophisticated options
- Focuses on content structure
- Very powerful for creating:
  - Manuals
  - Books
  - Catalogs
  - Document collection
  - …



Problems with SGML

- SGML has too many optional features making the language complex
- SGML standard is very long and complicated

➔ difficult to maintain

➔ difficult to build parsers

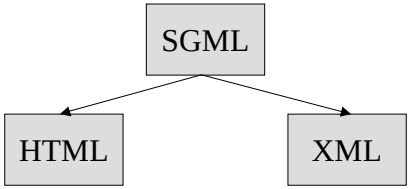
➔ difficult for programmers to write processing programs

➔ difficult to mark up content

➔ Not always legible

Simplified SGML

- HTML is derived from SGML and so is XML
- XML is a simplified version of SGML without the many features that do not apply in the Web context.



- XML is a meta-language with SGML flexibility and structure but without SGML complexities

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Introduction to XML

- XML the eXtensible Markup Language is a standard of the World-Wide Web Consortium
- The official current version is 1.0 and was originally recommended in 1998
- The official specification from the W3C are: http://www.w3.org/TR/1998/REC-xml-19980210
- More info can be found at: http://www.w3.org/XML/
- Many working groups and advisory boards are currently enhancing XML

What is Special with XML

- It is a language to markup data
- There are no predefined tags like in HTML
- Extensible ➔ tags can be defined and extended based on applications and needs
- Basically, you can create your own tags and associate meanings to them
- You need to follow rules for creating and using tags

HTML vs. XML

```
<HTML>
<BODY>
   <H1>Shovel</H1>
   <H2>10.59</H2>
   <H2>4</H2>
   <H1>Rake</H1>
   <H2>15.00</H2>
   <H2>1</H2>
   <H1>Hoe</H1>
   <H2>12.99</H2>
   <H2>2</H2>
</BODY>
</HTML>
```

HTML conveys the look-n-feel

```
<HTML>
<BODY>
<Table border=1><TR>
   <td>Shovel</td>
   <td>10.59</td> <td>4</td>
</tr><tr>
   <td>Rake</td>
   <td>15.00</td><td>1</td>
</tr><tr>
   <td>Hoe</td>
   <td>12.99</td> <td>2</td>
</tr></table>
</BODY>
</HTML>
```

Easy for us to pinpoint the price of a hoe, but what about a program?

```
<?xml version="1.0" encoding="ISO8859-1" ?>
<Products>
   <product ID="123">
      <ProdName>Shovel</ProdName>
      <price>10.59</price>
      <Quantity>4</Quantity>
   </product>
   <product ID="456">
      <ProdName>Rake</ProdName>
      <price>15.00</price>
      <Quantity>1</Quantity>
   </product>
   <product ID="789">
      <ProdName>Hoe</ProdName>
      <price>12.99</price>
      <Quantity>2</Quantity>
   </product>
</Products>
```

In XML tags have meanings ➔ easy for a program to find the price of a hoe.

XML inside HTML

- Some browsers, such as Microsoft Internet Explorer allow XML inside an HTML document with the <XML> tag

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.0 Transitional//EN">
<HTML>
<BODY>
<XML ID = "xmlDoc">
<Products>
        <product ID="123">
          <ProdName>Shovel</ProdName>
          <price>10.59</price>
          <Quantity>4</Quantity>
        </product>
        <product  ID="456">
          <ProdName>Rake</ProdName>
          <price>15.00</price>
          <Quantity>1</Quantity>
        </product>
        <product  ID="789">
          <ProdName>Hoe</ProdName>
          <price>12.99</price>
          <Quantity>2</Quantity>
        </product>
</Products>
</XML>
```

```
<TABLE BORDER = "1" DATASRC = "#xmlDoc">
<THEAD>
<TR> <TH>Product Name</TH>
     <TH>Quantity</TH><TH>Price</TH></TR>
 <THEAD>
<TR>
        <TD><SPAN DATAFLD = "ProdName"></SPAN></TD>
        <TD><SPAN DATAFLD = "Quantity"></SPAN></TD>
        <TD><SPAN DATAFLD = "price"></SPAN></TD>
</TR>
</TABLE>
</BODY>
</HTML>
```

<XML ID="xmlDoc" src="products.xml"></xml>

Rules for Creating XML Documents

- **Rule 1**: All terminating tags shall be closed
  - Omitting a closing XML tag is an error. Example: <FirstName>Osmar</FirstName>
- **Rule 2**: All non-terminating tags shall be closed
  - Omitting a forward slash for non-terminating tags is an error. Example <Available answer="yes"/>
- **Rule 3**: XML shall be case sensitive
  - Using the wrong case is an error. Example: <FirstName>Osmar</firstname>
  - It is OK in HTML <H1>my header</h1>

More Rules for Creating XML

- **Rule 4**: An XML document shall have one root
  - Attempting to create more than one root element would generate a syntax error
- **Rule 5**: Nesting tag terminations shall not be allowed
  - Closing a parent tag before closing a child's tag is an error. Example <Author><name>Osmar</Author></name>
  - It is OK in HTML <I>bold italic text</I>
- **Rule 6**: Attributes shall be quoted
  - Omitting quotes, either single or double, around and XML attribute's value is an error. Example <Product ID="123">

What is needed?

- XML needs to be parsed to check whether the documents are well formed
- XML needs to be printed
- XML needs to be interpreted for information exchange or populating database
- XML needs to be queried efficiently

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Example1: Business Letter

```
<?xml version = "1.0"?>
<letter>
 <contact type = "from">
        <name>John Doe</name>
        <address>123 Main St.</address>
        <city>Anytown</city>
        <province>Somewhere</province>
        <postalcode>A1B 2C3</postalcode>
</contact>
<contact type = "to">
        <name>Joe Schmoe</name>
        <address>123 Any Ave.</address>
        <city>Othertown</city>
        <province>Otherplace</province>
        <postalcode>Z9Y 8X7</postalcode>
</contact>
```

Example1: Business Letter Con't

```
<paragraph>Dear Sir,</paragraph>
<paragraph>It is our privilege to inform you about
 our new  database managed with XML. This new
system will allow you to reduce the load of your
inventory list server by  having the client machine
perform the work of sorting  and filtering the data.
</paragraph>
<paragraph>Sincerely, Mr. Doe</paragraph>
</letter>
```

Example2: Memo

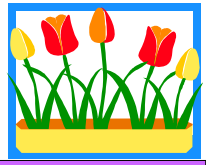
```
<?xml version = "1.0"?>
<memo>
        <from>
                <fname>Osmar</fname>
                <lname>Zaiane</lname>
        </from>
        <date>Tuesday March 21, 2001</date>
        <to> cmput 499 </to>
        <subject>Assignment 7</subject>
        <message type = "U"\>
        <content>
                The seventh assignment will be about XML
                and rendering XML documents on a browser.
        </content>
</memo>
```

Example3: Book Collection

```
<?xml version = "1.0"?>
<collection>
   <book>
        <title>Web Programming, Building Internet Applications</title>
        <author>Chris Bates</author>
        <isbn>0-471-49669-3</isbn>
         <pages>469</pages>
        <publisher>Wiley</publisher>
        <image>wprog.jpg</image>
   </book>
   <book>
        <title>Internet & World Wide Web: How to Program</title>
        <author>Deitel, Deitel and Nieto</author>
        <isbn>0-13-016143-8</isbn>
         <pages>1157</pages>
        <publisher>Prentice Hall</publisher>
        <image>iw3.jpg</image>
   </book>
</collection>
```

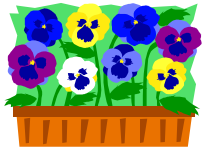
Example4: Garden Catalog

```
<?xml version = "1.0"?>
<catalog>
   <plant>
        <name>Butterfly bush</name>
        <latin>Buddleja alternifolia</latin>
        <height>4.5m</height>
         <season>Summer</season>
        <price>$3.45</price>
        <condition>dry sun</condition>
        <image>bbush.jpg</image>
   </plant>
   <plant>
        <name>Pineapple broom</name>
        <latin>Cytisus Battandieri</latin>
        <height>4m</height>
         <season>Early Summer</season>
        <price>$5.00</price>
        <condition>dry sun</condition>
        <image>pbroom.jpg</image>
   </plant>
```



Example4: Garden Catalog Con't

```
…
   <plant>
        <name>Peony</name>
        <latin>Paeonia Lactiflora hybrids</latin>
        <height>60cm</height>
         <season>Summer</season>
        <price>$2.15</price>
        <condition>shade</condition>
        <image>peony.jpg</image>
   </plant>
   <plant>
        <name>Hollyhock</name>
        <latin>Alcea rosea</latin>
        <height>2.5m</height>
         <season>Summer</season>
        <price>$2.00</price>
        <condition>Clay soil</condition>
        <image>alcea.jpg</image>
   </plant>
</catalog>
```



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Introduction to DTDs

- DTD stands for Document Type Definition
- A DTD is a set of rules that specify how to use an XML markup. It contains specifications for each element, the attributes of the elements, and the values the attributes can take.
- A DTD also specifies how elements are contained in each other
- A DTD ensures that XML documents created by different programs are consistent

Example1: Business Letter

```
<?xml version = "1.0"?>
<letter> <Urgency level="1"\>
 <contact type = "from">
        <name>John Doe</name>
        <address>123 Main St.</address>
        <city>Anytown</city>
        <province>Somewhere</province>
        <postalcode>A1B 2C3</postalcode>
</contact>
<contact type = "to">
        <name>Joe Schmoe</name>
        <address>123 Any Ave.</address>
        <city>Othertown</city>
        <province>Otherplace</province>
        <postalcode>Z9Y 8X7</postalcode>
</contact>
<paragraph>Dear Sir,</paragraph>
<paragraph>It is our privilege to inform you about our new database managed with XML.
This new system will allow you to reduce the load of your inventory list server by having the
client machine perform the work of sorting and filtering the data.</paragraph>
<paragraph>Sincerely, Mr. Doe</paragraph>
</letter>
```


DTD Example for business letter

```
<?xml version="1.0" encoding="UTF-8" ?>
<!ELEMENT letter (Urgence, contact+, paragraph+)>
<!ELEMENT Urgency (EMPTY)>
<!ATTLIST Urgency level CDATA #IMPLIED>
<!ELEMENT contact (name, address, city, province,  postalcode,
phone?, email?)>
<!ATTLIST contact type CDATA #REQUIRED>
<!ELEMENT name (#PCDATA)>
<!ELEMENT address (#PCDATA)>
<!ELEMENT city (#PCDATA)>
<!ELEMENT province (#PCDATA)>
<!ELEMENT postalcode (#PCDATA)>
<!ELEMENT paragraph (#PCDATA)>
```

+ means one or more

Empty means no end tag

? means optional

CDATA means string
#IMPLIED means that the attribute value is unspecified.

#PCDATA is parsed character data, it means that the element contains text

DTD Header

```
<?xml version="1.0" encoding="UTF-8" ?>
```

Version of the xml
Currently 1.0

Encoding specifies the character set used:
•UTF-8 Unicode Transformation 8 bits
•UTF-16 Unicode Transformation 16 bits
•Etc.

Enables use of different character sets ➔ Internationalization

DTD Rules

<!ELEMENT elementName (components and content)>

Example: <!ELEMENT name (#PCDATA)>
name is an element tag for text data

<!ELEMENT Urgency (EMPTY)>
Urgency is an element tag without closing tag

<!ELEMENT letter (Urgence, contact+, paragraph+)>
letter is an element that contains and Urgency element followed by one or more contact elements and one or more paragraph elements

Multiple Elements

<!ELEMENT letter (Urgence, contact+, paragraph+)>
<!ELEMENT contact (name, address, city, province, postalcode, phone?, email?)>

Are called multiple elements (lists of elements). They require the rule to specify their sequence and the number of times they can occur.

|	Any element may occur
,	Occur in specified sequence
?	Optional, may occur 0 or once
+	Occurs ate least once (1 or many)
*	Occurs many times (0 or many)

Attributes in DTD

<!ATTLIST elementName attributeName Type Specification>

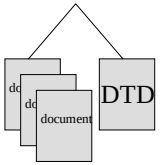
• elementName and attributeName associate the attribute with the element
• The Type specifies if the attribute is free text (CDATA) or a list of predefined values (value1 | value2 | value3)
• Example:
<!ATTLIST Urgency level CDATA #IMPLIED>
<!ATTLIST contact type CDATA #REQUIRED>
<ATTLIST P align (center | right | left) #IMPLIED>
• Specification could be:
  - #REQUIRED attribute must be specified
  - #IMPLIED attributes can be unspecified
  - #FIXED attribute is preset to a specific value
  - "defaultvalue" default value for the attribute

Calling an External DTD

- A DTD can be referenced from XML documents
- <!DOCTYPE letter SYSTEM "letter.dtd">
- Any element, attribute not explicitly defined in the DTD generates an error in the XML document.
- An XML document that conforms to a DTD is called valid and well-formed.
- There is a need to parse XML documents and validate them vis-à-vis a DTD.
- The keyword **SYSTEM** indicates that the DTD is system wide (or private). **PUBLIC** references a public DTD.
- <!DOCTYPE rss PUBLIC "-//Netscape Communications//DTD RSS 0.91//EN" "http://my.netscape.com/publish/formats/rss-0.91.dtd">

Portability of XML

- Adherence to DTDs ensure consistency between XML documents
- Defining a DTD is equivalent to creating a customized markup language.
- There are many domain specific markup languages based on XML: MML (Mathematical Markup Language), CML (Chemical Markup Language),…many other XML-based languages
- This is one of the main reasons why XML is so successful for data exchange between applications



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Parsing XML Documents

- An XML parser (also XML processor) combines an XML document and its DTD to determines the content and structure of the XML document which is turn is used by an application.
- A parser is in between the document and the application that uses XML documents. This application can be a Java application and Servlet or any other application that needs to use XML documents.

XML Parser

- An XML parser enables applications to access XML documents.
- The parser can be embedded in the application or separated as a different tier.
- There are many parsers available on-line for Java, Perl, C/C++, Python, etc.

XML Parser's General Tasks

1. Accesses and retrieves an XML document and its DTD (if there is one), whether locally or across the network;
2. Ensures that the XML document is well formed and adheres to its DTD;
3. Makes the XML document's content available to applications in a readable format.

Advantages of XML Parsers

- You can write your own XML parser and embed it into your XML applications, but why not taking advantage of the pre-built parsers that already take care of the three specified tasks (1-accessing and retrieving XML docs, 2-validating XML docs, 3-modeling XML content)
- There are many XML parsers available as open source, for free, and some commercially. They are written for different platforms and languages, Java, C/C^{++} Perl, and even PHP.
- A list of XML parsers, browsers and editors, etc. can be found and downloaded from http://www.xmlsoftware.com/

What is the Difference?

- In addition to the platforms and languages, parsers differ in the way they validate XML and the way they make the XML content available to applications
- Some parsers verify whether and XML document adheres to its DTD, they are called validating parsers. Others don't and are called non-validating parsers. Some give the choice.
- Some parsers follow the DOM standard and other follow the SAX standard to model XML content.

Why Validating, Why not?

- Validating parsers need to check the XML document vis-à-vis the rules in the DTD
- Validating XML can be slow and necessitates large memory.
- While validating XML is valuable, convenient and certainly useful, often a compromise is necessary when speed and space is at stake.
- For fast solution with limited memory, a non-validating parser is a better choice. However, when speed and memory is not an issue, validating parsers are better.

Summary on Validating Parsers

- A validating parser checks both the XML document and its DTD. If the XML document strays away from the rules defined in the DTD the parser generates an error and stops processing.
- A non-validating parser uses only the XML document and is more tolerant s long as the XML is well formed based on the general XML rules.
- Non-validating parsers are faster and need less memory

Interfacing with XML Application

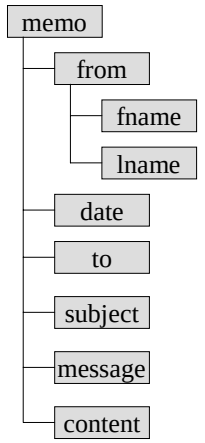
- An XML parser makes the XML content available to XML applications.
- There are two ways to present the content of XML documents: present it as a tree of component or present it as a stream of events.
- There are two types of XML parsers: tree-based and stream-based parsers.

Tree-Based XML Parser

- Tree-based parsers use the DOM (Document Object Model) recommendations by W3C to represent the content of XML documents in a tree format.
- The tree is created in memory. It starts with the root tag as the root of the tree and represents each element as a node of the tree with parent-children relationship between nested elements.
- The DOM standard is the same that also supports HTML documents that we used with JavaScript

Example of the Tree Model

```
<?xml version = "1.0"?>
<memo>
        <from>
                <fname>Osmar</fname>
                <lname>Zaiane</lname>
        </from>
        <date>Tuesday March 21, 2001</date>
        <to> cmput 499 </to>
        <subject>Assignment 7</subject>
        <message type = "U"\>
        <content>
                The seventh assignment will be about XML
                and rendering XML documents on a browser.
        </content>
</memo>
```



Stream-Based XML Parsers

- Stream-based parsers see the XML documents as a stream of events
- An informal specification of stream-based parsers developed by volunteers on the xml-dev mailing list is SAX, primarily written for use with Java.
- SAX stands for Simple API for XML
- http://www.megginson.com/SAX/
- Because it is event based, SAX does not explicitly build the document tree in memory.
- The parser generates events as it reads the XML document and the application needs to define and event handler

Example of the Event Model

```
<?xml version = "1.0"?>
<memo>
        <from>
                <fname>Osmar</fname>
                <lname>Zaiane</lname>
        </from>
        <date>Tuesday March 21, 2001</date>
        <to> cmput 499 </to>
        <subject>Assignment 7</subject>
        <message type = "U"\>
        <content>
                The seventh assignment will be about XML
                and rendering XML documents on a browser.
        </content>
</memo>
```

- Start **memo** element
- Start **from** element
- Start **fname** element
- Character event Osmar
- End **fname** element
- Start **lname** element
- Character event Zaiane
- End **lname** element
- End **from** element
- Start **date** element

…

- End **content** element
- End **memo** element

Each event generated is intercepted by an event handler in the application

DOM or SAX?

- Since SAX does not build a document tree in memory, it is more efficient than DOM and can process documents larger than the available memory.
- DOM creates a static tree representation of the document that can be updated (adding, removing and modifying elements)➔ Needs more memory but is more effective and useful.
- Most available parsers support SAX and DOM and have options to turn validation on and off.

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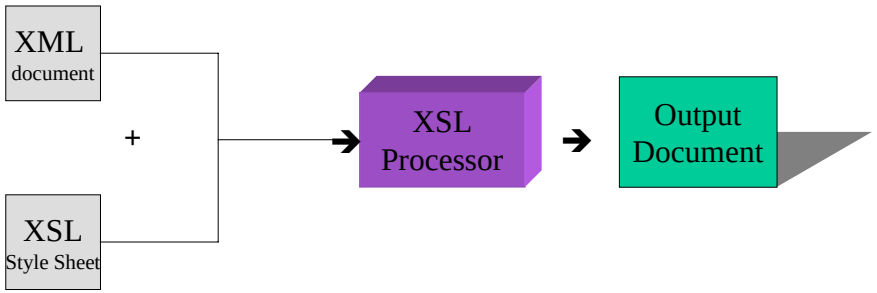
How to Render XML in a Browser

- HTML tags carry presentation instructions. XML tags are related to the structure of the content
- XML represents data only (structure-centric) and does not specify how to render it. There is the what, not the how. HTML is presentation-centric.
- There is a need for style sheets like CSS to specify how things should be displayed.
- Internet Explorer is capable of displaying XML in a tree format.
- Netscape ignores the XML tags.

Separate Data from Description

- XSL (Extensible Style Language) defines the layout of an XML document.
- XSL is to XML what CSS is to HTML. However, XSL is much more powerful since XSL rules provide control on displaying and organizing of data.
- XSL provide rules to transform an XML document into another XML document.
- Notice that HTML is a particular XML
- XSL for Transformations is also known as XSLT
- XSL are style sheets for displaying.
- XSLT are rules for reorganizing.

XSL Transformations



XSL Style Sheet

```
<xsl:stylesheet xmlns:xsl="http://www.w3.org/XSL/Transform/1.0"
                xmlns:fo="http://www.w3.org/XSL/Format/1.0">
  <xsl:template match="root-document name">
    <!-- processing stuff goes here -->
  <xsl:apply-templates select="node()" />
  </xsl:template>
</xsl:stylesheet>
```

Simple recursive XSL template

Element Matching

<xsl:template match="element-name">

Use of Xpath

alpha ➔ selects the element *alpha*, child of the context node
* ➔ selects all element children of the context node
beta() ➔ selects all *beta* element children of the context node
@name ➔ selects the *name* attribute of the context node
@* ➔ selects all the attributes of the context node
alpha[1] ➔selects the first alpha element child of the CN
alpha[last()] ➔ selects the last alpha element child of the CN
alpha[@type="hello"] ➔ selects all alpha children of the Context node that have a type attribute with value hello
…

Processing and Control Flow

```
<xsl:for-each select="node-expression">
        content
</xsl:for-each>

<xsl:if test="Boolean test">
        <xsl:template>
                content
        </xsl:template>
</xsl:if>
```


Processing and Control Flow (2)

```
<xsl:choose>
        <xsl-when test="Boolean test">
            <xsl:template>
                content
            </xsl:template>
        </xsl:when>
        <xsl-when test="Boolean test">
            <xsl:template>
                content
            </xsl:template>
        </xsl:when>
        <xsl-otherwise>
            <xsl:template>
                content
            </xsl:template>
        </xsl:otherwise>
</xsl:choose>
```


Processing and Control Flow (3)

<xsl:sort select"string" lang="??" data-type ="text" |
"number" order="ascending" | "descending"
case-order = "upper-first" | "lower-first" />

Transforming XML

- Transforming on the server
  - Works with ant browser
- Transforming on the client
  - Less use of server resources

Outline of Lecture 11

- Brief Overview of SGML and the Origin of XML
- Introduction to XML
- Examples of XML Documents
- Syntax and Document Type Definition
- Parsing XML
- Displaying XML: Style (XSL) & Transformation (XSLT)
- Examples and Case Study


```
<?xml version="1.0"?>
<productList xmlns="http://www.leeanne.com/aristotelian/productlist"
    xmlns:xsi="http://www.w3.org/1999/XMLSchema-instance"
    xsi:schemaLocation="http://www.leeanne.com/aristotelian/productlist/03xmp01.xsd">
 <!-- Aristotelian Product List -->
 <listTitle>Aristotelian Logical Systems - Product List</listTitle>
 <product>
  <name>European Translator</name>
  <model>Mark IV</model>
  <languages>de fr es en</languages>
 </product>
 <product>
  <name>Universal Translator</name>
  <model>Mark V</model>
  <languages>de fr es en jp</languages>
 </product>
 <product>
  <name>Universal Translator</name>
  <model>Mark VI</model>
  <languages>de fr es en jp ch</languages>
 </product>
 <product>
  <name>BabelFish</name>
  <model>Mark VII</model>
  <languages>
        de fr es en jp ch kl rm fg
  </languages>
 </product>
 <product>
  <name>BabelFish</name>
  <model>Mark VIII</model>
  <languages>
        all {by direct thought transference}
  </languages>
 </product>
</productList>
```



```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE xsd:schema PUBLIC "-//W3C//DTD XMLSCHEMA 19991216//EN" "" [
    <!ENTITY % p 'xsd:'> <!ENTITY % s ':xsd'>]>
<xsd:schema xmlns:xsd="http://www.w3.org/1999/XMLSchema"
  xmlns="http://www.leeanne.com/aristotelian/productlist" targetNamespace="http://www.leeanne.com/aristotelian/productlist">
 <xsd:complexType name="productType" content="elementOnly">
  <xsd:sequence>
   <xsd:element name="name" type="xsd:string" />
   <xsd:element name="model" type="xsd:string" />
   <xsd:element name="languages" type="xsd:string" />
  </xsd:sequence>
 </xsd:complexType>
 <xsd:element name="productList">
  <xsd:complexType content="elementOnly">
   <xsd:sequence>
    <xsd:element name="listTitle" type="xsd:string"/>
    <xsd:element name="product" type="productType" minOccurs="1" maxOccurs="unbounded"/>
   </xsd:sequence>
   <xsd:attribute name="xmlns:xsi"
          type="xsd:uriReference"
          use="default"
          value="http://www.w3.org/1999/XMLSchema-instance"/>
   <xsd:attribute name="xsi:noNamespaceSchemaLocation"
          type="xsd:string"/>
   <xsd:attribute name="xsi:schemaLocation"
          type="xsd:string"/>
  </xsd:complexType>
 </xsd:element>
</xsd:schema>
```

```
<?xml version="1.0" encoding="UTF-8"?>
<xsl:stylesheet xmlns:xsl="http://www.w3.org/TR/WD-xsl">
  <!-- XSL Stylesheet for Aristotelian Product List -->
  <xsl:template match="/">
    <html> <head><title>
        <xsl:value-of select="//productList/listTitle"></xsl:value-of>
      </title> </head>
     <body>
      <h2><xsl:value-of select="//productList/listTitle"></xsl:value-of></h2>
      <div>
       <table border="1">
        <tr> <th>Product</th> <th>Model Number</th> <th>Supported Languages</th></tr>
        <xsl:for-each select="//productList/product">
         <tr>
          <td><xsl:value-of select="name"></xsl:value-of></td>
           <td><xsl:value-of select="model"></xsl:value-of></td>
           <td><xsl:value-of select="languages"></xsl:value-of></td>
         </tr>
        </xsl:for-each>
       </table>
      </div> </body> </html>
  </xsl:template></xsl:stylesheet>
```



```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.0 Transitional//EN">
<HTML>
<BODY>
<XML ID = "xmlDoc">
<Products>
        <product ID="123">
          <ProdName>Shovel</ProdName>
          <price>10.59</price>
          <Quantity>4</Quantity>
        </product>
        <product  ID="456">
          <ProdName>Rake</ProdName>
          <price>15.00</price>
          <Quantity>1</Quantity>
        </product>
        <product  ID="789">
          <ProdName>Hoe</ProdName>
          <price>12.99</price>
          <Quantity>2</Quantity>
        </product>
</Products>
</XML>
```

Example of XSL and XSLT Using Microsoft MSXML


```
<XML ID = "xmlSortProdName">
<Products>
   <xsl:for-each order-by = "+ProdName" select = "product" xmlns:xsl = "http://www.w3.org/TR/WD-xsl">
      <product>
            <ProdName><xsl:value-of select = "ProdName"/> </ProdName>
            <price><xsl:value-of select = "price"/> </price>
            <Quantity><xsl:value-of select = "Quantity"/> </Quantity>
         </product>
   </xsl:for-each>
</Products>
</XML>
<XML ID = "xmlSortPrice">
<Products>
   <xsl:for-each order-by = "-price" select = "product" xmlns:xsl = "http://www.w3.org/TR/WD-xsl">
         <product>
            <ProdName><xsl:value-of select = "ProdName"/> </ProdName>
            <price><xsl:value-of select = "price"/> </price>
            <Quantity><xsl:value-of select = "Quantity"/> </Quantity>
         </product>
   </xsl:for-each>
</Products>
</XML>
```



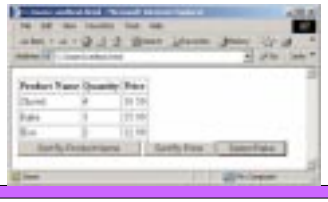
```
<XML ID = "xmlFilterProd">
<Products>
   <xsl:for-each select = "product[ProdName='Rake']"
                                        xmlns:xsl = "http://www.w3.org/TR/WD-xsl">
      <product>
            <ProdName><xsl:value-of select = "ProdName"/> </ProdName>
            <price><xsl:value-of select = "price"/> </price>
            <Quantity><xsl:value-of select = "Quantity"/> </Quantity>
         </product>
   </xsl:for-each>
</Products>
</XML>

<SCRIPT LANGUAGE = "Javascript">
 var xmldoc = xmlData.cloneNode( true );
 function sort( xsldoc ) {
    xmldoc.documentElement.transformNodeToObject(
      xsldoc.documentElement, xmlData.XMLDocument );
 }
</script>
```

Copies xmlData into xmldoc

Applies a specified XSL style sheet to the data in parent node

documentElement provides the root element of document

```
<TABLE BORDER = "1" DATASRC = "#xmlDoc">
<THEAD>
<TR> <TH>Product Name</TH> <TH>Quantity</TH><TH>Price</TH></TR>
<THEAD>
<TR>    <TD><SPAN DATAFLD = "ProdName"></SPAN></TD>
        <TD><SPAN DATAFLD = "Quantity"></SPAN></TD>
        <TD><SPAN DATAFLD = "price"></SPAN></TD>
</TR> </TABLE>
<INPUT TYPE = "button" VALUE = "Sort By Product Name"
        ONCLICK = "sort(xmlSortProdName.XMLDocument);">
<INPUT TYPE = "button" VALUE = "Sort By Price"
        ONCLICK = "sort(xmlSortPrice.XMLDocument);">
<INPUT TYPE = "button" VALUE = "Select Rake"
        ONCLICK = "sort(xmlFilterProd.XMLDocument);">
</BODY>
</HTML>
```



XML Schema

- Microsoft proposed an extension to DTD called *schema* (or XML-Data).
- W3C is developing a new XML schema standard also known as DCD for Document Content Description.
- Schema is an XML document definition using XML syntax.

Book Collection Example

```
<?xml version = "1.0"?>
<collection>
   <book>
        <title>Web Programming, Building Internet Applications</title>
        <author>Chris Bates</author>
        <isbn>0-471-49669-3</isbn>
         <pages>469</pages>
        <publisher>Wiley</publisher>
        <image>wprog.jpg</image>
   </book>
   <book>
        <title>Internet $ World Wide Web: How to Program</title>
        <author>Deitel, Deitel and Nieto</author>
        <isbn>0-13-016143-8</isbn>
         <pages>1157</pages>
        <publisher>Prentice Hall</publisher>
        <image>iw3.jpg</image>
   </book>
</collection>
```


DTD for Book Collection

```
<?xml version="1.0" encoding="UTF-8" ?>
<!ELEMENT collection (book+)>
<!ELEMENT book (title,author,isbn,pages,publisher,image)>
<!ELEMENT title (#PCDATA)>
<!ELEMENT author (#PCDATA)>
<!ELEMENT isbn (#PCDATA)>
<!ELEMENT pages (#PCDATA)>
<!ELEMENT publisher (#PCDATA)>
<!ELEMENT image (#PCDATA)>
```

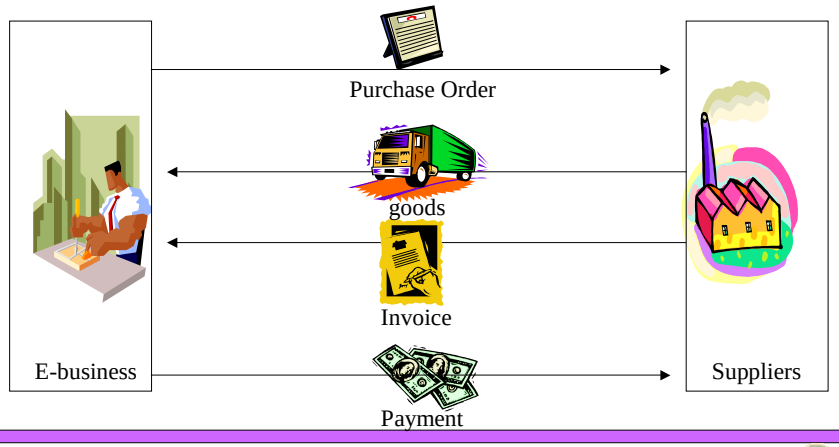
Schema for Book Collection

```
<?xml version = "1.0"?>
<Schema xmlns = "urn:schemas-microsoft-com:xml-data" >
<ElementType name = "author"/>
<ElementType name = "image"/>
<ElementType name = "title"/>
<ElementType name = "isbn"/>
<ElementType name = “publisher"/>
<ElementType name = "pages"/>
<ElementType name = “collection" content = "eltOnly">
    <group minOccurs = "1" maxOccurs = "*">
            <element type = "book"/>
    </group>
</ElementType>
<ElementType name = "book" content = "eltOnly">
    <element type = "title"/>
    <element type = “author"/>
    <element type = "isbn"/>
    <element type = "pages"/>
    <element type = “publisher"/>
    <element type = "image"/>
</ElementType>
</Schema>
```


Advanced Example

Example from Internet and WWW: How to Program by Deitel, Deitel and Nieto (Prentice Hall)

B2B Case: Commercial Transaction



B2B Case: Commercial Transaction