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# XML and the Exchange of Data Across Systems

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## XML is:

- Not a programming language
- Not the next generation of HTML
- Not a database
- Not specific to any horizontal or vertical market
- Not the solution to all your problems, but it can be a very powerful tool in building such a solution.

**XML is a clearly defined way to structure, describe, and interchange data.**

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## XML - Extensible Markup Language

- **XML is** a clearly defined way to structure, describe, and interchange data.
- **XML is** the universal format for structured documents and data on the Web
- **XML has** the potential to alleviate many of the interoperability problems associated with the sharing of documents and data. Realizing the potential requires cooperation not only within but also across organizations.

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## HTML - Language of the Web

- Uses tags to define how information will be displayed.  
`<b>BOLD FACE</b>`
- Tags have attributes to further control the display of information.  
`<font color="red">RED</font>`
- Tags are predefined with predetermined behaviors.

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## XML - Language of Data

- Uses tags to define what the information is and how it relates to other information. Tags are defined as needed.  

```
<customer> ABC Productions </customer>  
  <addr>123 Main St</addr>  
  <city>Dallas</city>
```
- Tags have attributes to further control the information and how it is used.  

```
<opendate type="date">1993-01-25</opendate>
```
- Tag attributes are predefined with predetermined behaviors. The tags themselves are defined by the application.

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## XML Definitions

- XML "files" are referred to as "documents". Each document must meet certain criteria to be considered "valid".
- XML must be "well-formed"
  - Means that the XML document **syntax** is correct
    - i.e. there is a root element, each start tag has a corresponding end tag, all elements are nested correctly
- XML must be "valid"
  - Document is checked against a particular set of user-defined content rules set forth in its Schema.
- If the document is not well formed and valid, it is not considered to be XML.

Check out these resources:

- [www.oasis-open.org](http://www.oasis-open.org)
- [www.w3c.org](http://www.w3c.org)
- [www.w3schools.com](http://www.w3schools.com)

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## Simple Schema

```
<?xml version="1.0" encoding="UTF-8"?>
<!ELEMENT SimpleSample (customer, product, order)>
<!ATTLIST SimpleSample
  xmlns CDATA #REQUIRED
  xmlns:xsi CDATA #REQUIRED
  xsi:schemaLocation CDATA #REQUIRED
>
<!ELEMENT customer (#PCDATA)>
<!ATTLIST customer contactType CDATA #REQUIRED>
<!ELEMENT order (#PCDATA)>
<!ELEMENT product (#PCDATA)>
```

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## Schemas

- The purpose of a Schema is to define the legal building blocks of an XML document.
- A Schema can be declared inline in your XML document, or as an external reference
- With a Schema, independent groups of people can agree to use a common Schema for interchanging data
- Your application can use a standard Schema to verify that the data you receive from the outside world is valid

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## What Schemas Provide

- Schemas provides a robust method of defining data for XML:
  - Schemas are rich in the ability to define and refine data.
  - Schemas are written in XML
  - Schemas support implementation of Business Rules in the Data Structure.
  - Schemas support complex data types
  - A standard, published Schema ensures all parties use the same rules and definitions for processing data.

```
<date type="date">1999-03-11</date>
```

ensures a mutual understanding of the content  
because the XML data type date requires the format  
CCYY-MM-DD.

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## Sample XML Document

```
<?xml version="1.0" encoding="UTF-8"?>  
<Recipe name="bread" prep_time="5 mins" cook_time="3 hours">  
  <title>Basic bread</title>  
  <ingredient amount="3" unit="cups">Flour</ingredient>  
  <ingredient amount="0.25" unit="ounce">Yeast</ingredient>  
  <ingredient amount="1.5" unit="cups" state="warm">Water</ingredient>  
  <ingredient amount="1" unit="teaspoon">Salt</ingredient>  
  <Instructions>  
    <step>Mix all ingredients together, and knead thoroughly.</step>  
    <step>Cover with a cloth, and leave for one hour in warm room.</step>  
    <step>Knead again, place in a tin, and then bake in the oven.</step>  
  </Instructions>  
</Recipe>
```

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## XML – Simply Put

- XML Is ideal for transferring data between applications and platforms because:
  - It uses a publicly posted definition of how the information is to be formatted and parsed.
  - Does not set formats and lengths for data.
  - Does not set a specific order or require all elements be present on order to be a valid, well formed document.
  - Has well defined supporting technology that describes how to format or transform the data in an XML document



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## Inter-Operability and XML

- XML promotes inter-operability by providing a open, flexible method of transferring data between systems and platforms.
  - It is simultaneously human- and machine-readable in it's format;
  - It supports Unicode, allowing almost any information in any human language to be communicated;
  - Represent the most general data structures: records, lists and trees;
  - The self-documenting format that describes structure and field names as well as specific values;
- The next step in using XML across applications and platforms is to transform the XML into a usable format.

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## Transforming XML

- Extensible Stylesheet Language (XSL) is a supporting technology that describes how to format or transform the data in an XML document.
  - The document is changed to a format suitable for browser display.
  - The process is similar to applying a CSS to an HTML document for rendering.
- Without using CSS or XSL, a generic XML document is rendered as raw XML text by most web browsers.

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## XSL Family

- XSL (Extensible Stylesheet Language Family) is used to transform an XML file for displaying or printing.
  - XSLT (XSL Transformations)
  - XSL-FO (XSL Formatting Objects)
  - XQuery (XML Query Language)
  - XPath (XML Path Language)



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## XSLT

- XSLT is a declarative, XML-based document transformation language.
- An XSLT processor can use an XSLT *stylesheet* as a guide for converting an XML document into another document type:
  - XML,
  - HTML,
  - Plain text,
  - Any other format supported by the processor.

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## XSLT – What It Does

- XSLT can:
  - Add new elements into the output file, or remove elements
  - Rearrange and sort elements, and test and make decisions about which elements to display
  - Determine order and validation of elements
- The XSL Style sheet is referenced in the XML file
- The original document is not changed; rather, a new XML document is created based on the content of an existing document.

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## XSLT – What It Does

- In order to style the rendering of the XML, the XML document must include a special reference to the stylesheet:

```
<?xml version="1.0" encoding="ISO-8859-1"?>  
<?xml-stylesheet type="text/xsl" href="?????.xsl"?>
```

- The rules in the stylesheet determine how any selected elements will appear in the document rendered by the page.

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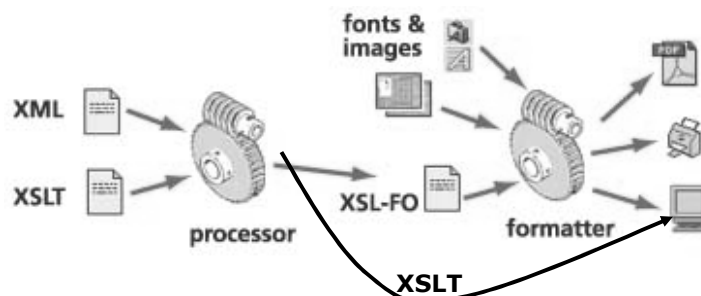
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## XSL-FO

- Is a declarative, XML-based page layout language.
- Produce documents designed for print, such as pdfs



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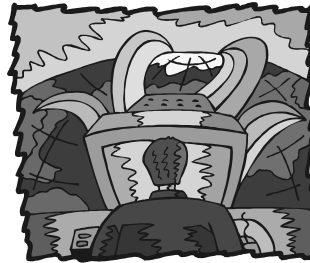
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## XQuery

- XQuery is a language for addressing parts of a single XML document.
- XQuery is to XML what SQL is to relational databases.



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## XPath

- XPath is a language for addressing parts of an XML document or documents at the same time.
- XPath allows stylesheets in XSLT to dynamically "cherry-pick" pieces of a document in any sequence needed in order to compose the required output.
- XPath defines a library of standard functions
  - `text()` selects all text node children of the context node
  - `@*` selects all the attributes of the context node
  - `..` selects the parent of the context node

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## XPath Example

XML File	XPath Expression
<pre>&lt;catalog&gt;   &lt;cd country="USA"&gt;     &lt;title&gt;Abbey Road&lt;/title&gt;     &lt;artist&gt;The Beatles&lt;/artist&gt;     &lt;price&gt;15.75&lt;/price&gt;   &lt;/cd&gt;   &lt;cd country="USA"&gt;     &lt;title&gt;Greatest Hits&lt;/title&gt;     &lt;artist&gt;Elton John&lt;/artist&gt;     &lt;price&gt;11.50&lt;/price&gt;   &lt;/cd&gt; &lt;/catalog&gt;</pre>	<p><code>/catalog/cd</code> selects all the cd elements of the catalog element</p> <p><code>/catalog/cd/price</code> selects all the price elements of all the cd elements of the catalog element</p>

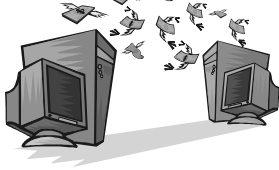
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## XML and Interoperability

- Publishing a common XML Schema guarantees commonality of data definitions and understanding.
- Publishing XML Stylesheet guarantees consistent presentation across platforms and applications.
- Changing the Schema and/or Stylesheet automatically ripples to all users of the published documents.



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## XML and Transportability

- XML is not human language, programming language, operating system, nor platform specific.
  - The same xml schema and document can be processed by Java, Natural, Cobol, C++, VB, etc.
  - An xml document can be sent from any platform to any other:
    - MF to Unix
    - Unix to Linux
    - Windows to MF
    - Etc.
- XML is a definition used by convention to determine how to use data. There is no restriction on where and how it used.

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## Conclusion

- XML is the best option for interoperability and transportability available.
  - Not restricted by language, platform, application.
  - Definitions used by all.
  - Changes to common definition – Schema – are rippled to all users automatically.
  - Changes to common stylesheets – XSLT – are rippled to all applications using it automatically.
- Combining common Schema and Stylesheets provides a common, easy to use, easy to update mechanism for common applications.

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