Session 17

XML

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XML Reading and Reference

- Reading
  - XML in a Nutshell (Ch. 1-3), available in Safari On-line
  - J2EE Tutorial (Chapter 2)
  - JavaWorld XML tutorial:
    www.javaworld.com/javaworld/jw-04-1999/jw-04-xml_p.html
  - Book chapter, describes how to design an xml document that will later be used to generate html
    www.phptr.com/articles/article.asp?p=170571&seqNum=1
- Reference:
  - W3C General spec of Document Object Model-
    www.w3.org/TR/DOM-Level-2/core.html
  - XML Glossary -
    www.javaworld.com/javaworld/jw-09-2002/jw-0927-xmlglossary.html

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Lecture Objectives

- Understand the goal of application specific markup languages
- Understand XML as a meta language that defines application specific languages
- Understand general concept of tree-structured access to an XML document
- Be familiar with DTDs as a way of defining the rules of an XML document

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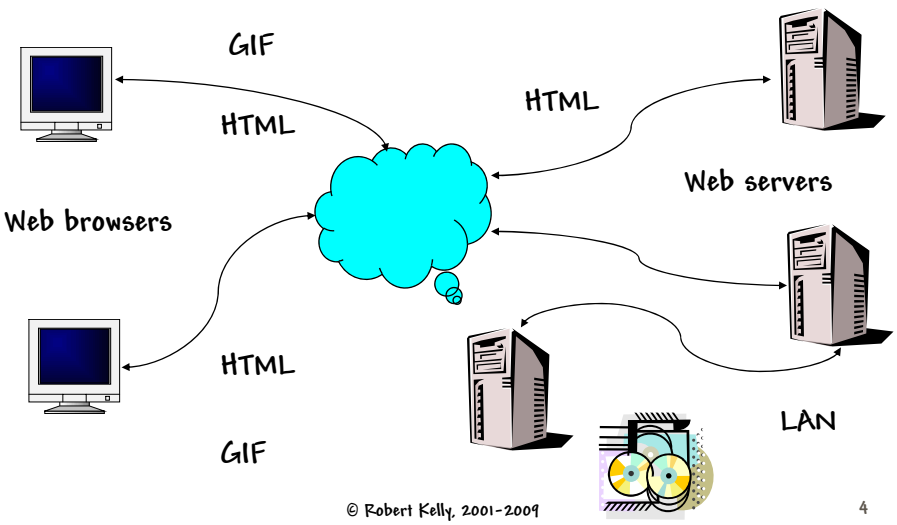
HTML Limitations



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HTML Limitations

- Not extensible (unless you are Microsoft)
- Intended for display (not processing)
- Appearance information is intertwined with content information
- Working HTML is rarely syntactically correct
- No way to specify the meaning of data

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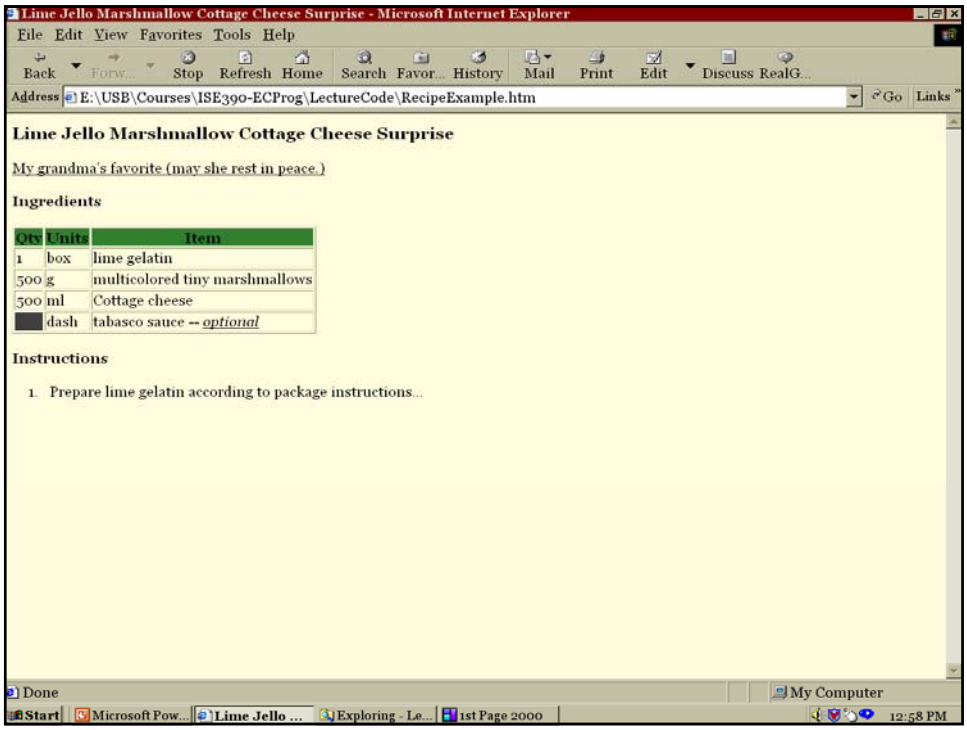

Example - HTML Code

```
<HTML> <HEAD>
<TITLE>Lime Jello Marshmallow Cottage Cheese Surprise</TITLE>
</HEAD> <BODY>
 <H3>Lime Jello Marshmallow Cottage Cheese Surprise</H3>
 <U>My grandma's favorite (may she rest in peace.)</U>
 <H4>Ingredients</H4>
 <TABLE BORDER="1">
<TR BGCOLOR="#308030"> <TH>Qty</TH> <TH>Units</TH>
<TH>Item</TH></TR>
 <TR> <TD>1</TD> <TD>box</TD> <TD>lime gelatin</TD></TR>
 <TR> <TD>500</TD> <TD>g</TD> <TD>multicolored tiny
marshmallows</TD></TR>
<TR> <TD>500</TD> <TD>ml</TD> <TD>Cottage cheese</TD></TR>
<TR> <TD BGCOLOR="#404040"/> <TD>dash</TD> <TD>tabasco sauce
<SPAN> -- <i><u>optional</u></i></SPAN></TD></TR>
</TABLE>
<H4>Instructions</H4>
<OL> <LI>Prepare lime gelatin according to package
instructions...</LI> </OL> </BODY> </HTML>
```

Recipe - Tasks That Would be Difficult

- Directly manipulate the recipe object in your server program to:
  - Aggregate information about multiple recipes
  - Build a shopping list
  - Convert from grams/liters to ounces/quarts

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Electronic Commerce Vision

- New EC applications are possible when all applications on all platforms interact
  - Product finders
  - Billing data (invoices, purchase orders)
  - Medical records
- Possible when applications are interacting through standard data exchange rather than DB / application method access

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Simple Recipe as an XML Document

```
<?xml version="1.0"?>
<!DOCTYPE Recipe SYSTEM "recipe.dtd">
<Recipe>
  <Name>Lime Jello Marshmallow Cottage Cheese Surprise</Name>
  <Description> My grandma's favorite (may she rest in peace).
   </Description>
  <Ingredients>
    <Ingredient>
      <Qty unit="box">1</Qty>
      <Item>lime gelatin</Item>
    </Ingredient>
    <Ingredient>
      <Qty unit="g">500</Qty>
      <Item>multicolored tiny marshmallows</Item>
    </Ingredient>
</Ingredients>
  <Instructions>
    <Step>Prepare lime gelatin according to package instructions
   </Step>
    <!-- And so on... -->
  </Instructions>
</Recipe>
```

Notice that the element names and attribute names refer to recipes

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Well-Formed (Parsable) XML

- How does parsable XML help you write Electronic Commerce applications?
- Basic Rules (common to all XML documents)
  - No unclosed tags
  - No overlapping tags
  - Attribute values must be enclosed in quotes
  - The text characters >, <, and " must always be represented by character entities
- Extended rules (Specific to each XML application)

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XML Document

- Structures textual information
- Does not contain styling information
- Defines a hierarchical structure
- Contains elements and attributes
- Follows basic XML syntax rules
- Usually adheres to a set of domain rules
  - Element names
  - Attribute names
  - Containment rules

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XHTML

- Extensible Hypertext Markup Language
- An official W3C recommendation
- Designed to bring the structure and accuracy of XML to HTML
- If an HTML page conforms to an XML DTD you can:
  - Easily extract information
  - Ensure consistent display
  - Convert to other markup languages (i.e., device specific languages)

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XHTML Syntax ...

- Conforms to XML syntax rules (embedding, null tags, etc.)
- Very similar to HTML 4.01 (Strict, Transitional ...)
- Major differences:
  - Elements must be properly nested
  - Documents must be well-formed
  - Tag names and attribute names must be in lower case
  - All elements must be closed
  - Attribute values must be quoted

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... XHTML Syntax ...

- Attribute minimization is forbidden

```
<dl compact>          <dl compact="compact">
<input checked>       <input checked="checked">
<input readonly>  =>  <input readonly="readonly">
<input disabled>      <input disabled="disabled">
<option selected>     <option selected="selected">
<frame noresize>      <frame noresize="noresize">
```

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Application-Specific XML Rules

- Rules define each unique XML language (e.g. the simple recipe language)
- Examples of document rules:
  - Names of the elements and attributes
  - Rules for the maximum and minimum number of ingredients in a recipe
  - Rules for the maximum and minimum number of quantities in an ingredient
- Defined in a schema
  - DTD (Document Type Definition)
  - XML Schema

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Simple Recipe DTD

```
<!ELEMENT Recipe (Name, Description?, Ingredients?,
   Instructions?)>
<!ELEMENT Name (#PCDATA)>
<!ELEMENT Description (#PCDATA)>
<!ELEMENT Ingredients (Ingredient)*>
<!ELEMENT Ingredient (Qty, Item)>
<!ELEMENT Qty (#PCDATA)>
<!ATTLIST Qty
   unit CDATA #REQUIRED
>
<!ELEMENT Item (#PCDATA)>
<!ATTLIST Item
   optional CDATA "0"
   isVegetarian CDATA "true"
>
<!ELEMENT Instructions (Step)+>
<!ELEMENT Step (#PCDATA)>
```

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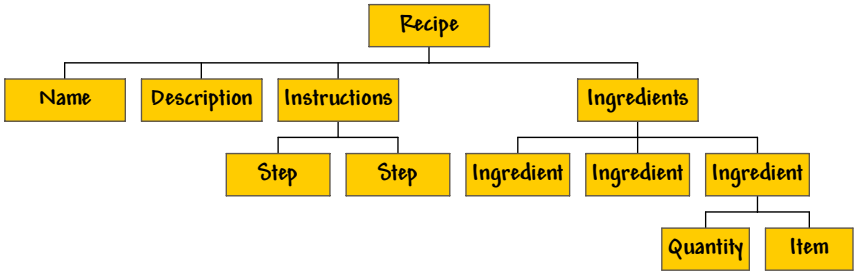
The Simple Recipe as a Tree



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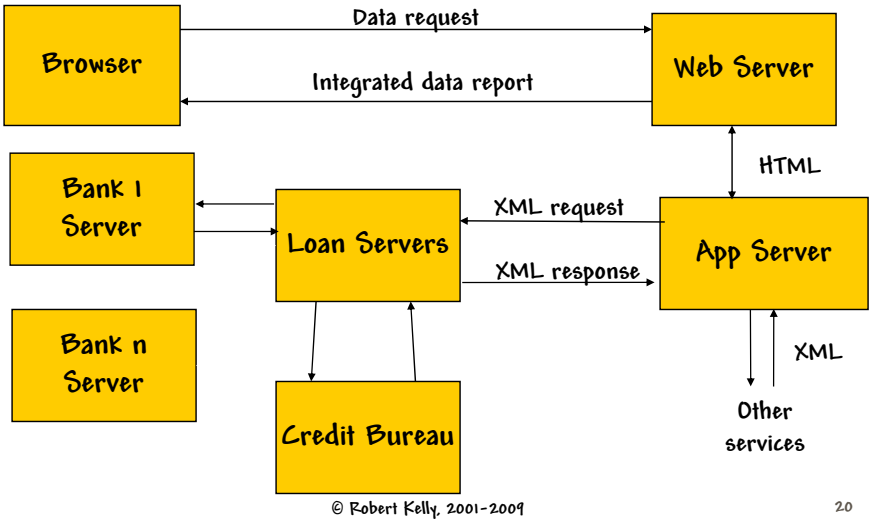
XML as a Data Exchange Standard

- XML documents are often transformed into
  - HTML (XHTML)
  - XML
  - Java (and other languages) object

Case - Banking Use of XML



Document Object Model (DOM)

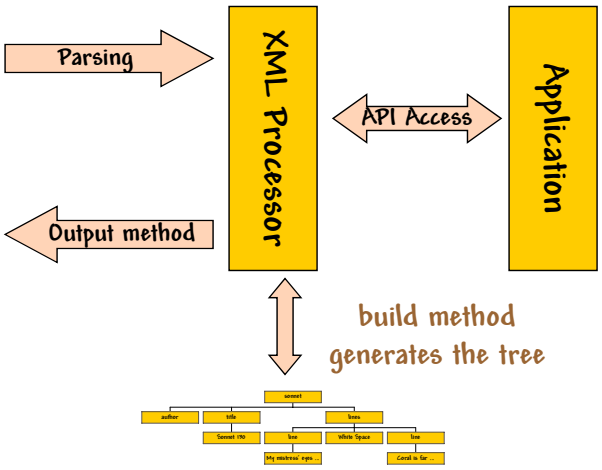
- Hierarchical object representation of an XML or HTML document
- Produced by XML parsers
- Your Java program can
  - Extract a given node (element)
  - Walk the tree
  - Search for particular nodes or data (e.g., IMG tags)
  - Modify the nodes
  - Generate a new document as
    - A DOM object
    - An XML text file

You will use DOM for the Ajax part of the course

You will use a JSP tag library to access an XML document, but you should understand the concepts of DOM for browser HTML changes

XML DOM

```
<?xml version="1
<!DOCTYPE sonne
<sonnet type="S
  <author>
    <last-name>S
    <first-name>
    <nationality
    <year-of-bir
    <year-of-dea
  </author>
  <title>Sonnet
  <lines>
    <line>My mist
    <line>Coral i
    <line>If snow
    ...
```

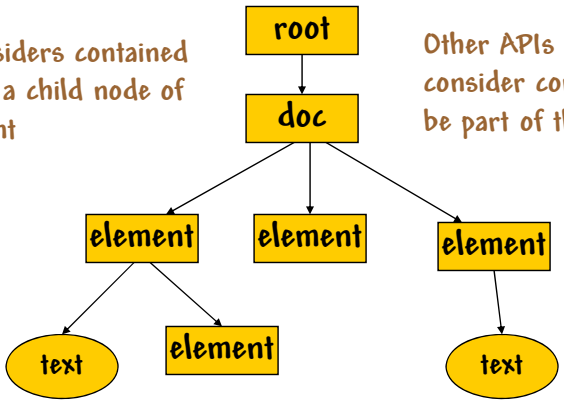


Document Validity

- Well-formed - follows the rules of XML
- Valid - Corresponds to the specified schema

Access a DOM Tree

DOM considers contained text to be a child node of the element



Other APIs (e.g., JDom) consider contained text to be part of the element

XML Applications

- Extending a Web application requires agreement among the trading partners
  - Structure of XML document
  - Names of elements and attributes
- Usually defined as a
  - Company standard - e.g., credit reports
  - Industry standard - e.g., HL7
- The standard is defined as a schema, using one of may languages (e.g., DTD)

XML Schema (XSchema)

- W3C standard
- Individual schemas define a class of XML documents (a schema file usually has an .xsd extension)
- An individual document that conforms to a particular schema is called an instance document
- Details are covered in the Web Services course

Example - DTD/Schema

```
<!ELEMENT note (to, from, heading, body)>
<!ELEMENT to (#PCDATA)>
<!ELEMENT from (#PCDATA)>
<!ELEMENT heading (#PCDATA)>
<!ELEMENT body (#PCDATA)>
```

DTD

Corresponding schema

```
<?xml version="1.0"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
    targetNamespace="http://www.w3schools.com"
    xmlns="http://www.w3schools.com"
    elementFormDefault="qualified">
<xs:element name="note">
    <xs:complexType>
        <xs:sequence>
            <xs:element name="to" type="xs:string"/>
            <xs:element name="from" type="xs:string"/>
            <xs:element name="heading" type="xs:string"/>
            <xs:element name="body" type="xs:string"/>

</xs:sequence> </xs:complexType> </xs:element></xs:schema>
```

root

Namespace declaration

Corresponds to namespace declaration in XML document

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Have You Satisfied the Lecture Objectives?

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Assignment 6

- Prepare an XML document containing a "typical" set of responses to the questions in the Sun form
  - Prepare a schema (using either DTD or XML Schema) using an XML tool (XML Spy or EditiX)
  - The inclusion rules in your schema should be consistent with the meaning of the form elements (e.g., first name and last name are children of a name element)
  - Prepare the XML document consistent with the schema

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