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XML

What is XML?

- XML: a "skeleton" for creating markup languages
- you already know it!
  - syntax is identical to XHTML's:

```
<element attribute="value">content</element>
```

- languages written in XML specify:
  - names of tags in XHTML: `h1, div, img`, etc.
  - names of attributes in XHTML: `id/class, src, href`, etc.
  - rules about how they go together in XHTML: inline vs. block-level elements

Why do we need XML?

- to present complex data in human-readable form
  - "self-describing data"

Anatomy of an XML file


```
<?xml version="1.0" encoding="UTF-8"?> <!-- XML prolog -->
      <note> <!-- root element -->
            <to>Tove</to>
            <from>Jani</from> <!-- element ("tag") -->
            <subject>Reminder</subject> <!-- content of
element -->
            <message language="english"> <!-- attribute
and its value -->
                  Don't forget me this weekend!
            </message>
      </note>                                          XML
```

- begins with an <?xml ... ?> header tag ("prolog")
- has a single root element (in this case, note)
- tag, attribute, and comment syntax is just like XHTML

Uses of XML

- XML data comes from many sources on the web:
  - **web servers** store data as XML files
  - **databases** sometimes return query results as XML
  - **web** services use XML to communicate
- XML is the de facto universal format for exchange of data
- XML languages are used for music, math, vector graphics
- popular use: RSS for news feeds & podcasts

Pros and cons of XML

pro:

- easy to read (for humans and computers)
- standard format makes automation easy
- don't have to "reinvent the wheel" for storing new types of data
- international, platform-independent, open/free standard
- can represent almost any general kind of data (record, list, tree)

Pros and cons of XML

con:

- bulky syntax/structure makes files large; can decrease performance
  - example: quadratic formula in MathML
- can be hard to "shoehorn" data into a good XML format

What tags are legal in XML?

- any tags you want!
- examples:
  - an email message might use tags called to, from, subject
  - a library might use tags called book, title, author
- when designing an XML file, you choose the tags and attributes that best represent the data
- rule of thumb: data = tag, metadata = attribute

Doctypes and Schemas

- "rule books" for individual flavors of XML
  - list which tags and attributes are valid in that language, and how they can be used together
- used to validate XML files to make sure they follow the rules of that "flavor"
  - the W3C HTML validator uses the XHTML doctype to validate your HTML
- for more info:
  - Document Type Definition (DTD) ("doctype")
  - W3C XML Schema

XML and Ajax

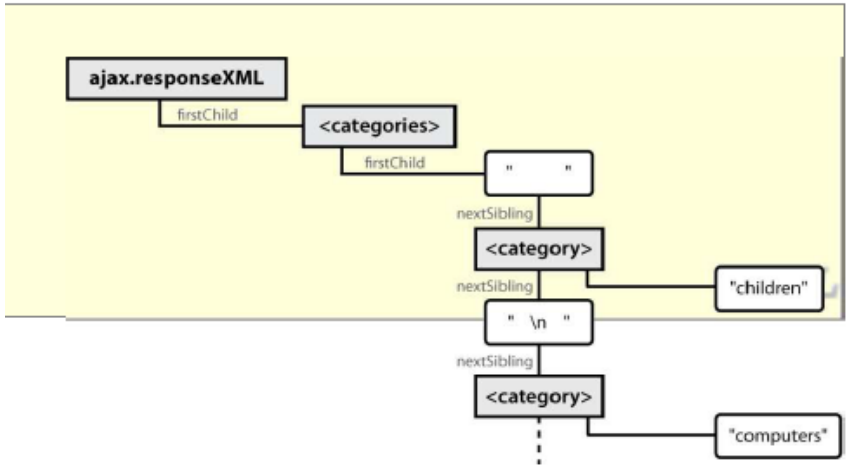
- web browsers can display XML files, but often you instead want to fetch one and analyze its data
- the XML data is fetched, processed, and displayed using Ajax
  - (XML is the "X" in "Ajax")
- It would be very clunky to examine a complex XML structure as just a giant string!
- luckily, the browser can break apart (parse) XML data into a set of objects
  - there is an XML DOM, very similar to the (X)HTML DOM

XML DOM tree structure


```
<?xml version="1.0" encoding="UTF-8"?>
      <categories>
            <category>children</category>
            <category>computers</category>
            ...
      </categories>                                    XML
```

- the XML tags have a tree structure
- DOM nodes have parents, children, and siblings

XML DOM tree structure



Recall: Javascript XML (XHTML) DOM

The DOM properties and methods we already know can be used on XML nodes:

- properties:
  - firstChild, lastChild, childNodes, nextSibling,
  - previousSibling, parentNode
  - nodeName, nodeType, nodeValue, attributes
- methods:
  - appendChild, insertBefore, removeChild, replaceChild
  - getElementsByTagName, getAttribute, hasAttributes, hasChildNodes

- caution: cannot use HTML-specific properties like innerHTML in the XML DOM!

Navigating the node tree

- caution: can only use standard DOM methods and properties in XML DOM
  - HTML DOM has Prototype methods, but XML DOM does not!
- caution: can't use ids or classes to use to get specific nodes
  - id and class are not necessarily defined as attributes in the flavor of XML being read

Navigating the node tree

- caution: firstChild/nextSibling properties are unreliable
  - annoying whitespace text nodes!
- the best way to walk the XML tree:

```
var elms = node.getElementsByTagName("tagName")
```

  - returns an array of all node's children of the given tag name

```
node.getAttribute("attributeName")
```

  - gets an attribute of an element

Using XML data in a web page

- Procedure:
  1. use Ajax to fetch data
  2. use DOM methods to examine XML:
     - `XMLnode.getElementsByTagName()`
  3. extract the data we need from the XML:
     - `XMLelement.getAttribute()`, `XMLelement.firstChild.nodeValue`, etc.
  4. create new HTML nodes and populate with extracted data:
     - `document.createElement()`, `HTMLelement.innerHTML`
  5. inject newly-created HTML nodes into page
     - `HTMLelement.appendChild()`

Fetching XML using AJAX (template)

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```
new Ajax.Request(
"url",
{
        method: "get",
        onSuccess: functionName
}
);
...
function functionName(ajax) {
        do something with ajax.responseXML;
}
```
JS

- ajax.response**Text** contains the XML data in plain text
- ajax.response**XML** is a pre-parsed XML DOM object

Analyzing a fetched XML file using DOM

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```
<?xml version="1.0" encoding="UTF-8"?>
<foo bloop="bleep">
        <bar/>
        <baz><quux/></baz>
        <baz><xyzzy/></baz>
</foo>
```
XML

We can use DOM properties and methods on ajax.responseXML:

```
// zeroth element of array of length 1
var foo = ajax.responseXML.getElementsByTagName("foo")[0];
// ditto
var bar = foo.getElementsByTagName("bar")[0];
// array of length 2
var all_bazzes = foo.getElementsByTagName("baz");
// string "bleep"
var bloop = foo.getAttribute("bloop");
```
JS

Larger XML file example

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```
<?xml version="1.0" encoding="UTF-8"?>
<bookstore>
        <book category="cooking">
                <title lang="en">Everyday Italian</title>
                <author>Giada De Laurentiis</author>
                <year>2005</year><price>30.00</price>
        </book>
        <book category="computers">
                <title lang="en">XQuery Kick Start</title>
                <author>James McGovern</author>
                <year>2003</year><price>49.99</price>
        </book>
        <book category="children">
                <title lang="en">Harry Potter</title>
                <author>J K. Rowling</author>
                <year>2005</year><price>29.99</price>
        </book>
        <book category="computers">
                <title lang="en">Learning XML</title>
                <author>Erik T. Ray</author>
                <year>2003</year><price>39.95</price>
        </book>
</bookstore>
```
XML

Navigating node tree example

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```
// make a paragraph for each book about computers
var books = ajax.responseXML.getElementsByTagName("book");
for (var i = 0; i < books.length; i++) {
    var category = books[i].getAttribute("category");
    if (category == "computers") {
       // extract data from XML
       var title =
        books[i].getElementsByTagName("title")[0].firstChild.node
Value;
        var author =
        books[i].getElementsByTagName("author")[0].firstChild.nod
eValue;
        // make an XHTML <p> tag containing data from XML
        var p = document.createElement("p");
        p.innerHTML = title + ", by " + author;
        document.body.appendChild(p);
     }
}
```
JS

Resources

- http://www.sitepoint.com/really-good-introduction-xml/
- http://www.w3.org/XML/Schema.html