Chapter 9.

XML & XHTML

Content

1.1. XML (eXtensible Markup Language)

- A new standard by W3C, derived from SGML
- EXtensible Markup Language (XML) is a meta-language that describes the content of the document (self-describing data)

  Java = Portable Programs; XML = Portable Data
- XML does not specify the tag set or grammar of the language
  - Tag Set – markup tags that have meaning to a language processor
  - Grammar – defines correct usage of a language's tag

1.1. XML (2)

- Applications of XML
  - Media for data interchange
    - A better alternative to proprietary data formats
  - B2B transactions on the Web
    - Electronic business orders (ebXML)
    - Financial Exchange (IFX)
    - Messaging exchange (SOAP)

```
<?xml version="1.0" encoding="utf-8"?>
<recipe>
    <name>Iced Tea</name>
    <description>An iced tea that we serve
     everyday</description>
    <preparation>…</preparation>
</recipe>
```

1.2. XML vs. SGML

- SGML (Standard Generalized Markup Language)
  - ISO-standard meta-language
  - Powerfull but very complex, suffers from lack of industry support
  - The basis for XML, first published in 1988
- XML (eXtensible Markup Language)
  - Simpler yet offers most of the power of SGML because it is also a meta-language
  - More likely to have broad industry support, because many companies and universitites involved in development

1.3. XML vs. HTML

- Both based on SGML
  - XML is a subset of SGML
  - HTML is a markup language written in SGML
- XML fundamentally separates content (data and language) from presentation; HTML specifies the presentation
- HTML explicitly defines a set of legal tags as well as the grammar (intended meaning)
  - <TABLE> … </TABLE>
- XML allows any tags or grammar to be used (hence, eXtensible)
  - <BOOK> … </BOOK>

1.3. XML vs. HTML (2)

- HTML
  - Not extensible – cannot customize
    - Cannot accommodate special needs (e.g. mathematics, chemical formulas)
    - Proprietary, vendor-specific tags to extends capabilities
  - Only codes for display, not document structure, semantics or content
- XML
  - Can define own markup language → Flexible
  - Tagging/content separate from display
  - Reflects structure and semantics of documents → better searching and navigation

1.4. XHTML

- History of HTML
  - HTML 1.0
    - Created by Tim Berners-Lee and submitted to IETF
  - HTML 2.0
    - RFC1866 in Nov. 1995
  - HTML 3.2
    - Jan. 1997
    - moved from IETF to W3C
  - HTML 4.0
    - Dec. 1997
  - HTML 4.01
    - Dec. 1999
  - HTML 5.0
    - 2008
  - HTML 5.1
    - 2016

HTML4.01

- HTML4.01 has three versions
  - Strict

<!DOCTYPE html PUBLIC “-//W3C//DTD HTML 4.01//EN”

"http://www.w3.org/TR/html4/strict.dtd">

  - Transitional

<!DOCTYPE html PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN"
“http://www.w3.org/TR/html4/loose.dtd”>

  - Frameset

<!DOCTYPE html PUBLIC “-//W3C//DTD HTML 4.01 Frameset//EN”

“http://www.w3.org/TR/html4/frameset.dtd”>

XHTML1.0

- Reformulation of HTML4.01 in XML
  - more strict syntax than HTML
- Three types of XHTML1.0
  - Strict

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN”
        "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
```

  - Transitional

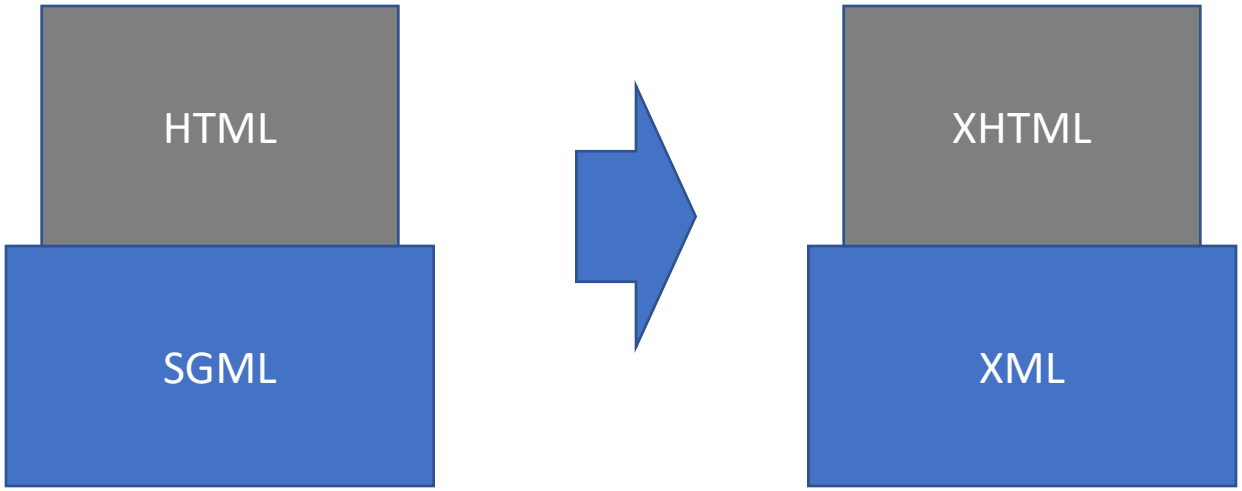
```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
      "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
```

  - Frameset

```
<!DOCTYPE html PUBLIC “-//W3C//DTD XHTML 1.0 Frameset//EN"
        "http://www.w3.org/TR/xhtml1/DTD/xhtml1-frameset.dtd">
```

HTML, XHTML and XML

- HTML is an SGML application
- XHTML is an XML application



1.5. XHTML Features

- Characters for a tag must be lower case
  - C <title>
  - I <TITLE>, <Title>
- Close tags must be needed
  - C Para.
  - I Para Next para
- An empty element needs “ />” on the end
  - C
  - I <img src=“” alt=“” >

1.5. XHTML Features (2)

- An attribute element needs its value
  - C <select multiple="multiple" name="test">
  - I <select multiple name="test">
- Attribute values must be quoted by the single quotation or the double quotation.
  - C <h1 id="title">Title</h1>
  - I <h1 id=title>Title</h1>

1.5. XHTML Features (3)

- XML Declaration is needed
  - <? xml version="1.0" encoding="utf-8" ?>
- xmlns attribute and xml:lang attribute
  - <html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en">

Content

1. XML and XHTML Overview
2. XML Components
3. DTD & XML Schema
4. XML Validation
5. XML Applications

2. XML Components

- Prolog
  - Defines the xml version, entity definitions, and DOCTYPE
- Components of the document
  - Tags and attributes
  - CDATA (character data)
  - Entities
  - Processing instructions
  - Comments

2.1. XML Prolog

- XML Files always start with a prolog
- Includes:
  - Declaration
  - Entities and DTD definitions

2.1.1. XML Declaration

- XML version and document encoding

```
<?xml version="1.0" encoding="ISO-8859-1" standalone="no"?>
```

  - The version of XML is required
  - The encoding identifies character set (default UTF-8)
  - The value standalone identifies if an *external document is* referenced for DTD or entity definition

2.1.2. DOCTYPE Declaration

- Specifies the location of the DTD defining the syntax and structure of elements in the document
- Common forms:
  - <!DOCTYPE root [*DTD]*>
  - <!DOCTYPE root SYSTEM *URL*>
  - <!DOCTYPE root PUBLIC *FPI-identifier URL*>
- The root identifies the starting element (root element) of the document

2.1.2. DOCTYPE Declaration (2)

- The DTD can be external to the XML document, referenced by a SYSTEM or PUBLIC URL
  - SYSTEM URL refers to a private DTD
    - Located on the local file system or HTTP server
  - PUBLIC URL refers to a DTD intended for public use

```
<?xml version="1.0" encoding="utf-8"?>
<!DOCTYPE authors SYSTEM
  "http://example.org/authors.dtd">
<authors>
…
```

Root element

URI Reference of DTD

SYSTEM or PUBLIC

DTD (Document Type Definition)

- A schema language for SGML and XML
  - Definitions of elements, attributes, entities
  - Content model: Tree structure by nested elements
- In authors.dtd on http://example.org:

```
<!DOCTYPE authors [

  <!ELEMENT authors(name)*>
  <!ELEMENT name(firstname, lastname)>
  <!ELEMENT firstname(#PCDATA)>
  <!ELEMENT lastname(#PCDATA)>

]>
```

Simple XML Example

```
<?xml version="1.0"?>
<!DOCTYPE authors SYSTEM
  "http://example.org/authors.dtd">
<authors>
        <name>
                <firstname>Larry</firstname>
                <lastname>Brown</lastname>
        </name>
        <name>
                <firstname>Marty</firstname>
                <lastname>Hall</lastname>
        </name>
        ...
</authors>
```

Standalone XML document

```
<?xml version="1.0" standalone="yes"?>
<DOCTYPE authors [
  <!ELEMENT authors (name)*>
  <!ELEMENT name (firstname, lastname)>
  <!ELEMENT firstname (#PCDATA)>
  <!ELEMENT lastname (#PCDATA)>
]>
<authors>
  <name>
        <firstname>James</firstname>
        <lastname>Gosling</lastname>
  </name>
  ...
</authors>
```

Specifying a PUBLIC DTD

```
<!DOCTYPE root PUBLIC FPI-identifier URL>
```

- The Formal Public Identifier (FPI) has four parts:
  - 1. Connection of DTD to a formal standard
    - - if defining yourself
    - + nonstandards body has approved the DTD
    - ISO if approved by formal standards committee
  - 2. Group responsible for the DTD
  - 3. Description and type of document
  - 4. Language used in the DTD
- E.g.

```
<!DOCTYPE Book PUBLIC "-//W3C//DTD XHMTL 1.0
  Transitional//EN"

   "http://www.w3.org/TR?xhtml1/DTD/xhtml1-
  transitional.dtd">

<!DOCYTPE CWP PUBLIC "-//Prentice Hall//DTD Core Series
  1.0//EN" "http://www.prenticehall.com/DTD/Core.dtd">
```

2.2. Component of the document

- Tags and attributes
- CDATA (character data)
- Entities
- Processing instructions
- Comments

2.2.1. XML Comment

- XML Comments
  - The same as HTML comments
  - **`<!-- This is an XML and HTML comment -->`**

2.2.2. Processing Instructions

- Application-specific instruction to the XML processor

```
<?processor-instruction?>
```

- Example

```
<?xml version="1.0" ?>
<?xml-stylesheet type="text/xml" href="orders.xsl" ?>
<orders>
  <order>
    <count>37</count>
    <price>49.99</price>
    <book>
            <isbn>0130897930</isbn>
            <title>Core Web Programming Second Edition</title>
            <authors>
                    <author>Marty Hall</author>
                    <author>Larry Brown</author>
            </authors>
    </book>
  </order>
</orders>
```

2.2.3. XML Root Element

- Required for XML-aware applications to recognize beginning and end of document
- Example

```
<?xml version="1.0" ?>
<book>
  <title>Core Web Programming</title>
  <contents>
     <chapter number="1"> Designing Web Pages with HTML
     </chapter>
     <chapter number="2"> Block-level Elements in HTML 4.0
     </chapter>
     <chapter number="3"> Text-level Elements in HTML 4.0
     </chapter>
     ...
  </contents>
</book>
```

2.2.4. XML Tags

- Tag names:
  - Case sensitive
  - Start with a letter or underscore
  - After first character, numbers, - and . are allowed
  - Cannot contain whitespaces
  - Avoid use of colon except for indicating namespaces
- For a well-formed XML documents
  - Every tag must have an end tag

```
<elementOne> … </elementOne>
<elementTwo />
```

  - All tags are completely nested (tag order cannot be mixed)

2.2.4. XML Tags (2)

- **Tags can also have attributes**

```
<message to="Gates@microsoft.com"
  from="Gosling@sun.com">
    <priority/>
    <text>We put the . in .com.
          What did you do?
    </text>
</message>
```

2.2.5. XML Attributes

- Element Attributes
  - Attributes provide metadata for the element
  - Every attribute must be enclosed in "" with no commas in between
  - Same naming conventions as elements

2.2.6. Document Entities

- Entities refer to a data item, typically text
  - General entity references start with & and end with ;
  - The entity reference is replaced by it's true value when parsed
  - The characters < > & ' " require entity references to avoid conflicts with the XML application (parser)

< > & " '

- Entities are user definable

```
<?xml version="1.0" standalone="yes" ?>
<!DOCTYPE book [
  <!ELEMENT book (title)>
  <!ELEMENT title (#PCDATA)>
  <!ENTITY COPYRIGHT "2001, Prentice Hall">
]>
<book>
  <title>Core Web Programming, &COPYRIGHT;</title>
</book>
```

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Well-formed versus Valid

- An XML document can be *well-formed if it* follows basic syntax rules
- An XML document is *valid if its structure* matches a Document Type Definition (DTD) or an XML Schema

3.1. Document Type Definition (DTD)

- Defines Structure of the Document
  - Allowable tags and their attributes
  - Attribute values constraints
  - Nesting of tags
  - Number of occurrences for tags
  - Entity definitions

DTD Examples

```
<?xml version="1.0" encoding="ISO-8859-1" ?>
<!ELEMENT perennials (daylily)*>
<!ELEMENT daylily (cultivar, award*, bloom, cost)+>
<!ATTLIST daylily
status (in-stock | limited | sold-out) #REQUIRED>
<!ELEMENT cultivar (#PCDATA)>
<!ELEMENT award (name, year)>
<!ELEMENT name (#PCDATA)>
<!ATTLIST name note CDATA #IMPLIED>
<!ELEMENT year (#PCDATA)>
<!ELEMENT bloom (#PCDATA)>
<!ATTLIST bloom code (E | EM | M | ML | L | E-L) #REQUIRED>
<!ELEMENT cost (#PCDATA)>
<!ATTLIST cost discount CDATA #IMPLIED>
<!ATTLIST cost currency (US | UK | CAN) "US">
```

3.2. XML Schema

- W3C recommendation released May 2001
  - – http://www.w3.org/TR/xmlschema-0/
  - – http://www.w3.org/TR/xmlschema-1/
  - – http://www.w3.org/TR/xmlschema-2/
  - Depends on following specifications
    - XML-Infoset, XML-Namespaces, XPath
- Benefits:
  - Standard and user-defined data types
  - Express data types as patterns
  - Higher degree of type checking
  - Better control of occurrences
- Clearly the future … but limited support

XML Schema Example

```
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema">
  <xsd:element name="perennials" type="PerennialType"/>
  <xsd:complexType name="PerennialType" >
        <xsd:element name=daylily" type="DaylilyType"
                                          maxOccurs="unbounded"/>
  </xsd:complexType>
  <xsd:complexType name="DaylilyType" >
        <xsd:sequence>
          <xsd:element name="cultivar" type="xsd:string"/>
          <xsd:element name="award" type="AwardType"
                                         maxOccurs="unbounded"/>
          <xsd:element name="bloom" type="xsd:string"/>
          <xsd:element name="cost" type="xsd:decimal"/>
        </xsd:sequence>
        <xsd:attribute name="status" type="StatusType"
                            use="required"/>
  </xsd:complexType>
```

XML Schema Example (2)

```
  <xsd:simpleType name="StatusType">
      <xsd:restriction base="xsd:string">
            <xsd:enumeration value="in-stock"/>
            <xsd:enumeration value="limited"/>
            <xsd:enumeration value="sold-out"/>
      </xsd:restriction>
  </xsd:simpleType>
  ...
</xsd:schema>
```

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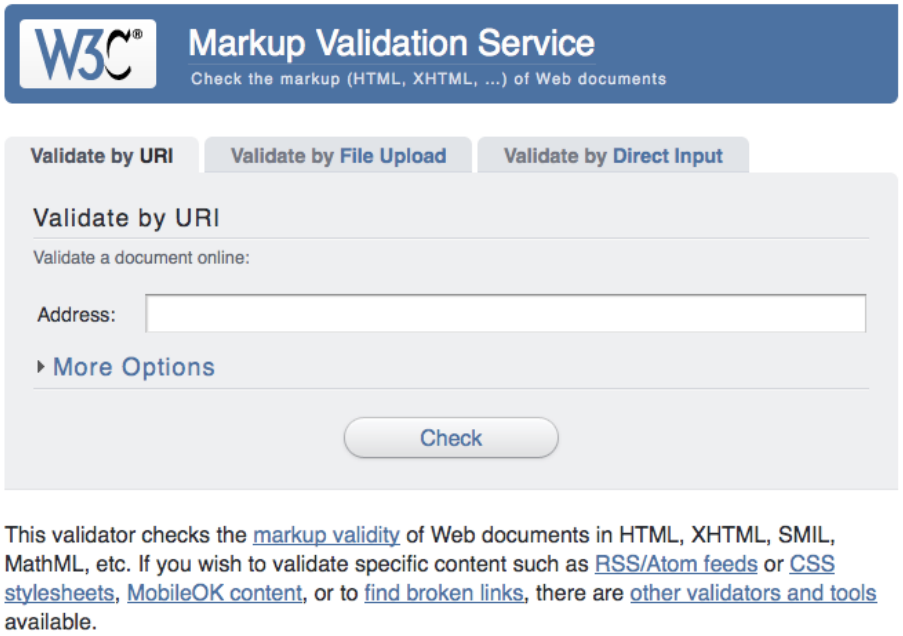
4. XML Validation

- DTD Validaton
  - Process of checking a document against a DTD
    - Correct syntax
    - Correct structure
  - If the document is invalid, a user agent may not be able to handle it correctly
    - parse error

Markup Validation Service

- Validator for HTML
  - URI, Local File or Direct Input
- http://validator.w3.org



Validator Results

This document was successfully checked as XHTML 1.0 Strict!

Result:	Passed	
Address :	http://www.w3.org/	
Encoding :	utf-8	(detect automatically)
Doctype :	XHTML 1.0 Strict	(detect automatically)
Root Element:	html	
Root Namespace:	http://www.w3.org/1999/xhtml	

I ♥ VALIDATOR

The W3C validators rely on community support for hosting and development.

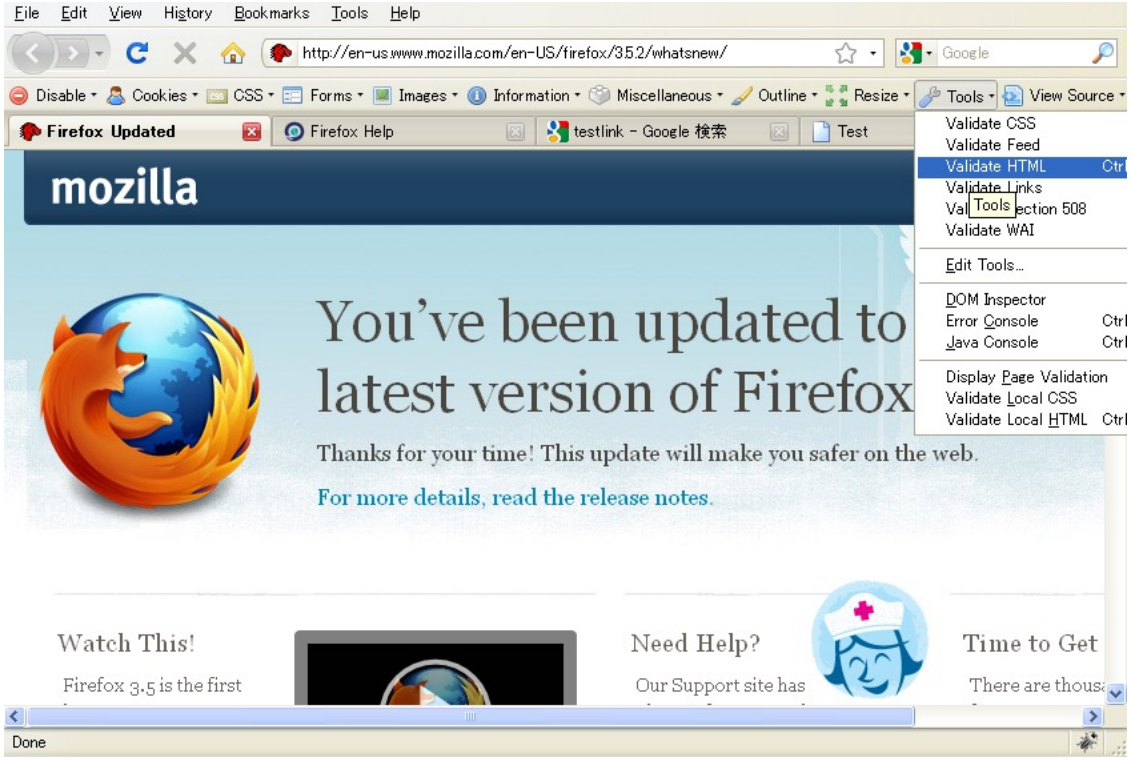
Donate and help us build better tools for a better web.

Errors found while checking this document as HTML 4.01 Transitional!

Result:	34 Errors, 8 warning(s)	
Address :	http://www.yahoo.com/	
Encoding :	utf-8	(detect automatically)
Doctype :	HTML 4.01 Transitional	(detect automatically)
Root Element:	html	

Web Developer Tool with Validator

- A link to the validation service on the Tool menu
  - It posts the URI of the current page to the validator



Content-Type

- An HTML document can specify its MIME type and character encoding with meta http-equiv
  - NOTE: it is unrelated to xml declaration

```
<meta http-equiv="Content-Type"
  content="text/html;charset=utf-8" />
```

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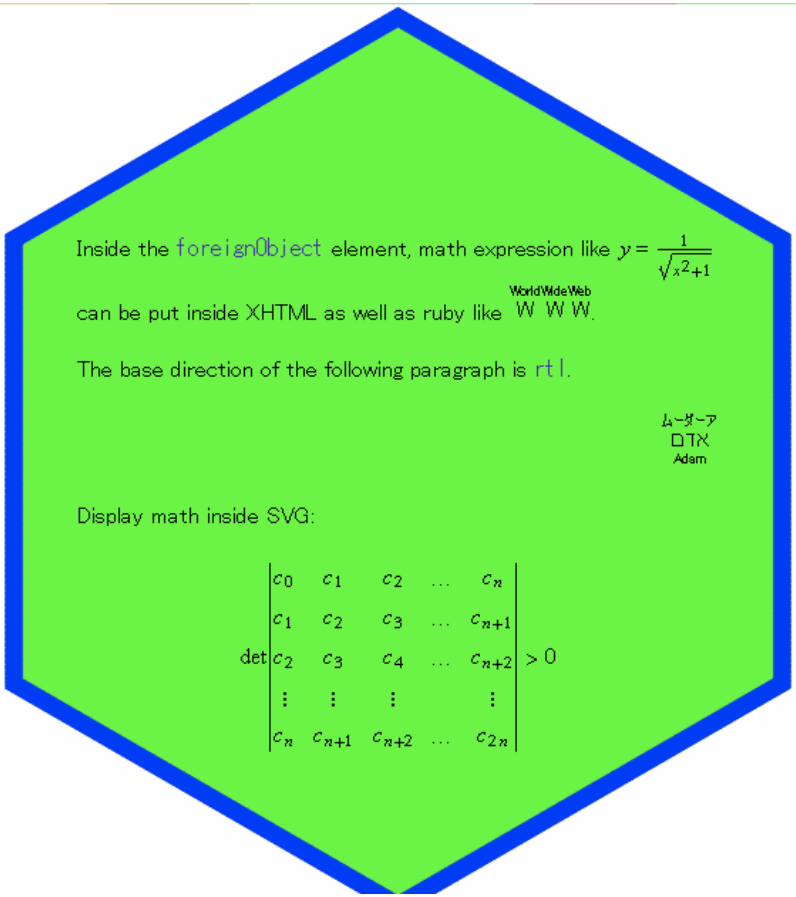
5. XML Application

- MathML
  - Mathematical expressions
- SVG (Scalable Vector Graphics)
  - 2D graphics applications and images
- KML (Keyhole Markup Language)
  - Geographical data for Google Earth, Maps, etc…
- XUL (XML User Interface Language, /ˈzuːl/)
  - GUI descriptions for Mozilla project applications (firefox)
- EPUB (Electronic PUBlications)
  - E-book description standard
- ATOM
  - Web content and metadata syndication format
  - Replacement of RSS

XML Namespace

- A way to use various XML applications as components for a document
  - Ex) HTML + MathML + SV



http://www.w3.org/TR/XHTMLplusMathMLplusSVG/

XML Namespace (2)

- Each namespace has a URI
- xmlns attribute
  - Default namespace for the branch

```
<html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en">
 <head><title>XHTML as the host language</title></head>
 <body>
   ... XHTML content ...
  <math xmlns="http://www.w3.org/1998/Math/MathML"> ... MathML
   content ...
  </math>
…
```

Namespace prefix

- xmlns:?? attribute
  - Namespace for the ?? prefix

```
<math xmlns="http://www.w3.org/1998/Math/MathML"
  <xhtml:p
 xmlns:xhtml="“http://www.w3.org/1999/xhtml”>XHTML
 Paragraph</xhtml:p>
  <svg:svg version="1.1"
    xmlns:svg="http://www.w3.org/2000/svg“>
  </svg:svg>
```

5.1. MathML

- You can try with firefox > 3.6
  - http://www.mozilla.org/projects/mathml/start.xhtml

```
<mrow xmlns="&mathml;">
 <mi>x</mi><mo>=</mo>
 <mfrac>
  <mrow>
   <mrow><mo>-</mo><mi>b</mi></mrow>
   <mo>&PlusMinus;</mo>
   <msqrt><mrow>
     <msup><mi>b</mi><mn>2</mn></msup>
     <mo>-</mo>
     <mrow><mn>4</mn><mi>a</mi><mi>c</mi></mrow>
   </mrow></msqrt>
  </mrow>
  <mrow><mn>2</mn><mi>a</mi></mrow>
 </mfrac>
</mrow>
```

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

MathML example – Doctype and xmlns

- Both of xhtml and MathML vocabulary in the same document

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.1 plus MathML 2.0//EN"
http://www.w3.org/Math/DTD/mathml2/xhtml-math11-f.dtd [
<!ENTITY mathml "http://www.w3.org/1998/Math/MathML"> ]>
<html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en" lang="en">

…

<mrow xmlns="&mathml;">
```

5.2. KML (Keyhole Markup Language)

- Display geographic data in an Earth browser such as Google Earth, Google Maps,
- Example: sample.kml

```
<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://www.opengis.net/kml/2.2">
  <Placemark>
    <name>HUT placemark</name>
    <description>Location of HUT</description>
    <Point>
      <coordinates>105.84413,21.00438,0</coordinates>
    </Point>
  </Placemark>
</kml>
```

To open KML files

- Google Earth: Open from the file menu
- Google Map: maps.google.com
  - “My Maps” on the left sidebar
  - Use “import” menu
  - You need google account

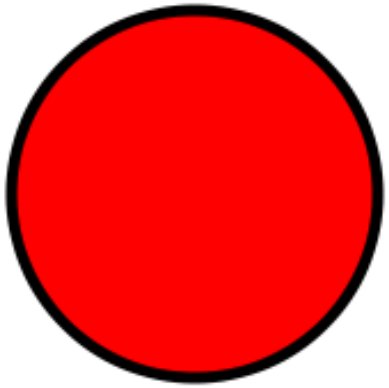
- KML Tutorial
  - http://code.google.com/intl/en/apis/kml/documentation/kml_tut.html

5.3. SVG (Scalable Vector Graphics)

- 2D vector graphics applications and images
- You can try with firefox > 3.6
  - http://commons.wikimedia.org/wiki/SVG_examples
  - http://www.carto.net/papers/svg/samples/

```
<?xml version="1.0"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 1.1//EN"
 "http://www.w3.org/Graphics/SVG/1.1/DTD/svg11.dtd">

<svg xmlns="http://www.w3.org/2000/svg"
 width="200" height="200">
 <circle cx="100" cy="100" r="50" stroke="black"
  stroke-width="5" fill="red" />
</svg>
```



Standalone SVG document example

- Doctype and svg element

```
<?xml version="1.0"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 1.1//EN"
  "http://www.w3.org/Graphics/SVG/1.1/DTD/svg11.dtd">
<svg xmlns="http://www.w3.org/2000/svg" width="200" height="200">
</svg>
```

- Rectangular

```
<rect x=”20" y=”20" width="250" height="50" fill="green” stroke="black"
stroke-width="1" />
```

- Circle

```
<circle cx="100" cy="100" r="50" stroke="black" stroke-width="5"
fill="red" />
```

Question?