

MathML

A Quick Introduction

mathml-1

What is MathML

- MathML an XML application for representing mathematical formulas.
- MathML 2.0, a W3C Recommendation, was released on 21 Feb 2001 (www.w3.org/Math/), MathML 3.0 is being drafted.
- MathML *Presentation Code* is for describing how to render mathematical expressions.

```
<math><msup><mi>x</mi><mn>2</mn></msup></math>
```

- MathML *Content Code* is for representing the semantics (meaning) of mathematical computations.

```
<apply>
```

```
  <power/><ci>x</ci><cn type="integer">2</cn>
```

```
</apply>
```

mathml-2

- MathML *Composite Code* provides both Presentation and Content encodings.
- Design Science is a company specializing in MathML related software.

mathml-3

Expression Trees

Look at the presentation code for another example $(a - b)^3$

```
<msup>  
  <mfenced>  
    <mi>a</mi> <mo>-</mo> <mi>b</mi>  
  </mfenced>  
  <mn>3</mn>  
</msup>
```

mathml-4

The Corresponding Content Code

```
<apply> <power/>  
  <apply> <plus/>  
    <ci>a</ci> <ci>b</ci>  
  </apply>  
<cn>2</cn>  
</apply>
```

mathml-5

MathML Composite Code Example

```
<math xmlns='http://www.w3.org/1998/Math/MathML'>  
<semantics>  
  
  <msup><mi>x</mi><mn>2</mn></msup>  
<annotation-xml encoding="MathML-Content">  
  <apply>  
    <power/><ci>x</ci><cn type="integer">2</cn>  
  </apply>  
</annotation-xml>  
<annotation-xml encoding="Text-Infix">x^2  
</annotation-xml>  
</semantics></math>
```

mathml-6

Browser Support for MathML

As of 2009:

- Firefox, Opera, Camino support native MathML.
- IE needs MathPlayer plugin (free from Design Science) to work.
- Safari has some support for MathML.
- In anycase, Math fonts need be installed. See [font installation instructions](#).

mathml-7

MathML in Web Pages

- Use MathML Presentation or MathML Mixed code to produce browser display of math formulas. Support for rendering MathML Content code is lacking.
- In order to mix xhtml and mathml code in one Web page, we need to use the *XHTML + MathML Profile* and deliver the document with the content type `application/xhtml+xml`.
- See [mathSameple.html](#)

mathml-8

MathML Code in Firefox

- An XHTML page containing Mathml for Firefox (Mozilla) needs the HTTP content-type header:

Content-Type: application/xhtml+xml

- `<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.1 plus MathML 2.0 plus SVG 1.1//EN" "http://www.w3.org/2002/04/xhtml-math-svg/xhtml-math-svg-flat.dtd">`
- MathML code mixed in with XHTML code
`<math xmlns='http://www.w3.org/1998/Math/MathML'>`
`...`
`</math>`

mathml-9

MathML Code in IE

- MathML code in IE is treated by the MathPlayer Plugin. The Plugin will generate the required Mathplayer headers for the page. For example,

```
<object id="icmdemo"
  CLASSID="clsid:32F66A20-7614-11D4-BD11-00104BD3F987"
  CODEBASE="http://www.dessci.com/dl/mathplayer.cab">
</object>
<?IMPORT NAMESPACE="mml" IMPLEMENTATION="#icmdemo" ?>
```

- MathPlayer needs to put a namespace prefix in front of all MathML code and it is also done automatically. The default prefix is `m:` but the host page can define any preferred prefix, for example

```
<html xmlns="http://www.w3.org/1999/xhtml">
```

mathml-10

```
xml:lang="en" lang="en"  
xmlns:mml='http://www.w3.org/1998/Math/MathML'>
```

- Firefox does not use MathPlayer and no namespace prefix is needed for MathML code.

mathml-11

Infix to MathML Demo

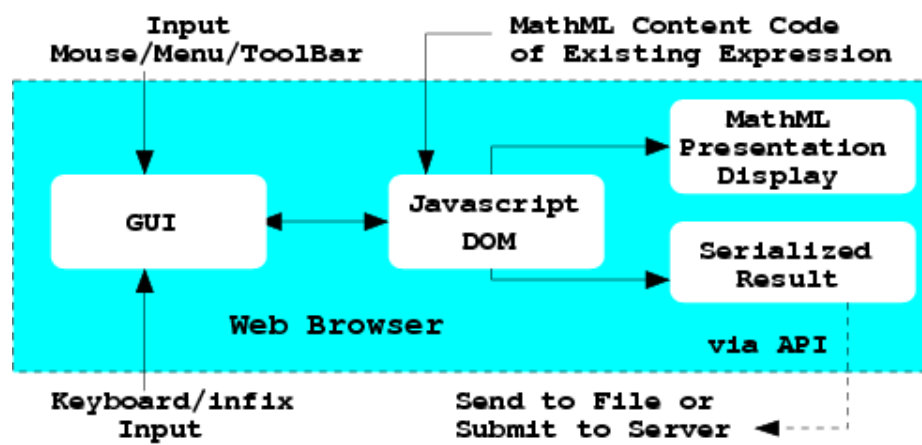
- Given any valid infix notation, we can generate the correct MathML code for use in a Web page.
- See [this page](#)
- Inserting MathML into DOM tree

mathml-12

What is MathEdit

- A self-contained visual editor for Math that is easily interfaced to WME and other Web applications.
- MathEdit is implemented in standard JavaScript uses DOM to represent the mathematical expression being created/edited.
- MathEdit can produce MathML code—content, presentation, and composite codes. It can also generate L^AT_EX and OpenMath notations.
- Its GUI offers visual navigation of sub-expressions and an expression template palette for expression input.
- [MathEdit Homepage](#).

mathml-13



mathml-14

MathML Code Generation

- MathML for long and complicated mathematical expressions can be hard to construct by hand.
- ICM supports a version of MAXIMA that can generate MathML code for computational results.
- See [this demo](#).
- See [this demo](#) for creating Mixed MathML.

mathml-15

MathEdit Applications

- Derivative Answer Checking
- Derivative Answer Checking Again
- MathEdit New Version

mathml-16

MathML Cross-Browser

Development Steps

mathml-17

Step 1: Enable PHP

- Enable PHP processing of .html, .xhtml, and .php source files.
- In httpd.conf include

```
<IfModule mod_php5.c>  
AddType application/x-httpd-php .php .html .xhtml  
AddType application/x-httpd-php-source .phps  
</IfModule>
```

mathml-18

Step 2: Send Correct Content Type

- To make sure browsers treat the lesson page as an XML page we need

```
<?php header("Content-Type: application/xhtml+xml"); ?>
```

at the very beginning of any page.

- Make sure this line is placed at the beginning of the lesson page and comes before all other PHP processing, and file inclusion.

mathml-19

Step 3: Send Correct XML Headers

Page content starts with

```
<!DOCTYPE html PUBLIC
"-//W3C//DTD XHTML 1.1 plus
  MathML 2.0 plus SVG 1.1//EN"
"http://www.w3.org/2002/04/xhtml-math-svg/
  xhtml-math-svg-flat.dtd">
<html xmlns="http://www.w3.org/1999/xhtml"
  xml:lang="en" lang="en"
  xmlns:mml='http://www.w3.org/1998/Math/MathML'>
```

mathml-20

Step 4: Use MathML Presentation Code

- Because Firefox does not support the display of MathML Content code yet, we need to use Presentation MathML for display.
- There is no need to add any MathPlayer object or IMPLEMENTATION headers to the HTML. MathPlayer (2.0 and later) automatically adds these lines now.
- There is no need to add `mml:` namespace prefixes to MathML code.
- For example $3x^2\cos(x)$ is given as

```
<math xmlns='http://www.w3.org/1998/Math/MathML'>
<mrow> <mn>3</mn><mo>&InvisibleTimes;</mo>
      <msup><mi>x</mi><mn>2</mn></msup>
```

mathml-21

```
      <mo>&InvisibleTimes;</mo>
    <mi>cos</mi><mo>&ApplyFunction;</mo>
    <mrow> <mo>(</mo><mi>x</mi><mo>)</mo>
  </mrow></mrow></math>
```

mathml-22

Inserting Result MathML into Page

For Firefox use

```
var dtm='<!DOCTYPE math PUBLIC
    "-//W3C//DTD MathML 2.0//EN"
    "http://www.w3.org/Math/DTD/
    mathml2/mathml2.dtd">';

if ( navigator.appName == "Netscape" )
{   node.innerHTML
    = "<p>Your answer is incorrect.
      The correct answer is</p>";
    // just in case
    ca = answer.standard.replace(/mml:/g, "");
    ca = dtm + ca; // doctype gives entities
```

mathml-23

```
d2 = parseXML(ca);
var math_node = d2.documentElement;
```

mathml-24

Inserting Result MathML into Page

For IE

```
{  node.innerHTML = "<p>Your answer is  
    incorrect.  The correct answer is "  
    + answer.standard + "</p>";  
}
```

mathml-25

The Javascript Code

To see the full Javascript source for this demo

[Cross-browser Javascript.](#)

mathml-26