

MathML

A Quick Introduction

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

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>
```

The Corresponding Content Code

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

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>
```

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 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 `mathSample.html`

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 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">
```

```
xml:lang="en" lang="en"
```

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

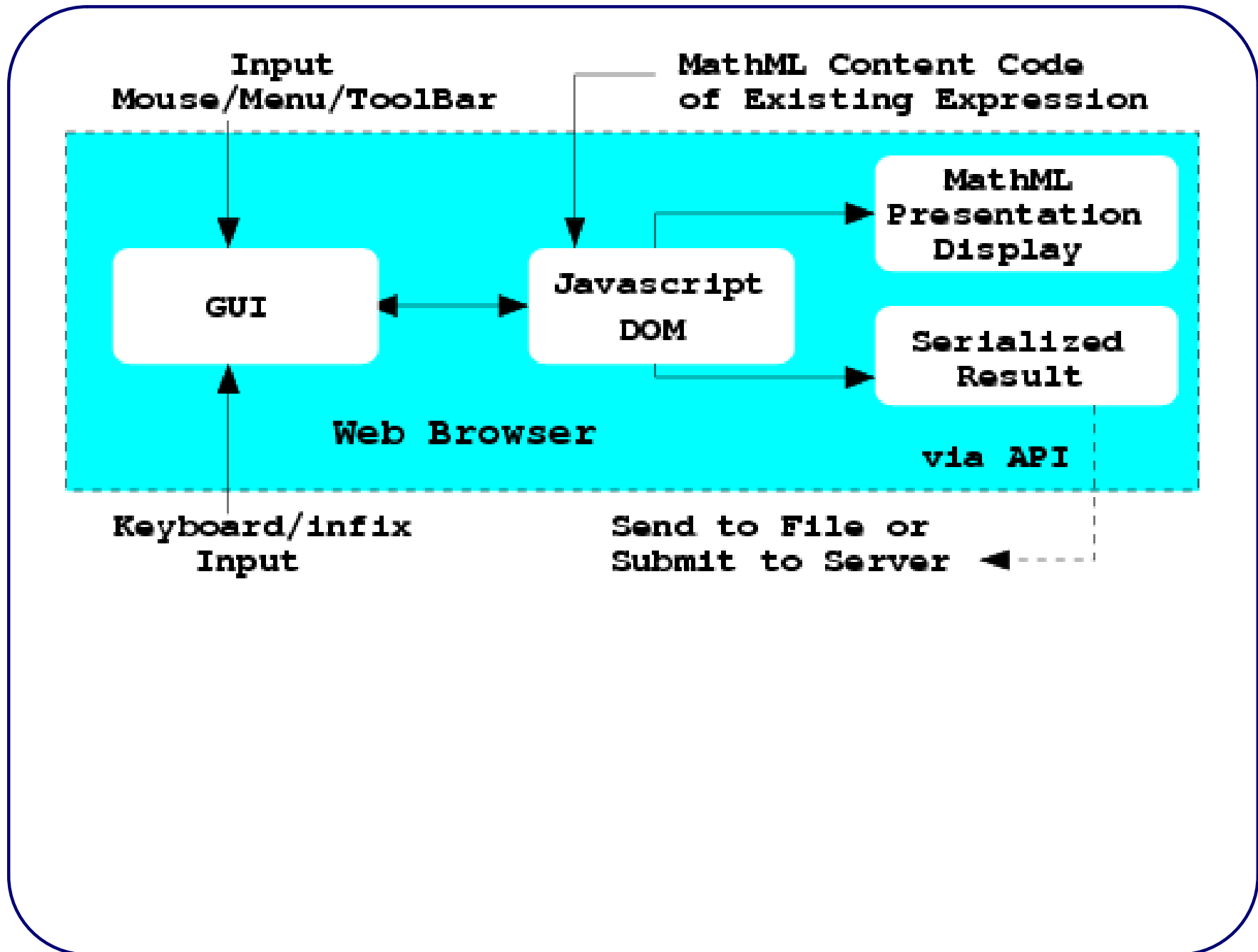
- Firefox does not use MathPlayer and no namespace prefix is needed for MathML code.

## 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

## 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<sup>A</sup>T<sub>E</sub>X and OpenMath notations.
- Its GUI offers visual navigation of sub-expressions and an expression template palette for expression input.
- MathEdit Homepage.



## 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.

## MathEdit Applications

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

# *MathML Cross-Browser*

## *Development Steps*

## 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>
```

## 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.

### 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'>
```

## 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>⁢</mo>
 <msup><mi>x</mi><mn>2</mn></msup>
```

```
<mo>⁢</mo>
<mi>cos</mi><mo>⁡</mo>
 <mrow> <mo>(</mo><mi>x</mi><mo>)</mo>
</mrow></mrow></math>
```

## 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
```

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

## Inserting Result MathML into Page

For IE

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

## The Javascript Code

To see the full Javascript source for this demo

Cross-browser Javascript.