

Displaying Maths on the Web: a survey

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The World Wide Web is here to stay so we may as well take advantage of it. Facilities to display static mathematical documents—research and teaching material—are already well developed, and PDF is a good choice. Facilities to display dynamic mathematical documents, generated in response to user input, are fluid and developing. MathML, essentially the mathematical extension of HTML, appears to be the way forward, although right now the options are more open.

References ([http://](#))

- ❖ This talk: centaur.maths.qmw.ac.uk/Talks/WebMath/
- ❖ centaur.maths.qmw.ac.uk/Papers/SIGSAM_MathML/
- ❖ centaur.maths.qmw.ac.uk/Generating_PDF/
- ❖ centaur.maths.qmw.ac.uk/CTI_MathML_Workshop/
- ❖ www.w3.org/Math/
- ❖ www.mathtype.com/

What Kind of Maths?

- ❖ Static: page oriented
 - Research papers
 - Teaching material
- ❖ Dynamic: display oriented
 - Software (CA) tools / demonstrations, e.g.
 - The Integrator <http://integrals.wolfram.com/>
(uses GIFs)
 - CATHODE <http://www-lmc.imag.fr/cathode2/>
 - Computer-assisted learning

Why Publish Maths on the Web?

- ❖ Expectation: students, electronic journals, EU projects
- ❖ Cost, convenience
- ❖ Hyperlinks: structured library, easy to find
- ❖ Easy access: local, global, fast
- ❖ Choice: print (n up), browse
- ❖ Can be dynamic (CGI, DHTML, etc.)

Static Mathematics

- ❖ Formatted for printing on paper: research papers, lecture notes, exercises
- ❖ Properties of the format to consider:
 - Ease of copying / risk of plagiarism
 - Ease of producing / editing
 - Ease of browsing / portability
- ❖ Web formats [explain formats, pros, cons]
 - Preserving layout:
 - Proprietary (MS Word etc.): non-portable
 - T_EX DVI: figures awkward, fonts non-portable
 - PostScript: large files, awkward to display
 - Portable Document Format (PDF)
 - Ignoring layout:
 - T_EX etc. (techexplorer)
 - HTML + GIF, MathML (mathematical HTML)
- ❖ Source format → Web format
 - T_EX $\xrightarrow{\text{tex}}$ DVI $\xrightarrow{\text{dvips}}$ PS $\xrightarrow{\text{ps2pdf}}$ PDF
 - T_EX $\xrightarrow{\text{tex}}$ DVI $\xrightarrow{\text{dvi2pdf}}$ PDF
 - T_EX $\xrightarrow{\text{pdftex}}$ PDF
 - (L_AT_EX / hyperref → hyperlinks)

- Any (Word, Maple, etc.) $\xrightarrow{\text{print to PS file}}$
PS $\xrightarrow{\text{ps2pdf}}$ PDF (loses links)
- L^AT_EX $\xrightarrow{\text{LaTeX2HTML}}$ HTML + GIF
(Nikos Drakos, CBL Unit, Leeds)
- Word, Maple $\xrightarrow{\text{save as HTML}}$ HTML + GIF
- HTML + MathML (Amaya, MathType, Mozilla, etc.)

Dynamic Mathematics

❖ Requirements

- Rapid generation (no translation)
- Rapid download (single file)
- Rapid *automatic* rendering (no plug-ins or applets)

❖ Format options

- T_EX (techexplorer)
- HTML with “special symbols and formatting”
TtH: T_EX → HTML, TeX2HTML (proprietary)
- HTML with embedded MathML (techexplorer)
- XHTML/XML + MathML (Amaya, Mozilla, ...)

MathML

❖ What it is

- XML
- Presentation markup (cf. L^AT_EX)

```
<mrow>
  <msup> <mi>x</mi> <mn>2</mn> </msup>
  <mo>+</mo>
  <mrow>
    <mn>4</mn>
    <mo>&invisibletimes;</mo>
    <mi>x</mi>
  </mrow>
  <mo>+</mo>
  <mn>4</mn>
</mrow>
```

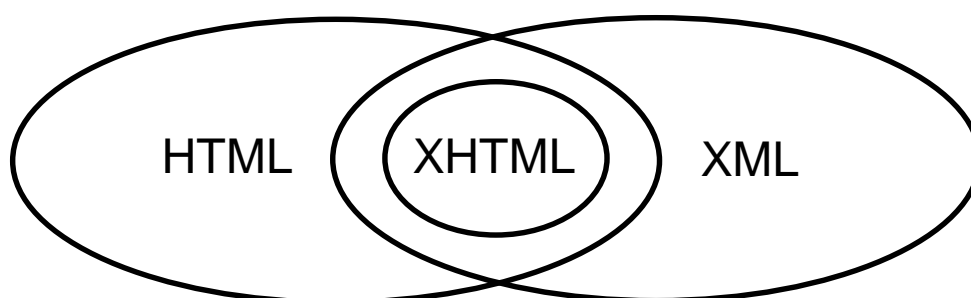
- Content markup (cf. REDUCE, Maple)

```
<apply>
  <plus/>
  <apply>
    <power/>
    <ci>x</ci>
    <cn>2</cn>
  </apply>
  <apply>
    <times/>
    <cn>4</cn>
    <ci>x</ci>
  </apply>
  <cn>4</cn>
</apply>
```

❖ Brief history of MathML

- The need for standards became apparent very early in the development of the Web. In 1994, the World Wide Web Consortium (W3C) was founded, and began putting in place a process to recommend standards for the Web. Almost at once, proposals for adding math capabilities to HTML began circulating at W3C, and in 1995, the formal development of MathML began. The first release of the MathML Specification was in 1997.
- Relation to OpenMath

❖ HTML, XML and XHTML



- XML syntax
 - tags are case-sensitive
 - end tags are required, e.g. `</p>` and ``
 - a `/` must be added to empty tags, e.g. `
` and `<hr />`
 - all attribute values must be quoted, e.g. ``

❖ How to display MathML via a web browser

➤ Amaya: XHTML + *Presentation* MathML

```
<?xml version="1.0"?>
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
  <title>MathML in Amaya</title>
  <meta name="GENERATOR" content="amaya v2.5" />
  <meta http-equiv="Content-Type" content="text/html" />
</head>

<body>

<p>
<math xmlns="http://www.w3.org/1998/Math/MathML" mode="display">
  <mrow>
    ...
  </mrow>
</math>
</p>
```

➤ Mozilla: XML + *Presentation* MathML

➤ IBM techexplorer: browser plug-in

```
<embed type="text/mathml" mmldata='
  <math>
    ...
  </math>'
  height=75 width=200>
```

➤ WebEQ: (*proprietary*) Java applet

➤ MathPlayer: Internet Explorer 5.5 plug-in (soon)

❖ How to generate it

➤ By hand: MathML editors

- Amaya (Mozilla)
- WebEQ: (*proprietary*) Java applet

- By translation
 - TeX4ht: L^AT_EX → XML/MathML
 - Omega: L^AT_EX → MathML
 - TtM (*proprietary*): T_EX → MathML
 - MathPage (*proprietary*): Word → HTML/MathML
- As computer algebra output
 - Mathematica
 - REDUCE (currently *Content* MathML only)
 - needs post-processing, e.g. by CGI processor

Summary

- ❖ To display *static* mathematical documents use PDF: single-file, portable, well-defined, free
- ❖ To display *dynamic* mathematical documents use
 - HTML with embedded MathML and a browser plug-in *now*
 - XHTML + *Presentation* MathML and
 - Amaya *now*
 - any (?) browser *soon* (?)

Screen shots from ODESolve demo