

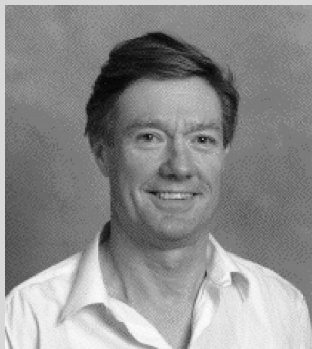
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# MathML – Cleared for Take-off?

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For more than 20 years, thanks to the energy and genius of Donald Knuth, authors have been able to turn themselves into professional composers overnight. The easy-to-learn mark-up of Plain TeX and its dialects enables scientists to typeset technical documents to the highest standards produced by the traditional methods of hot metal type.

Why has there not been a parallel development for the screen-presentation of mathematical documents transmitted via the World Wide Web? Two reasons come immediately to mind:

- **Commercial interests**

Or more accurately, lack of commercial interest. A browser is needed to display mathematics on the Web, and the mainstream browser makers need “five good business reasons” why they should contribute resources and add half a megabyte to the download in order to satisfy the needs of a relatively small community of mathematicians.

- **Verbosity**

The two sets of recommendations by Mathematics Working Group of the World Wide Web Consortium (W3C) for a Mathematical Mark-up Language (MathML 1 and 2) in 1999 and 2001 include mark-up for *content* as well as for *presentation*. Tags in a source document come thick and fast, and no one in their right mind would want to mark up a mathematics document of any complexity without the help of authoring software.

The second International MathML Conference was held in Lisle, a suburb of Chicago, from 28th to 30th June 2002. It was attended by 126 people with varied interests in the subject, and thanks to the generosity of the LTSN Maths, Stats & OR Network and the Warwick University Teaching and Learning Development fund, I was among those participants. What follows is a short account of the meeting, starting with a quick fix for those potential users wanting only to hear about current browser take-up.

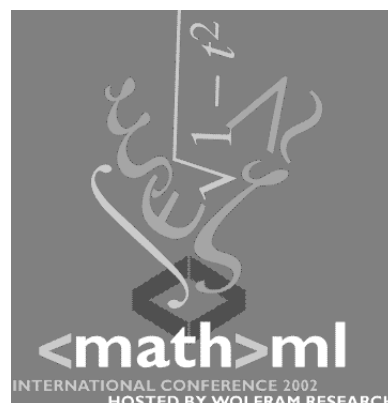
### ***The Current State of Play for Users***

Perhaps the most important news is that for Windows and Linux/UNIX users *Netscape* and *Internet Explorer* (IE) can display presentation MathML embedded in a normal HTML Web page. But this is

- only in the preview release of *Netscape 7*, and
- for *IE* ( $\geq 5.5$ ) only with a *Mathplayer* or *Techexplorer* plugin.

Moreover, these two browsers interpret the document type definition (DTD) in an XHTML header in diametrically opposite ways, and so you can't get both of them to display a MathML Web page without including a link to David Carlisle's "Universal MathML stylesheet", a copy of which must sit on the same server as the page in question.

The browsers *Mozilla 1.0* and *Amaya* will also display MathML pages natively on the same platforms.



Visit the MathML conference web at:

[www.mathmlconference.org/2002/](http://www.mathmlconference.org/2002/)

On the negative side, we mention

- The preview release of *Netscape 7* is built on *Mozilla 1.0*, which includes full native support for MathML 2. It is not yet clear whether this will be included in the final release of *Netscape 7*.
- MathML support for the Mac is not available for any of these browsers.
- *Internet Explorer 6* fails to display any document containing mathematical symbols in the Unicode Plane-1 character set. Microsoft's promise of a fix for the next release has been unfulfilled for almost a year now.

Nevertheless, there are now four browsers that will render mathematics to a high standard on the most popular operating systems, and, despite the caveats, this is significant progress since the previous MathML conference two years ago.

### **The Conference by Themes**

I will now survey selectively the papers and posters presented to the conference under the following headings:

- Writing MathML
- Translating to, from, and within MathML
- Free trade in mathematics
- Off message but fun

#### **1 MathML Authoring Tools**

There is now a good selection of authoring packages available to those wishing to include mathematics in their Web documents. Here are some that were reported on at the conference:

**Mathtype 5.** This is the professional version of *Equation Editor* that comes with *Word* for Windows. This program adds a new button "Export to Mathpage" to the *Word* toolbar, and the associated dialogue box offer several choices, including

- HTML + MathML
- HTML +GIF images for the equations

The MathML option allows the user considerable choice in the kind of output produced. On the other hand, the GIF-image option is a mature technology that optimises output for older browsers. Detailed information can be found in the excellent Status Report (dated Jan 2002) by Robert Miner and Paul Topping on the Design Science Web site (see URL below).

**Techexplorer.** At the conference Sam Dooley described and demonstrated the IBM *MathML Expression Editor*

which works in conjunction with the IBM *Techexplorer Hypermedia Browser* to render, create, and edit both content and presentation MathML. He handed out copies of the program (called *Zed* in development) on floppy disks and offered to send copies to anyone who emailed him at dooley@watson.ibm.com. To work, *Zed* needs *Techexplorer* running in the background.

**Amaya.** Amaya is the World Wide Web Consortium's open-source Web browser and editor that acts as a shop window for the Consortium's developments. It is available free for Windows and UNIX platforms. The current release 6.1 supports most of the W3C's standards including presentation mark-up for MathML, which can be edited within the browser window, a feature that suits it well for interactive e-learning.

**WebEQ Editor.** Design Science also offers a suite of 5 tools for creating, publishing, and viewing mathematics in Web pages. WebEQ Editor provides a graphical interface for creating and editing both content and presentation MathML.

**Maple, Mathematica and Mathcad.** These computer algebra systems all provide a "Save as HTML" option for their notebooks and so can be used to generate MathML output. Interactivity is currently limited but under energetic development.

#### **2 Translators**

There were a number of talks on translation, addressing ways of converting

- TeX and LaTeX documents into MathML format (presentation only)
- MathML into LaTeX and back, preserving content mark-up
- within a MathML document; content into presentation (relatively easy) and vice-versa (less straightforward).

Several of the editors mentioned in the previous section will carry out the first function on this list. Translation from presentation MathML into Scalable Vector Graphic format is another route being explored for displaying mathematics on the Web.

#### **3 Server Side Support**

'Web services' was one of the buzz phrases at the conference. In the shorter term, servers will process mathematical consumers' requests (solve this integral, analyse this data, display this equation) and provide quick intelligent answers. Both *Mathematica* and *Maple* showed off their wares: *WebMathematica* (already released) and *MapleNet* (coming soon), which will

include SOAP! Both demonstrations were less than impressive on the network from the Marriot Conference Hotel.

SOAP is an acronym for the Simple Object Access Protocol for accessing services, objects and servers in a platform-independent manner, a language for trading information on the Internet. We were asked to imagine, in some glorious future, a world-wide market in mathematical knowledge. Then we will be able to fire off our questions, suitably lathered, into cyberspace, and servers across the world will fight over the privilege of sending us back the best answers in the shortest time. (There may be a small charge for the service.)

#### 4 And more besides

**OpenMath.** MathML is designed to handle mathematics up to the US educational level K14 (the second year of college). Research mathematicians have greater needs, and here the emerging standard OpenMath ([www.openmath.org](http://www.openmath.org)) expects to play a role. It is closely related to MathML (but more translators will be needed), handling both presentation and content (or rather semantics, a fine distinction I did not fully grasp). Its strength is extensibility through the use of specialist dictionaries to handle the language and notation from different areas of mathematics.

**Keynote Speakers.** There were three invited talks, all very enjoyable. David Carlisle explained how he had rescued MathML from browser incompatibilities through his 'Universal Mathematics Stylesheet'. Roger Sidje, from the University of Queensland, gave a lucid account of the Mozilla project, for which he wrote the MathML component now included in the preview of Netscape 7. The computer scientist, Leslie Lamport, of LaTeX fame gave a chastening talk about the unreliability of proofs in currently published mathematics (around a third of published papers contain wrong proofs, he claimed) and suggested ways of remedying this by following formats akin to those used in computer programs. Incidentally, there were several delegates who work on automated

proof, and issues they raised about the communication of mathematics impinged naturally on MathML and OpenMath.

**Miscellany.** There was an intriguing talk by Stephen Watt from the University of Western Ontario about the development of recognition software for hand-written mathematics on hand-held devices; a talk on translating and rendering mathematics in Arabic; and an amazing list of statistics gleaned from Wolfram Research, ranging from MathML file sizes to browser usage, in a talk by Andrew Hunt.

#### Conclusion

Hard work over the past decade by the devoted people who have served on the W3C Mathematics Working Group (many of whom were at the conference) is starting to pay dividends. Growing browser adoption means that MathML will be seen an attractive and realistic way of communicating mathematical material over the World Wide Web. Early adopters will encourage the many developers waiting in the wings to provide ancillary services; the rest of us can watch closely and bide our time with optimism.

I will be happy to discuss any of the issues raised in this short survey. It was a very full meeting and I have only touched on the surface. Send me an email at [toh@maths.warwick.ac.uk](mailto:toh@maths.warwick.ac.uk) or ring me on 024 7652 3454.

#### Credits

As well as thanking the LTSN Maths, Stats & OR Network and the University of Warwick for making it possible to attend, I would like to acknowledge Wolfram Research, who hosted the conference in style, and also the other sponsors: Waterloo Maple, Design Science, the American Mathematical Society, Hewlett-Packard, IBM, the Ontario Research Center for Computer Algebra, and W3C.

#### Further Information on the Web

- (a) The Conference: <http://www.mathmlconference.org/2002/index.html>
  - (b) David Carlisle's Universal Mathematics Stylesheet  
Follow the instructions at <http://www.w3.org/Math/XSL/>
  - (c) The World Wide Web Consortium Mathematics Page: <http://www.w3.org/Math/>
  - (d) Robert Miner's Math-on-the-Web Status Reports (he promised a post-conference update soon):  
<http://www.dessci.com/webmath/status/>
- These and other links can be found at <http://ltsn.mathstore.ac.uk/mathml>