Dual Presentation with Math Using GELLMU

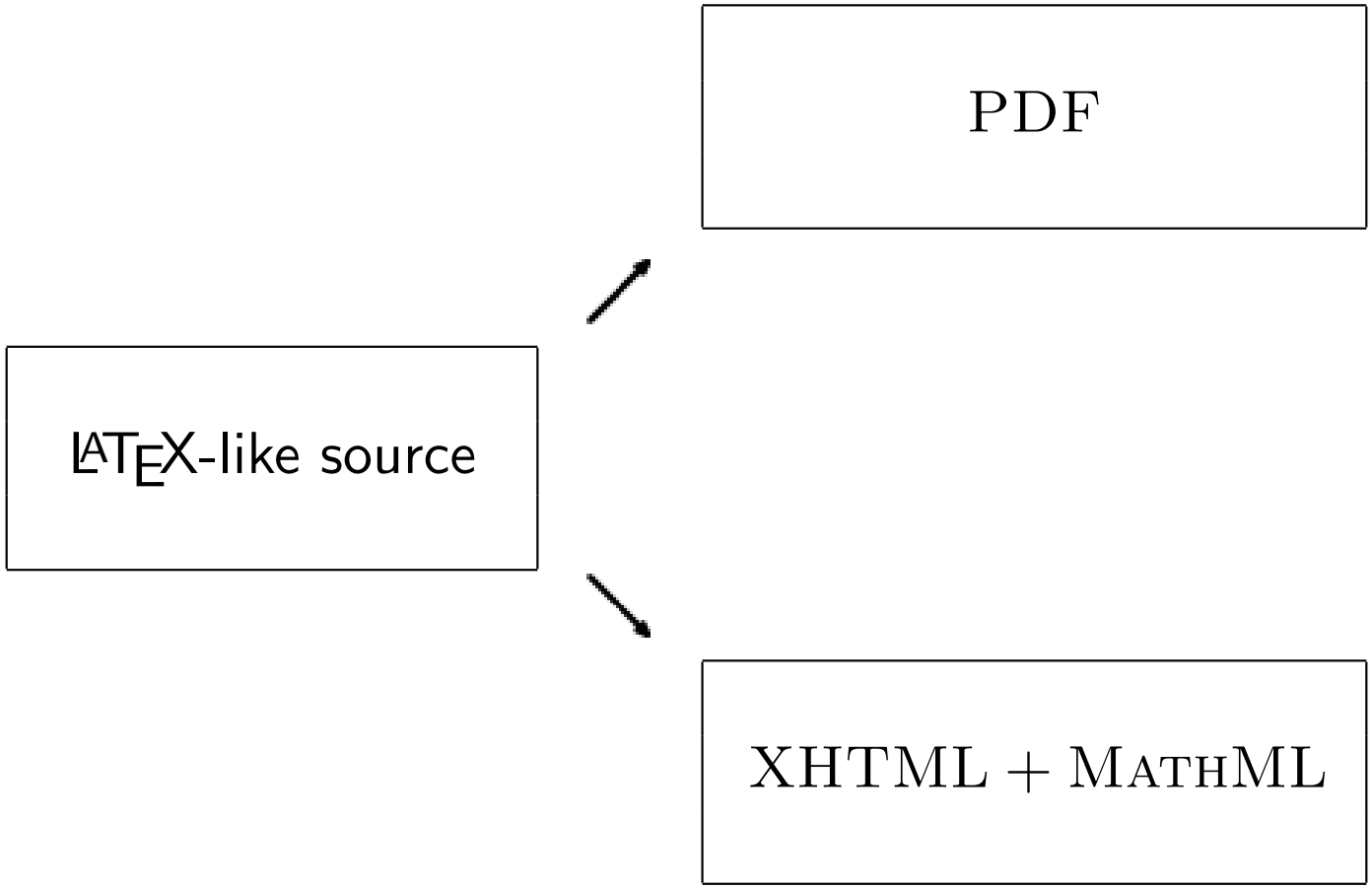
TEX Users Group (TUG) in San Diego

William F. Hammond

Dept. of Mathematics & Statistics
University at Albany
Albany, New York 12222 (USA)
http://www.albany.edu/~hammond/

July, 2007

1 The Idea



2 Example

The following identity may be regarded as a formulation of the Weierstrass product for the Gamma function.

$$\int_0^\infty t^x e^{-t} \frac{dt}{t} = \frac{1}{x} \prod_{k=1}^{\infty} \frac{\left(1+\frac{1}{k}\right)^x}{\left(1+\frac{x}{k}\right)}$$

Understanding the derivation of this identity is reasonable for a bright student of first year undergraduate calculus in the United States.

These are XHTML + MathML slides!

3 Computation of a Continued Fraction

$$
\begin{aligned}
\sqrt{10} &= 3 + \frac{1}{\frac{1}{\sqrt{10}-3}} \\
&= 3 + \frac{1}{\sqrt{10}+3} \\
&= 3 + \frac{1}{6 + \frac{1}{\frac{1}{\sqrt{10}-3}}} \\
&= 3 + \frac{1}{6 + \frac{1}{\sqrt{10}+3}} \\
&= 3 + \frac{1}{6 + \frac{1}{6 + \frac{1}{\cdots}}}
\end{aligned}
$$

4 Finding the tangent at a point

Curve: $y^2 = x^3 - 7x + 10$
Point: $B = (1, -2)$

Use implicit differentiation to find the slope:

$$2yy' = 3x^2 - 7$$

Evaluate when $(x, y) = (1, -2)$: $y' = 1$ The tangent line at $(1, -2)$ is parallel to any vector with slope 1, e.g., $V = (1, 1)$.

Parametric equation:

$$p(t) = B + tV = (1, -2) + t(1, 1) = (1 + t, -2 + t)$$

5 Mozilla MathML Torture Test 13

$$\sqrt{1+\sqrt{1+\sqrt{1+\sqrt{1+\sqrt{1+\sqrt{1+\sqrt{1+x}}}}}}}$$

6 Mozilla MathML Torture Test 24

$$\det \begin{vmatrix} c_0 & c_1 & c_2 & \cdots & c_n \\ c_1 & c_2 & c_3 & \cdots & c_{n+1} \\ c_2 & c_3 & c_4 & \cdots & c_{n+2} \\ \vdots & \vdots & \vdots & & \vdots \\ c_n & c_{n+1} & c_{n+2} & \cdots & c_{2n} \end{vmatrix} > 0$$

7 Madore's Challenge

In a letter to Godfrey Harold Hardy, Sr̄īn̄ivāsa Rāmān̄ujan̄ Aiyaṅkār asserts that

$$\frac{1}{1+\cfrac{e^{-2\pi\sqrt{5}}}{1+\cfrac{e^{-4\pi\sqrt{5}}}{1+\cfrac{e^{-6\pi\sqrt{5}}}{\cdots}}}} = \left(\frac{\sqrt{5}}{1+\sqrt[5]{5^{3/4}\left(\frac{\sqrt{5}-1}{2}\right)^{5/2}-1}}-\frac{\sqrt{5}+1}{2}\right)e^{2\pi/\sqrt{5}}$$

8 Zeta function calculation

With the condition $Z_X(0) = 1$ the function $Z_X(t)$ is determined by its logarithmic derivative:

$$\begin{aligned}
\frac{d}{dt}\log Z_X(t) &= \sum_{x \text{ closed}} d(x)\frac{t^{d(x)-1}}{1-t^{d(x)}} \\
&= \frac{1}{t}\sum_{r\geq 1}\sum_{\{x \text{ closed} \mid d(x)=r\}} r\frac{t^r}{1-t^r} \\
&= \frac{1}{t}\sum_{r\geq 1} rc_r\frac{t^r}{1-t^r} \quad = \quad \frac{1}{t}\sum_{r\geq 1} rc_r\sum_{m\geq 1} t^{rm} \\
&= \sum_{\nu\geq 1} N_\nu t^{\nu-1}
\end{aligned}$$

9 Dual Presentation

- One source
- Print and HTML outputs
- Print and XHTML + MathML if math is involved

10 How to write for dual presentation (I)

Standard Answers

1. Write LaTeX, then translate to HTML
2. Write SGML or XML, then
   - 2.1 Translate to LaTeX
   - 2.2 Translate to XHTML + MathML

11 How to write for dual presentation (II)

Translating

Translating from LaTeX involves

- Carefully written LaTeX source
- Customized tuning
- Hidden learning curve

Tough

12 How to write for dual presentation (III)

The GELLMU Approach

- Must first learn how
- Write with LaTeX-like syntax
- Use the vocabulary of an SGML document type

Easier!

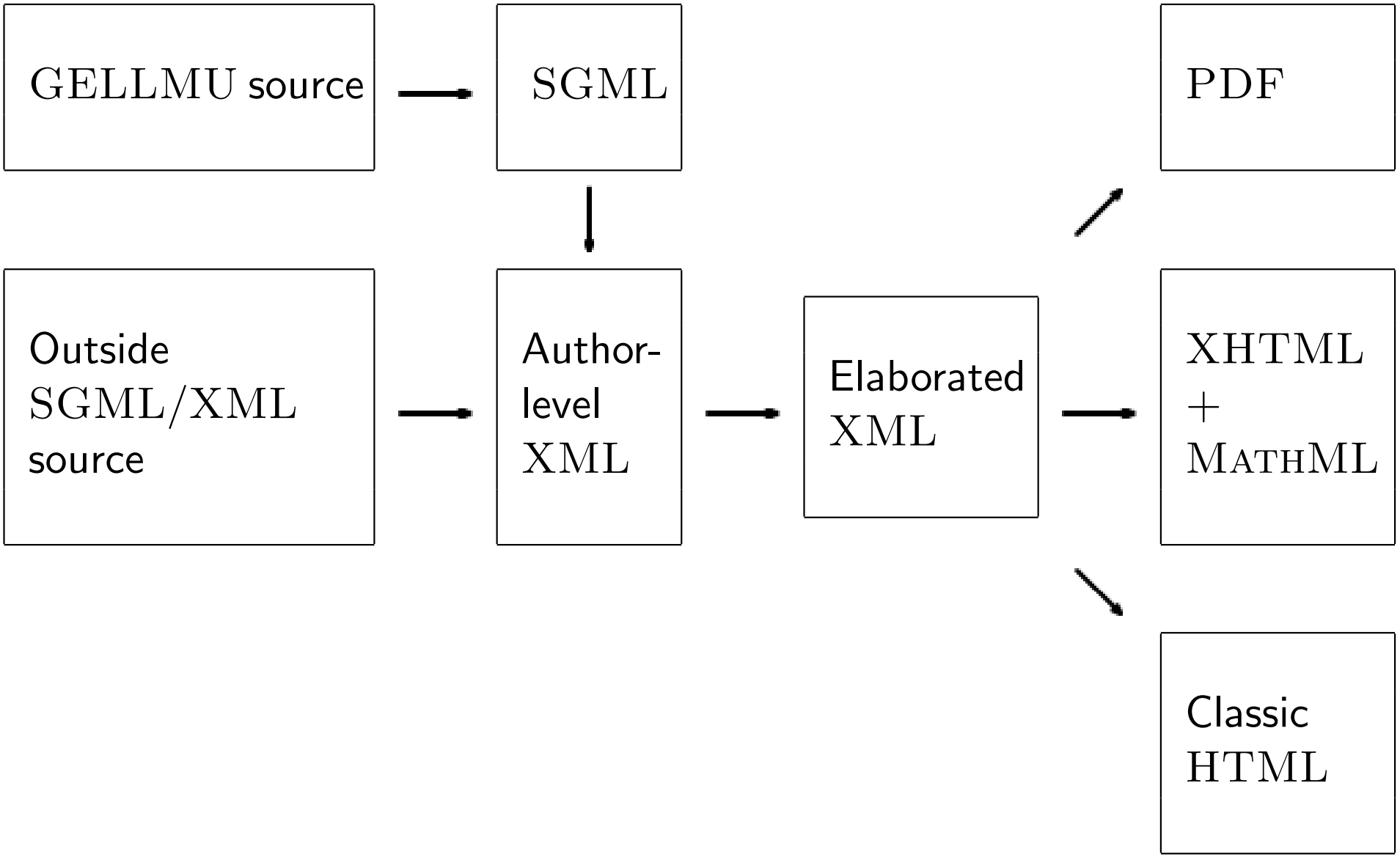
13 Conceptual Differences

- No pages
- No vertical lengths
- Relative horizontal lengths
- Content, yes.
- Style, no.
- Fonts, no.

14 Markup Differences in GELLMU

- No declaration style markup (like `{\centering ...}`)
- Braced zones provide logical grouping but not scope.
- `\begin{display} ... \end{display}` is the same as `\display{ ... }`
- No space allowed between a command and its arguments or between its successive arguments.
- The 33 non-alphanumeric but printable ASCII characters may all be referenced by names, e.g., `\tld;` for "~" is useful in URLs.
- Counters ride with labels.

15 Flow Chart



16 Style

Style choices are made in formatters
(arrows at the right end of the chart)

17 Style vs. Content

Style	Content
`\begin{center} ... \end{center}`	`\display{ ... }`
`\it` or `\textit`	`\emph`
`\bf` or `\textbf`	`\bold`
`\textsc`	`\abbr`
`\tt` or `\texttt`	`\quostr` or `\path`

18 Commands Correspond to XML Elements

LaTeX	GELLMU source	GELLMU XML
\\	\\	<brk/> or <fcell>...</fcell>
&	&	<acell>...</acell>
\'e	\acute{e}	<acute>e</acute>
é	é or é	é
\frac23	\frac{2}{3}	<frac><nm>2</nm><dn>3</dn></frac>
\left\{...\right\}	\balbr{ ... }	<balbr> ... </balbr>
\sum_j ...	\sum_j ... \sum:	<sum>_j...</sum>

19 Write a Document

Source for a document:

```
\documenttype{article}
\title{A Simple Sum}
\begin{document}

This is a simple summation formula:
\[ \sum_{k=1}^n k \sum: = \frac{n(n+1)}{2} \
\eos \]
It may be proved easily using mathematical
induction.

Mathematical induction is part of deductive,
not
inductive, logic.

\end{document}
```

20 Build a Document

1. Save it as "`smalldoc.glm`".
2. At a command line enter

   `mmkg smalldoc .`

3. Read the scroll.
4. Inspect the yield:

   XHTML PDF XML LaTeX HTML

21 Example Documents

- The *User Guide* (PDF) (Source)
- The *Manual* (PDF) (Source)
- A calculus handout (PDF) (Source)
- A port to GELLMU of Lamport's `"sample2e.tex"` (PDF) (Source)
- Port of an article from *The New Journal of Mathematics*

22 Acknowedgement

The XHTML + MathML version of these slides uses W3C's *Slidy* by Dave Raggett, a JavaScript/CSS package for sizing and flow control of an HTML or XHTML slide show.

(The slides were generated in a non-standard fashion from GELLMU source.)