

OpenMath 26 at CICM 2014

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1 Lars Hellström:

OM allows variadic operators, but how to state FMPs etc.? Claims can be solved by symbols in a CD.

Inspiration: TCL, as a scripting language. This is primarily a dispatch engine. The command procedure receives arguments, argv-like.

Core syntax can read variables, and use results of commands. Writing variables is via `set` command, also control flow. TCL is very variadic, so should be sufficient for OpenMath.

An entity can be an item or a (possibly empty) sequence of items. TCL uses `{*}`, `"splode"`, and a word beginning with `splode` contributes a sequence, else an item. `Splode` was new in 2003, revised in 2006. One argument against its introduction was that it could be done via `eval`.

`list4#eval` sort of does the same as TCL's `eval`. But this would need an infinite sequence of axioms. This solved items 1-3 of [HKR11]. Doesn't cover variadic variable binding (TCL not a problem as variable bindings are semantic, not syntactic).

JWK: I want a way to treat a sequence as a single item - possibly a further symbol.

CR: maybe we should define these as operators on lists.

2 Michael Kohlhase: OpenMath Language Extensions

Note that OM2 is 10 years old, and is now firmly embedded in MathML3. There is a lot of experience with OM2 and lots of extension proposals. Note that OM's CD mechanism is akin to adding functionality to a programming language by libraries. **But** programming languages (JHD would say only "some") allow extensions of syntax as well.

Therefore we present a language extension proposal, using [HKR11] as a running example. The semantics of LEDs (Language Extension Dictionaries) is given by translation into OM2. More formally, OM3 should be OM2 + bug fixes + LEDs.

An LED should

- Extend the syntax (RelaxNG)
- Specify the semantics (via translation)
- Equality . . . , need to know what equality of these extended objects means.

Example: OMNTH and OMNATS.

SMW What do you gain by going this way.

A OM is not meant to be minimal, but useful.

Future How does an OMOBJ specify what LEDs it is using —not currently addressed. Binary encoding?

3 Michael Kohlhase: Records in Pragmatic OM

"My pet language extension proposal". Note that OpenMath has gone for functionality rather than minimality (n -ary, integrals as binders etc.).

"A ring is a triple $\langle R, +, \cdot \rangle$ with . . .", a triple *with named components*, e.g. "a ring is commutative is the multiplication operator is".

LH Do you know of a textbook which goes into this (handling of tuples) formally?

A not as such.

Observations: record structures are syntactically similar to attributes, and his example (ab)uses `OMATP`, outside `OMATTR`, to give the names to the record elements. Note `OMATP` takes $2k$ arguments, with k implied equality symbols. However, this doesn't allow selectors, and we should also have equalities: these β/η equalities can be done via the mechanism of the previous talk.

4 Lars Hellström: Literate Programming

OM2013: suggested that CDs could benefit from Literate Programming approach. Have a system where generating the literate document produces the `.ocd` as a side-effect.

CMPs, FMPs and Examples all work. Not all omel currently supported.

Should do STS in a similar way.

Can the community please pick a standard for notation specification! It should cover priority vs binding strength!

Improve rendering of omels. Currently good if you are trying to debug the XML, but not very readable.

Works via `\begin{OpenMathCD}{list4}` Etc. currently uses straight quotes and text ..., but a referee objected, and we could use fancy \TeX commands, getting Unicode hex-escapes in the CML.

Users: me (addicted to LP), authors who are prepared to document, but who aren't necessarily familiar with XML technology. Also my students, for whom it reduces the learning curve.

JWK: did you consider Popcorn?

A: Popcorn parser in LaTeX is non-trivial

5 Rabe: MMT

This [MMT] may be the biggest OpenMath-based project. So what have I learned? This isn't a formal proposal

More that there's only four elements in the MMT grammar, with "complex object" unifying four of OpenMath's. Also, only a single "literal constructor".

MMT has no attributions, since contexts declare variables. Ignorable attributions should be extra-linguistic metadata.

MMT's complex object $c(\gamma; \Gamma; \bar{E})$. The semantics are purely those of c , the MMT constructor itself is purely structural.

6 Davenport

See slides at <http://staff.bath.ac.uk/Slides>

7 Formal OpenMath Business Meeting

7.1 Chair

MK was proposed by JHD seconded by JWK.

7.2 Secretary

JHD was proposed by MK and seconded by JWK

Minute checkers: JWK and CAR were proposed and seconded.

7.3 Annual Report

No income and expenditure. MS normally paid the domain registration fees, and he was thanked for doing this.

7.4 New Members

Moritz Schubolz was nominated as a new member, having worked on OpenMath for over three months.

7.5 Executive Committee

Christina Müller (Treasurer) was no longer active. MK nominated LH as Treasurer, who was willing, and JHD seconded. The Committee, as thus modified, was re-elected unanimously.

7.6 AOB

None.

8 Technical OpenMath Business Meeting

MK presented a report of the Standards Extension Committee. It was noted that synchronisation of OpenMath 2 with MathML 3 was an excellent idea, not to be sacrificed.

This report led to a useful debate.

Q Is there a concept of language binding, e.g. for GAP.

A Yes - phrasebook is the technical term. There is a GAP one, out of the Science project.

Q Is there any “why use MathML” documentation — how to persuade people not to use SVG?

A This isn’t exclusively OpenMath’s problem, but we should be part of the solution. There should be information on the MathML pages.

Q What are CDs for?

A That is for the author — largely mathematical objects.

Q I was thinking of (specification for) function plots — general approval.

Q In a field, e.g. special functions, these should be written by the real experts in the field

A Agreed: that’s the OpenMath philosophy. There’s a description in the OM standard, and “On Writing OpenMath Content Dictionaries” [Dav00] and on www.openmath.org/documents/.

Q What about RDF?

A See Christoph Lange’s work [Lan11, LID⁺12, and his thesis].

Q–JWK There are questions of what tool — MK was proposing XSLT, but what about XSLT2.

A Good question. But specifying from scratch would be a PhD project in itself.

8.1 Extended OpenMath

MK described the following. OM2 described a certain kind of labelled trees as OM2OBJ, and the standard specifies certain rules (e.g. α -conversion). The CDs specifies more rules, so that it is **legal** (not compulsory) to apply associativity to ‘+’, translate $\sin 0$ to 0, etc. If we extend OpenMath by some extension mechanism, then we get new objects (OM3OBJ). What then is their relationship and equality.

Proposal 1 *That there should be an OpenMath Extension Proposal, possibly based on a revised version of [Koh14]. JWK would write up his alternative. This would be continued by e-mail.*

Proposal 2 *That OpenMath should adopt MathML-3 (Content) as an alternative encoding, and mandated DPC¹ to propose the relevant extensions to the standard to document this.*

Proposal 3 *LH (and JHD) had called for a standard “notation” mechanism. MK to document and circulate the Bremen notation mechanism, which can generate Presentation Math-ML. JWK was very interested in this project.*

¹Post-Meeting Note. JWK was looking at upgrading the Java OM-LIP (RIACA) library to support this: he and DPC should liaise.

References

- [Dav00] J.H. Davenport. On Writing OpenMath Content Dictionaries. *ACM SIGSAM Bulletin* 2, 34:12–15, 2000.
- [HKR11] F. Horozal, M. Kohlhase, and F. Rabe. Extending OpenMath with Sequences. *Intelligent Computer Mathematics Work-in-Progress Proceedings (Ed. by A. Asperti et al.) Vol. UBLCS-2011-04. Technical Reports of University of Bologna. University of Bologna*, pages 58–72, 2011.
- [Koh14] Michael Kohlhase. Openmath language extensions. In Matthew England, James H. Davenport, Andrea Kohlhase, Michael Kohlhase, Paul Libbrecht, Walther Neuper, Pedro Quaresma, Alan Sexton, Petr Sojka, Josef Urban, and Stephen Watt, editors, *Joint Proceedings of the MathUI, OpenMath and ThEdu Workshops and Work in Progress track at CICM (CICM-WS-WiP)*, number 1186 in CEUR Workshop Proceedings, Aachen, 2014.
- [Lan11] C. Lange. Krextor — An Extensible Framework for Contributing Content Math to the Web of Data. In J.H.Davenport *et al.*, editor, *Proceedings CICM 2011*, pages 304–306, 2011.
- [LID⁺12] C. Lange, P. Ion, A. Dimou, C. Bratsas, L. Corneli, W. Sperber, M. Kohlhase, and I. Antoniou. Reimplementing the Mathematical Subject Classification (MSC) as a Linked Open Dataset. In J. Jeuring *et al.*, editor, *Proceedings CICM 2012*, pages 455–459, 2012.