Chapter 5

OpenMath — July 11

5.1 Mathematical Computations for Linked Data Applications — Wenzel

From the Frauenhofer Institute for Production Engineering. Data from many sources needs integration and their calculations. Use RDF. for data integration, and OpenMath. One use case is calculation of performance indicators.

- Query RDF data from OpenMath: done via a CD. The RDF model is based on triples. `http://www.openmath.org/cd/contrib/cd/rdf.xhtml` uses a subset of Manchester syntax. Has a native OpenMath encoding for literals.

- Embed formulae in RDF: an OpenMath ontology `http://numerateweb.org/vocab/math`. This is a verbatim mapping of the OpenMath XML. This can be queried with SPARQL. In practice use a Popcorn representation. The OpenMath RDF can then be used in a DL reasoner.

- Mathematical rules and reasoning. We have `Cnstraint` which related rdf:property to OM:Object.

  ```
  @e:bmi = @e:mass/@e:height^2
  ```

  Then can apply this as a λ-expression over a group of people.

  Our reasoning architecture has a common triple store, OWLIM Lite, for rules and data. Computer Algebra System 'Symja' is extended with RDF interface,

Need to scale the inference for large data sets and many formulae. Need a Popcorn-based Web REPL. Issues are the complexity of reasoning, especially in the resolution of cyclic dependencies. This might also leverage OWL2 meta-modelling.

5.2 The Gf Mathematical Grammar Library — Saludes

Came out of multilingual WebALT project, but in 2003 Gf was not mature enough. Gf is a functional language capable of representing natural grammars as well as formal ones. The Mathematical Grammar Library has 15 languages so far `svn://molto-project.eu/mhl`. over the ground layer, we have OpenMath. The CDs are viewed as abstract models, such as `arith1` Then `arith1l` will be the concrete version, and `arith1eng` the English-specific part. Above this layer, we have 'operations', such as simple exercises, commands (Computer, Assign, Assert, Approximate, BeginBlock, EndBlock) and word problems ("apples and oranges").

Gf has levels 'abstract' and 'concrete'. ValNum, ValSet etc are MathObj, which is a Noun Phrase. ValFun is a Noun Phrase with extra information. Prop is a clause with polarity, but FullProp is a sentence. In Gf we can only make questions from clauses, not sentences.

In English, we combine the adjective "absolute" with the noun "value" to get a common nun (CN). This and "of" also gives a CN. "the" then gets a noun phrase NP. Similar in German, but need to specify noun plural as well, and gender, for 'value' = 'Wert'.

The real problems, at least in English, is with functions: "f at 3" versus "sin of 3" versus "the derivative of sin at 3".

"compute the integral of the function mapping x to the square of x from minus infinity to infinity". Need various transfer rules: 'square' needs expanding, "minus infinity" needs to be the right symbol, interval needs specifying etc. This is not easy in Gf..

Working in 3 languages. A new language needs: Resource Grammar support (should already be in Gf); needs to fill the lexicon, and a review cycle. A new module (= CD) needs an abstract module $M, entries in the lexicon for M, concrete modules for M$, with input form language and maths exerts, and a review cycle.

5.3 OpenMath Business

JHD's note: as at 15 July 2012, these are unchecked minutes.

5.3.1 Introduction

MK opened the meeting. He reminded us of the formal agenda.

1. Election of the Chair of the Meeting — MK elected.

2. Election of the Meeting Secretary and Minute Checkers. JHD was elected as Meeting Secretary. JWK and CL were elected as checkers.

3. Annual Report. Last open meeting 2010 in Paris (none in 2011, partly because of delay in starting). Formal Meeting in Bremen in 2011 to pre-

serve legalities. There had been no financial transactions. The following non-financial contributions were noted.

- The webserver has been donated by DFKI.
- MS pays for the domain.
- TUE runs the mailing lists.

There is, following Paris, an OpenMath Infrastructure Team and mailing list (`infrastructure@openmath.org`).

4. It was noted that the list on the web page needs updating. Of today's speakers, Saludes should be a member: **elected**. It was observed that Robert Miner had unfortunately passed away.

5. The Balance sheet was adopted, and the Committee discharged.

6. Committee. It was noted Dewar and Gaëtano had not been at the meeting for the next few years. Dewar had contributed electronically, and NAG collectively were major contributors to OpenMath. The same could not be said of Gaëtano, as INRIA were no longer contributing.

   Though we have no assets, we **do** need a Treasurer (Currently Christine Müller). Kohlhase, Dewar, Caprotti, Müller, and Seppälä were re-elected. JHD proposed, PDFI seconded the election of CL as Member-At-Large. This was carried.

7. OpenMath 3. There has been no progress, basically due to MathML 3 overload. It was not proposed to resume this work, but rather to proceed less ambitiously via "Technical Notes" etc.: JHD noted that we might make more progress by being less ambitions, and this was generally agreed. It was noted that MathML 3 is currently in "maintenance mode". The W3C working group Charter runs out in March 2013. There are no plans for MathML 4.

   CL pointed out that we need a route for doing these "Technical Notes". JHD agreed: noting that the list was non-empty ('endianness bug', MathML 3 as an encoding, "DefMP" sprang to mind).

8. CD Management. MK reminded the meeting that the process of making a CD into "official" status was via the CD Editor, JHD, and suggestions should be mailed to him. He would organise reviewers, and circulate a proposal to the mailing list.

9. PL noted that his name is on the bottom of all pages, and wishes that it were `infrastructure@openmath.org`. This was agreed. Note also the site `http://www.openmath.org/infrastructure/`. He also noted that DFKI would not necessarily continue hosting, and wanted a proposed replacement. Bremen was willing to take this over, and give PL an account. JWK would check whether TUE could take over the website.