The International Math Union's Electronic Initiatives (Extended Abstract)

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September 3, 2001

1 INTRODUCTION

Great changes are underway in the way we compute and communicate. This extended and annotated abstract discusses a few of the changes that impinge especially on the mathematical sciences, concentrating on the initiatives of the IMU. Other threads are explored in Terry Stanway's contribution "From G.H.H. and Maple to Littlewood and XML: Changing Needs and Expectations in Mathematical Knowledge Management." This is a complicated world, for example, the CMS 'adheres' to the IMU within the *International Council of Scientific Unions* (ICSU, `www.icsu.org`), via the Canadian *National Research Council* (NRC) !

As evidence of the changes, I refer to two recent issues of *Computers in Science and Engineering*, a journal that is jointly published by the ACM and the IEEE. The first, in February 2000, was on the *Top Ten Algorithms*

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having "the greatest influence on the development and practice of science and engineering in the 20th century", see also the Science News coverage at `www.sciencenews.org/20000212/mathtrek.asp` entitled 'Algorithms for the Ages'.

A follow up issue in May 2001 was on *Tomorrow's Hardest Problems*, (`http://computer.org/cise/cs2001/c3toc.htm`). It includes my article with P. Borwein, discussing "Challenges in Mathematical Computing" for which a *true* preprint – the editor of the article edited – is available at `www.cecm.sfu.ca/preprints/2001pp.html#01:160`. Therein, we make the claim that

> "Almost all interesting mathematical algorithmic questions relate to NP-hard questions and such computation is prone to explode exponentially. More space, more speed and processors, and even say massive parallelism will have an impact but it will be largely at a 'micro not macro' level. We anticipate the greatest benefit accruing from mathematical platforms that allow for highly computer assisted insight generation (more 'aha's' per cycle), not from solution of grand challenge problems."

While I shall talk primarily from the perspective of a researcher, it is important to remember how many 'players' there are and how small a part of the scheme mathematical science publishing and computing really is. Though we, like Tom Lehrer, know math is everywhere, in reality even the bioscience disciplines are likely to tread over us. For example, Nobel Laureate Richard J. recently wrote in "PubMed Central: The GenBank of the published literature," Proc. Natl. Acad. Sci. USA, Vol. 98, Issue 2, 381–382, January 16, 2001 (`/www.pnas.org/cgi/content/full/041601398v1`)

> "What is a reasonable delay? I would argue that 6 months seems a reasonable time for a journal to monopolize the content. Most of us would not dream of scanning the contents of a journal published 6 months ago unless we were searching for a specific article. Thus it seems unlikely that a large number of subscriptions would be lost if 6-month-old issues were made freely available. I think rather few worthwhile journals would be adversely affected if they were to institute such a policy."

Such an outcome would destroy most current mathematics society publishing. Despite that such issues are not high on mathematicians' agendas. For example, only a handful out of over ten thousand mathematicians have chosen to grant the AMS permission to publish rather than transfer copyright, since they were offered the choice more than five years ago. Nor do they often distinguish public from commercial initiatives such as `www.mathpreprints.com` (which carefully hides its Elsvier roots).

2 PART I: THE WORK of THE CEIC

To set the stage:

> "The work then proceeds in a manner unique to science. Because practitioners publish their work electronically, through the e-print archives at the Los Alamos National Laboratory in New Mexico, the entire community can read a paper hours after its authors finish typing the last footnote. As a result, no one theorist or even a collaboration does definitive work. Instead, the field progresses like a jazz performance: A few theorists develop a theme, which others quickly take up and elaborate. By the time it's fully developed, a few dozen physicists, working anywhere from Princeton to Bombay to the beaches of Santa Barbara, may have played important parts."
>
> Gary Taubes, "String Theorists Find a Rosetta Stone," *Science* July 23 (1999), 513.

The *International Mathematical Union*'s (`www.mathunion.org/`) *Committee on Electronic Information and Communication*, or CEIC, (`www.ceic.math.ca/`) was established in 1998 and given a very broad mandate (see Appendix A) to advise the IMU on electronic matters.

The Committee met face-to-face in Berlin (November 13-14, 1998), at Berkeley (December 1-5, 1999), in Vienna (October 5-7, 2000), and in Princeton (May 12-14, 2001) at which time it reported directly to the Executive of the IMU. It will meet twice in 2002 – in Vancouver (February 15-17, 2002) and at the next ICM in Beijing (August 22-27, 2002), where various activities are planned.

Each meeting has comprised a working meeting along with a workshop or public presentations. The most ambitious workshop, which had over a hundred participants, was that in Berkeley on The Future of Mathematical Communication, 1999:
`www.msri.org/calendar/workshops/9900/Future_of_Math_Communications/`.
The presentations can be viewed on line in streaming video through the URL above.

As a member of the CEIC since its inception, and more recently deputy chair, I am fairly well placed to describe its present activities and future plans. Mathematics is perhaps the most international and transportable of the sciences, and hence has a great deal to gain from global mathematical knowledge management initiatives such as this Linz meeting.

In particular, I draw attention to

a. our statement on copyright (see Appendix B) and related copyright activities;

b. our plans for developing personal collected works (see Appendix C); and

c. our aim of propagating secondary homepages such as CECM's at: `www.cecm.sfu.ca/althome.html` and my own personal home page (`www.cecm.sfu.ca/Math-Net/persons_meta/jborwein.html`) (See also the *Installation Interface*: `http://elib.zib.de/cgi-bin/mpm.cgi`.

I also note the growing attempts to collect mathematical data in "global data-bases" such as *arXiv*: `http://front.math.ucdavis.edu/`. The arXiv has grown out of the Los Alamos preprint server which is now moving to Cornell (`www.nature.com/nature/debates/e-access/Articles/ginsparg.html`) and so should mesh better with the *Digital Library Initiative*, Euclid and like projects.

I especially mention CEIC's own involvement with:

a. *MPRESS*: `http://MathNet.preprints.org/` through international extension of the German

b. *Math-Net*: `www.math-net.de`.

c. *Persona Mathematica*:
`www.mi.uni-koeln.de/Math-Net/persona_mathematica/`.

d. Other services still to be set up, in accord with the *MathNet Charter*: www.math-net.org/Math-Net_Charter.html.

These are described in detail in Swanzl and Sperber's contribution to this meeting: "MathNet: Semantics, Visualization and Internalization."

I conclude by discussing our hopes to further develop tools for coordinating these efforts — and the issues and obstacles involved. For example, in our mandate we were asked 'to consider transferring the World Directory of Mathematicians to an electronic freely accessible form.' For logistic and especially intellectual property (IP) reasons, we have recommended *not* now doing so.

Whatever the obstacles, the upside can be amazing:

> "Three years ago, said Dr. Zanelli in Chile, one of his own students posted a paper and the next day received an e-mail message from Dr. Witten. The student was at first so shocked that he accused Dr. Zanelli of playing an elaborate practical joke. We learned that great physicists do read the archives daily and they browse through all the preprints,' Dr. Zanelli said, 'even if they come from an obscure place in the end of the world.'
>
> Dr. Witten's instant response, Dr. Zanelli said, 'was like having the pope drop by for tea.' "
>
> James Glanz, "Web Archive Opens a New Realm of Research," *New York Times*, April 30, 2001.

3 APPENDIX A: CEIC Terms of Reference

Building on the enabling resolution passed by the General Assembly in Dresden on August 16, 1998, the Executive Committee of the International Mathematical Union establishes a

Committee on Electronic Information and Communication (CEIC)
of the International Mathematical Union (IMU)

Terms of Reference.

a) The CEIC shall be a

- standing committee of the Executive Committee (EC) of the IMU,
- to be reviewed every four years by the EC at its meeting preceding that of the GA.
- Members will be appointed for four year terms by procedures identical to those for its Commissions. The Executive Committee will appoint one of its members to serve on the CEIC.

b) The CEIC may

- meet as necessary in each four year period,
- review the development of Electronic Information and Communication as it impacts the international mathematical community and
- review the development of Electronic Information and Communication submit a report to EC.

c) The CEIC may

- organize or sponsor international meetings or forums to bring together representatives of all interested parties, including
  + societies,
  + publishers,
  + libraries, and
  + researchers,
- publish and otherwise disseminate
  + proceedings,
  + reviews of recent developments, and
  + technical surveys for the use of the mathematical community.

d) The CEIC may

- recommend international standards on issues related to electronic communication. Such recommendations should be reviewed by the EC and, if approved, may be published and promoted in the name of the IMU.

e) During its first 4 year term, the CEIC is specifically asked to address

  - the coordination of world-wide efforts to establish web-based servers for
    + mathematical papers,
    + preprints,
    + journals and
    + books.
  - This includes issues of uniformizing
    + metadata,
    + document identifiers and
    + supported formats,
      promoting
    + mirroring and
    + the development of search engines for mathematical material and
    + coordination of existing servers.
  - It should publish its findings with the goal of making
    + the use of these servers universally understood and
    + usable by the whole mathematical community.
  - It is also asked to consider transferring the World Directory of Mathematicians to an electronic freely accessible form.

f) Membership (in 2000):

  1. Peter Michor (chair) University of Vienna, Vienna, Austria; `Peter.Michor@esi.ac.at`
  2. Jonathan Borwein, Simon Fraser University, Burnaby, Canada; `jborwein@cecm.sfu.ca`

3. John Ewing, American Mathematical Society, Providence, USA; `jhe@ams.org`
4. Jonas Gomes, IMPA, Rio de Janeiro, Brazil; `jonas@impa.br`
5. Martin Groetschel (IMU EC member), Konrad-Zuse-Zentrum, Berlin, Germany; `groetschel@zib.de`
6. Wilfrid Hodges, Queen Mary & Westfield College, London, UK; `w.hodges@qmw.ac.uk`
7. David Morrison, Duke University, Durham, USA; `drm@math.duke.edu`
8. Kapil Paranjape, Member, Institute of Mathematical Sciences, Chennai, India, `kapil@imsc.ernet.in`
9. Zhou Qing, East China Normal University, Shanghai, China; `qzhou@math.ecnu.edu.cn`
10. Alf van der Poorten, Macquarie University, Sydney, Australia; `alf@mpce.mq.edu.au`
11. Alexei Zhizhcenko, Russian Academy of Sciences, Moscow, Russia; `abz@ipsun.ras.ru`

4 APPENDIX B: A Copyright Checklist

What do you want from your publisher?

Executive summary for authors of research papers in journals Endorsed by the Executive Committee of the IMU in its 68th's session in Princeton, NJ, May 14-15, 2001

The number of mathematical papers that are stored or circulated as electronic files is increasing steadily. It is important that copyright agreements should keep in step with this development, and not inhibit mathematical authors or their publishers from making best use of the electronic medium together with more traditional media. While most mathematicians have no desire to learn the subtleties of copyright law, there are some general principles that they should keep in mind when discussing copyright for research papers with their publishers.

1. A copyright agreement with your publisher is a bargain struck between his interests and yours. You are entitled to look out for your interests.

Most journal publishers have a standard copyright form, and may be unwilling to vary it for individual authors. But nothing prevents you from asking, if you see room for improvement. Pressure from authors may lead publishers to change their standard contracts.

2. Three groups of people have an interest in your paper:

   a. Yourself and your employer (who may in some countries be automatically the original copyright holder and hence a party to the copyright agreement);

   b. The journal publisher;

   c. Users of paper who are not parties to the copyright agreement, including readers and libraries.

   One of the main purposes of your copyright agreement is to control how your publisher or you make the paper available to this third group. Publishers will hardly allow individual authors to dictate agreements with libraries. But if you know that a certain journal publisher makes life hard for libraries, you can take this into account when choosing where to submit your paper.

3. There is no ideal copyright agreement for all situations. But in general your agreement should contain the following features:

   a. You allow your publisher to publish the paper, including all required attachments if it is an electronic paper.

   b. You give your publisher rights to authorize other people or institutions to copy your paper under reasonable conditions, and to abstract and archive your paper.

   c. Your publisher allows you to make reprints of the paper electronically available in a form that makes it clear where the paper is published.

   d. You promise your publisher that you have taken all reasonable steps to ensure that your paper contains nothing that is libellous or infringes copyright.

   e. Your publisher will authorize reprinting of your paper in collections and will take all reasonable steps to inform you when he does this.

4. Should you grant full copyright to the publisher? In some jurisdictions it is impossible to transfer full copyright from author to publisher; instead the author gives the publisher an exclusive right to do the things that publishers need to do, and these things need to be spelt out in the agreement. This way of proceeding is possible in all jurisdictions, and it has the merit of being clear and honest about what is allowed or required.

The complete copyright checklist was written by Wilfrid Hodges. It was approved and is recommended by the Committee on Electronic Information and Communication of the International Mathematical Union (IMU). A final version will be posted in the near future
(`http://www.maths.qmw.ac.uk/ wilfrid/copyright.html`).

5 APPENDIX C: Personal Collections

Call to All Mathematicians

Endorsed by the IMU Executive Committee on May 15, 2001 in its 68th's session in Princeton, NJ.

> Open access to the mathematical literature is an important goal. Each of us can contribute to that goal by making available electronically as much of our own work as feasible. Our recent work is likely already in computer readable form and should be made available variously in TEX source, dvi, pdf (Adobe Acrobat), or PostScript form. Publications from the pre-TEX era can be scanned and/or digitally photographed. Retyping in TEX is not as unthinkable as first appears. Our action will have greatly enlarged the reservoir of freely available primary mathematical material, particularly helping scientists working without adequate library access.

This statement was written and recommended by the Committee on Electronic Information and Communication (CEIC) of the International Mathematical Union (IMU).

6 PART II: WestGrid, SFU CoLab and Related Canadian Experiences

I shall finish by briefly touching on some of the following where my interests overlap:

1. I am one of 6 co-PI's in the first large scale Canadian grid computing project: the eight institution WestGrid (`www.cecm.sfu.ca/personal/jborwein/SmartRoom/WestGrid.pdf`). This has as one of its nodes our own local *HPC@SFU* installation (`www.cecm.sfu.ca/hpc`) and accesses a national coordinating group c3.ca (www.c3.ca). The success of this and larger US and European grid initiatives depend heavily on greatly enhanced scientific For example, we aim to build low-end desk-top 'GridStations' and 3 to 6 person 'GridRooms' which will facilitate use of the WestGrid.

   Each of the four main Universities (UBC, SFU, Calgary), Alberta) has at least one group engaged in collaborative or visualization research. Thus, under the aegis of my recently awarded Canada Research Chair, we are presently establishing the Simon Fraser University CoLaboratory (`www.cecm.sfu.ca/personal/jborwein/colab.html`), modeled on the Stanford *iRoom* to explore mathematical collaboration within heterogeneous and ubiquitous computing environments.

2. I presently chair the Advisory Board of the *Canada Institute for Scientific and Technological Information*(NRC-CISTI) — Canada's 'National Science Library'(see`www.nrc.ca/cisti/cisti$e.shtml`). It has a large document deliver service with a highly uncertain future. Its contracts include delivery of papers from the American Mathematical Society's truly invaluable *MathSciNet* (`//e-math.ams.org/mathscinet`).

   CISTI like many organizations has a somewhat over-constrained mandate: (i) to serve Canadians (its Journals are free on line to '.ca' suffixes thanks to the Depository Services Program (DSP)of Public Works and Government Services Canada), (ii) to recover costs, but (iii) not to compete with the private sector.

3. The *Canadian Association of Research Libraries* (CARL) (`www.createchange.org`) has recently made a very good and strong

statement about open publishing. This link also leads to the more general *Public Library of Science* movement spear-headed by ex NIH director Harold Varmus and others.

Despite being committed to the principles above to open publishing the *Canadian Mathematical Society* (CMS) (`www.cms.math.ca`) has opted to develop its new Book Series with Springer-Verlag, a commercial publisher. This is in part because the most viable option is the AMS; we prefer to be more independent and also not to have all our eggs in one basket.

Revised: September 3/2001