A PROPOSAL FOR DEVELOPING MATH FONTS

Note 1: This proposal corresponds to "stage 3" of the TeX Gyre Project,
as described in Hans Hagen, Jerzy B. Ludwichowski, Volker Schaa, "The
New Font Project: TeX Gyre", TUGboat, Volume 27 (2006), No. 2
(http://www.gust.org.pl/projects/e-foundry/tex-gyre/tb87hagen-gyre.pdf
and/or http://tug.org/TUGboat/Articles/tb27-2/tb87hagen-gyre.pdf).
By taking on "stage 3" we are not abandoning "stage 2", i.e., "filling in
the gaps", see the article), but only changing the order of things -- math
features seem to be more important now.

1. INTRODUCTION
The results of the two recent font projects by the GUST e-foundry team
supported by the Local TeX Users Groups, i.e., the Latin Modern Project
(http://www.gust.org.pl/projects/e-foundry/latin-modern) and the TeX
Gyre Project (http://www.gust.org.pl/projects/e-foundry/tex-gyre)
received a very warm acceptance from users.

The main goal of both projects was to extend the existing freely
available fonts (Computer Modern and "35 base PostScript" fonts) with
Latin diacritical characters, to enable typesetting in as many as
possible Latin based scripts. The Latin Modern project was first,
benefiting the TeX Gyre Project, also known as the LM-ization of the "35
base PostScript" fonts. Now all European as well as some non-European
languages, e.g., Vietnamese and Navajo, are covered. At the request of
users, recent extensions of Latin Modern (TeX Gyre has to follow)
provide glyphs sufficient for typesetting of romanized transliterations
of Arabic and Sanskrit scripts.

Currently the Latin Modern fonts are more or less stable, and the first
stage of the TeX Gyre Project was finished in 2007 -- all text fonts
i.e., 8 families with 33 fonts were released in total. However, one
should note that "more or less stable" rather means "less". Maintenance is
in most cases time consuming thus being a drain on the scarcest of all
resources. The recently requested support for Arabic and Sanskrit
transliteration in Latin Modern lead to serious changes resulting in
versions 1.100 (from versions 1.010). For obvious consistency reasons,
such changes must be propagated to the TeX Gyre families -- they are the
LM-ized "35 base PostScript fonts".

2. PROJECT DESCRIPTION

The next important step should be the provision of support for
typesetting of advanced mathematics. The Latin Modern fonts, based on
the Computer Modern family, contain math subfamilies which allow
advanced mathematics typesetting. However, these math subfamilies are
only available as TeX metric files (TFM) + Type 1 couples. On the other
hand, the TeX Gyre fonts do not contain glyphs required for mathematics
and what is more important, there are no features allowing for their
proper provision within the Open Type font format. Textbooks containing
mathematics are being typeset in all languages. Modern and easy
typesetting requires Open Type Unicode fonts in order to allow handy
access to the diacritical characters which might be required for those
languages -- TeX metric files which allow for only 256 glyphs per font
impose restrictions which seem cumbersome to those who know the merits
of using Open Type fonts. One should note here, that Open Type
fonts, initially developed jointly by Adobe and Microsoft, have been
standardized in March 2007 as the ISO Standard ISO/IEC 14496-22 and
called the "Open Type Format".

The current situation is such, that both the Latin Modern and
the TeX Gyre fonts as the result of the efforts of the TeX community are
available in the Open Type Format and thus allow for typesetting texts
in almost all Latin based scripts, but do not allow for typesetting
advanced mathematics within the Open Type Format because of the missing
metric information. Moreover, employing mathematics typesetting
features, though possible with the TeX engines and Latin Modern fonts,

is not possible for TeX Gyre fonts as they do not contain math glyphs
and the respective metric information.

This poses a real challenge for the TeX world, as such an undertaking
must involve research into how to implement TeX math in the Open Type
Format and how to extend the capabilities of the TeX engines.

3. PROJECT STAGING

The project will be divided in the following stages:

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     I - inventory,
    II - math tools development,
   III - AMS compatible math symbols,
    IV - Unicode compatible math symbols,
     V - Unicode compatible math text fonts (mostly mappings),
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where stages I and II should necessarily be interleaved and
their outcome will determine the remaining stages in terms of
scope (results), timing and required resources. This means that we
are not able to detail the remaining stages but can only outline
their desired outcome ("to be done or not to be done").

It also should be taken into account that additional stages might be
needed, depending on the results and possible "feature demands" from
users.

One should note that there are related projects proposed or underway
like the Bezier curves research by Giuseppe Bilotta, or the MPlib
project, i.e., the conversion of MetaPost into a library of reentrant
components. The success of such projects might strongly influence the
way this project will be realized.

4. AN ESTIMATE OF THE AMOUNT WORK: TIME AND COST

(a) Undoubtedly, the most important part is not the selecting and
    preparing of the glyphs for the math collection, but designing the
    way to implement math features already present in the TeX world into
    the Open Type Format or -- in other words -- enhance the Open Type
    Format font tables with enough information for the TeX engines to
    make the fonts usable. This will involve both:

    -- registering TeX-oriented features and tables for Open Type math
       fonts and
    -- developing the tools for creating such prototype fonts.

    To find out what should really be done, inventory stage (I) is
    necessary during which math fonts features already available and
    -- perhaps -- desired will be cataloged, systematized and related to
    the specification of the Open Type Format. Workshop meetings with
    maintainers/developers of the TeX extensions in addition to an
    ongoing online communication are a necessary prerequisite. For an
    introduction please see the paper "Appendix G illuminated" by
    Bogus\l{}aw Jackowski
    (http://www.gust.org.pl/projects/e-foundry/tex-gyre/tb87jackowski.pdf).

    "Appendix G illuminated" is the starting point for stage II, i.e., for
    the preparation of the tools required for the making of math
    extensions. At least the following are required:

        -- MetaType1 documentation and extensions (MetaType1 is a
           set of tools developed for creating PostScript Type 1 fonts,
           first used to develop Antykwa P\'o\l{}tawskiego, later other
           fonts and recently extended for the Latin Modern and TeX
           Gyre projects)
        -- purchase of a workstation for the team

We expect the extensions of MetaPost promised for version 1.1
and MegaPost to be beneficial to MetaType1 (cf. Taco Hoekwater
"Have no fear, MegaPost is here", in Proceedings of EuroTeX 2007,
Bachotek, 2007).

Open-endedness of the project is a must: both stages should be
revisited and checked for needed amendments and new inputs with
an outlook to stages III, IV and V and therefore will be
realized in parallel. The importance of stages I and II should not
be underestimated: quality of their outcome will determine the
quality of the remaining work.

It should be noted that this project is an excursion into a weakly
charted territory. This means that especially the time estimates
given in (c) below are necessarily imprecise. The time estimates
might also be influenced by other factors. As was mentioned in
the introduction, both the LM and TeX Gyre families should be
maintained, and maintenance duties take precedence over development.
A further delay might be caused by the need to improve the Greek and
Cyrillic parts of the TeX Gyre fonts thus further fuzzing our
estimates.

(b) Accountability of the project requires deliverables. For stages
I and II these are:

    -- a specification of math fonts features with special emphasis on
       those needed to be registered with the Open Type Format
    -- documentation of the MetaType1 tool set
    -- releases of the MetaType1 tool set
    -- purchase of a workstation for the project
    -- presentations at conferences
    -- progress reports for parties funding the project
    -- minutes of external workshops/meetings
    -- articles for publication in LUG journals
    -- an up-to-date project web site (at the GUST portal)

    The deliverables listed do not include results by other groups,
    especially those working on TeX extensions except for the minutes
    of joint workshops/meetings.

(c) The time needed to accomplish stages I and II is realistically
    estimate but a realistic approximation is 18 month. The funding
    requested is about 16,000 euro, including the costs of several teams
    cooperating which implies additional travel and meeting expenses.
    A rough breakdown of the estimates:

    -- time total 18 month (stages interleaved):
       * stage I -- total 9 months
       * stage II -- total 9 months
    -- funds:
       * stage I -- 9,000 euro [meetings/workshops 2,000 euro,
         workstation 2,000 euro, team payments 5,000]
       * stage II -- 7,000 euro [mostly team payments]

    Timing and funds required for providing OpenType math support in the
    extended TeX engines is not included and will/should be the subject
    of separate proposals by the relevant developers/maintainers.

(d) Once the math requirements for the Open Type Format are completed
    (or nearly completed), stages III, IV and V, i.e., preparing of
    OpenType math fonts for the TeX Gyre fonts (and perhaps, later, for
    the Latin Modern fonts), i.e., providing of the set of basic and AMS
    math glyphs, can be estimated at a similar level as the cost of
    preparing the enhanced TeX Gyre fonts, i.e., about three months at
    2,500 euro per a 4-font family. Note that not all TeX Gyre families
    require math extensions, e.g., there is no point in equipping the

Chorus font with math, open to doubt is also the addition of the
full-featured math to monospaced or sans serif fonts. However, to
make the financial side of the project complete we assume for the
time being that math support will be provided for all TeX Gyre
families except for Chorus::

    TeX Gyre Adventor   (the replacement for ITC Avant Garde Gothic)
    TeX Gyre Bonum   (-- " -- ITC Bookman)
    TeX Gyre Cursor   (-- " -- Courier)
    TeX Gyre Heros   (-- " -- Helvetica)
    TeX Gyre HerosCondensed (-- " -- Helvetica Condensed)
    TeX Gyre Pagella   (-- " -- Palatino)
    TeX Gyre Termes   (-- " -- Times)
    TeX Gyre Schola   (-- " -- New Century Schoolbook)

    Thus, the total amount funding involved in that part of the
    project is estimated at 8 x 2,500 = 20,000 euro.

(e) As was mentioned in PROJECT STAGING, it is viable that further work,
    beyond the outlined above, might be required. Such additional work
    is not included in the funding requirements.

5. INDEPENDENT QUALITY ASSURANCE

    It is envisaged that following the example of the realization of
    the first stage of the TeX Gyre project a parallel and independent
    quality assurance activity should be conducted. Until now the main
    burden was born by a single person, Karel Piska, with no user group
    funding. As this is a very time consuming work, additional funding
    will be needed, at the very least to provide an appropriate
    workstation and conference travel/attendance support. At this writing,
    we estimate the expenses to be:
    * workstation -- 2,000 euro,
    * travel -- 1,500 euro.

6. TEX ENGINES

    It is expected that as work on the TeX Gyre Math project progresses,
    enhancements and updates to the various TeX engines -- ExTeX, LuaTeX,
    XeTeX -- and other TeX and math related software will follow suit.

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