Extending primitive coverage across engines
Joseph Wright

1 The pdfTeX situation ... 
In recent years, development of pdfTeX has intentionally been limited, with the v1.40 branch now being around for over 10 years. However, in the past there were plans for a v1.50 branch, and some code was written. One primitive that was fully coded-up at that time was \expanded. The idea of this is pretty simple: it carries out full expansion like \message (and almost like \edef), but is itself expandable. This highly useful idea made it into LuaTeX (which was initially based on the pdfTeX development code), but until recently wasn’t in released pdfTeX itself.

2 ... vs. the XeLaTeX situation 
XeLaTeX was primarily written to extend \LamTeX with full Unicode support, as well as loading system fonts. Its development started from \ SMP, rather than from pdfTeX, which had added various new primitives on top of \LamTeX. Many of pdfTeX’s additions to \SMP have to do with directly producing PDF output (\SMP supports only DVI), but others are entirely independent of that.

Over the years, some of these other “utilities” have been added to XeLaTeX (for example \pdfstrcmp, which in XeLaTeX is just \strcmp). However, several have not made it, but have been added to \TEX and up\TEX. That has meant that XeLaTeX has been “a bit behind” in feature terms: some things simply can’t be done without primitive support.

3 A development opportunity arises
Recently, a Travis-CI testing environment has been created for \TeX Live (see github.com/TeX-Live/texlive-source), meaning that it’s now easy to try adding new material to the \WEB sources of pdfTeX, XeLaTeX, etc. As part of more general work on primitives, it made sense to bring XeLaTeX “back in line” with (up)\TEX. That’s important for expl3, as the \TEX team have been using almost all of the primitives that were “missing” in XeLaTeX, as well wanting to bring \expanded into the mainstream.

4 Providing \expanded
For some time, the \TEX team have been thinking about asking for \expanded to be made more widely available. Unlike the \romannumeral “trick”, \expanded does not require any hard work to get “past” any output, so it is very useful for creating macros that work like functions. It’s also fast and clear in intention.

The code itself was easy enough to move around: a bit of copy-pasting! As well as merging into the stable branch of pdf\TEX, I worked out how to add \expanded to XeLaTeX and the Japanese \TEX engines \pTeX and up\TEX. So soon we’ll all be able to do
\begin{verbatim}
def\a{\b} def\b{c}
\message{Hello \a space \#}
\detokenize\expandafter
{\expanded{Hello \a space \#}}
\bye
\end{verbatim}

(Try the example in Lua\TeX if you don’t have the burning edge pdf\TeX binaries.)

5 New primitives in XeLaTeX
So, besides \expanded, what has been added? The new additions are all named without the pdf prefix that pdf\TEX includes, as they have nothing to do with PDFs (and XeLaTeX is not pdf\TEX):
\begin{verbatim}
\creationdate \elapsedtime \filedump
\filesize \resettimer
\normaldeviate \uniformdeviate \randomseed
\end{verbatim}

These enable things like random numbers in the \TEX FPU, measuring code performance, and checking the details of files: all stuff that is in expl3 will now work with XeLaTeX.

I should add that although I did the grind of working out how to integrate the pdf\TEX code into XeLaTeX, Akira Kakuto sorted out the areas that needed knowledge of C, in particular where XeLaTeX’s Unicode internals don’t match up with pdf\TEX’s 8-bit ones.

6 Adjusting \Ucharcat
I made one other minor adjustment to XeLaTeX: altering how \Ucharcat works so it can create category code 13 (“active”) tokens. That probably won’t show up for users; however, it helps the team extend some low-level expl3 code. It should just mean one fewer XeLaTeX restriction.

7 Getting the code
\TeX Live gets binary updates only once per year, so users there will need to wait for the 2019 release. On the other hand, MiK\TeX already has the new features, so if you are on Windows it’s pretty trivial to try. If you use \TeX Live and want to test this out, you can update your binaries in-place, for example from W32\TEX (w32tex.org): if you understand what that means, you probably know how to do it!

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