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TEX@2013

TEX in the 21st Century – where are we and what is up

Martin Schröder

LinuxTag 2013
22nd–25th May 2013, Berlin, Germany

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The foundations
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Motivation

Three types of booth visitors

1. Does not know TEX
2. Has used TEX some years or decades ago to typeset a larger document and is astonished that it still exists – and wants to know what is new
   This talk is for you
3. Currently typesets a larger document with TEX and needs help

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Where we have been

1978 TEX78

1979 METAFONT79

1982 TEX82 (0)

1983 TEX82 (1.0)

1984 METAFONT84 (0)

1986 Computers & Typesetting (TEXbook etc.)

1986 METAFONT84 (1.0)

1986 TEX 2.0

1986 LATEX

1990 TEX 3.0

1990 METAFONT 2.0

1994 METAPOST

1994 LATEX 2ε

1994–2006 teTEX

1996 TEX Live

1996 ConTEXt

1997 pdfTEX

2004 XETEX

2007 LuaTEX

2007 ConTEXt MKiV

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Problems we are working on: Unicode input

1982	TEX82: 7 bit
1990	TEX 3.0: 8 bit
1991	Unicode
1991–2004	Omega: 16 bit
2004	XETEX: 32 bit
2007	LuaTEX: 32 bit
2010–today	Unicode math (works with XETEX and LuaTEX, but we need more free fonts)

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Problems we are working on: Fonts

TEX does not handle fonts itself but reads only metric information (tfm files) and leaves the usage of font files to the output drivers. Originally these worked only with METAFONT fonts but nearly nobody outside of the TEX world created them.
The rest of the world instead developed PostScript (1984), TrueType (1991) and lately OpenType (1996). These fonts can be used with troubles (by experts) with TEX and pdfTEX, but then the special features of OpenType are ignored.
Today we have XƎTEX and LuaTEX which make the usage of OpenType fonts very simple.

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Problems we are working on: PDF

TEX as designed by Knuth writes a device independent output format (DVI). Today the standard is PDF (1993). For that we made output drivers and finally pdfTEX (1997), which can write PDF directly.
pdfTEX is now the default engine of the TEX world.
XƎTEX and LuaTEX can also write PDF.
The problem now is tagged PDF – that works with LuaTEX and ConTEXt since 2010, but not yet with LATEX.

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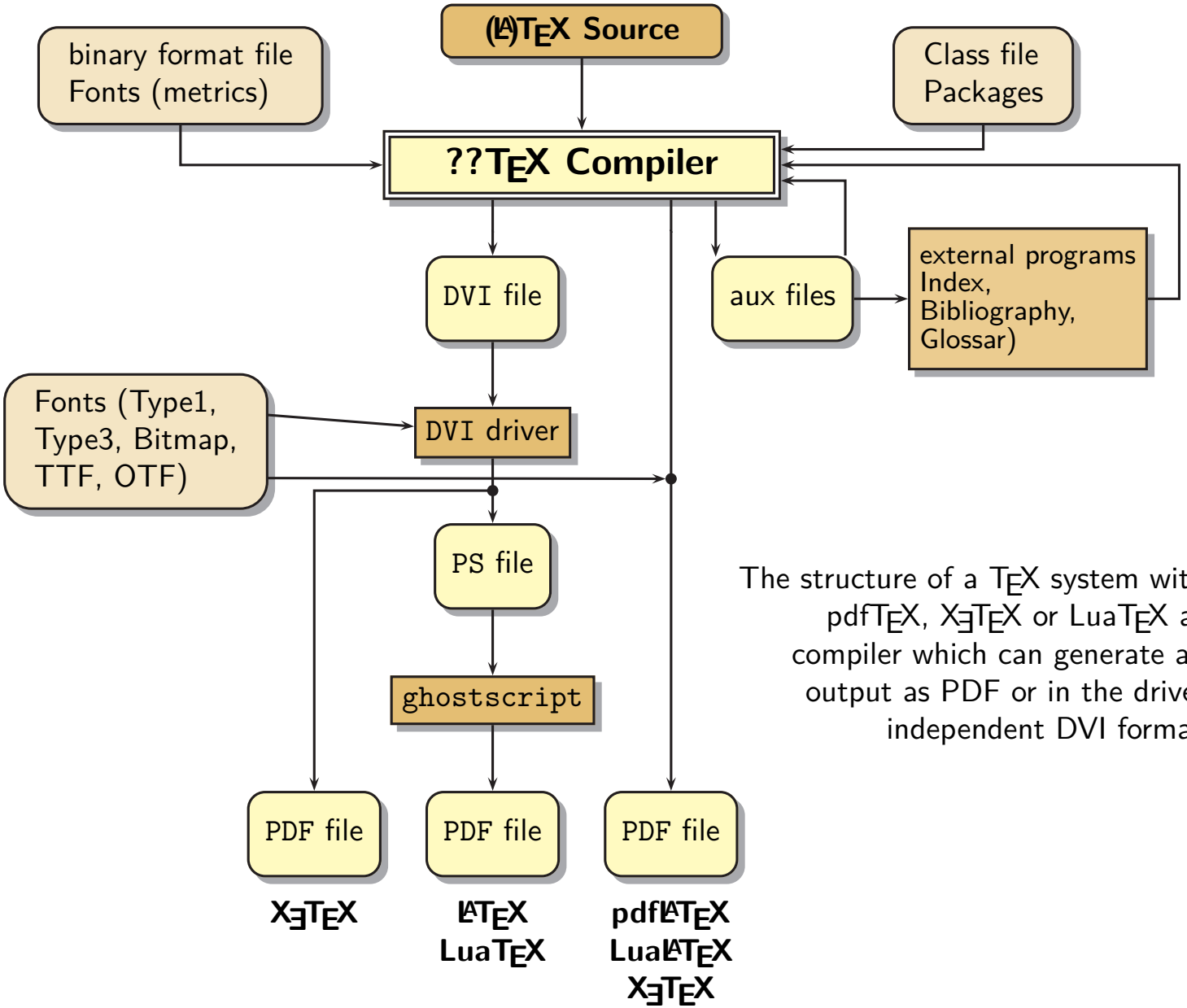
A short overwiew: LaTeX workflow



The structure of a TeX system with pdfTeX, XeTeX or LuaTeX as compiler which can generate an output as PDF or in the driver independent DVI format.

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The engines

- TeX — the original by Donald Knuth
- ε-TeX — small evolutionary extensions
- pdfTeX — can create PDF and offers microtypographical extensions
- XeTeX — handles Unicode input and OpenType fonts; uses operating system specific libraries for font handling
- LuaTeX — can create PDF and offers microtypographical extensions, handles Unicode input and OpenType fonts; integrates Lua as a programming language, but is still compatible to TeX; integrates METAPOST. Currently in beta (0.76); 1.0 is planned for 2014.

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LaTeX

Much has changed since LaTeX 2.09 (1989):

- LaTeX 2ε: Planned as an intermediate version (ϵ) between LaTeX 2.09 and LaTeX 3; very stable since 1994
- KOMA script: An alternative to the standard classes adapted to the typographical conventions of Europe which offers many extensions
- hyperref: Adds support for hyperlinks, forms and other capabilities of PDF (e. g. metadata)
- LaTeX3: Develops slowly but now offers a good foundation for developers of classes and packages which is used by many new packages (e. g. for XeLaTeX and LuaLaTeX)

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XeLaTeX and LuaLaTeX

To use the extensions of XeTeX and LuaTeX with LaTeX some packages have been developed which can be used with the commands `xelatex` and `lualatex`:

- `fontspec`: Font handling
- `polyglossia`: Multilingual documents; an alternative to babel
- `luatextra`: Loads all packages needed for LuaLaTeX

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Presentations with LaTeX

Presentations are one of the most popular uses of TeX. LaTeX 2ε offers only the obsolete `slides` class. Therefore alternatives have been developed of which two are most often used:

- beamer: Used for this talk, offers an excellent support of PDF
- powerdot: Uses PSTricks and therefore needs dvips or XeTeX

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ConTEXt

ConTEXt is an alternative to LATEX that now (with version Mk IV) makes extensive use of LuaTEX and PDF to offer features that are hard or impossible with LATEX, e. g.:

- Multicolumn typsetting
- Integrated use of METAPOST (also possible with LuaLATEX)
- Handling of XML
- Support of layers
- Typesetting on a grid
- Creation of tagged PDF, XML, ePUB

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Images

- Inclusion of images: pdfTeX, XeTeX and LuaTeX can handle JPEG, PNG and PDF when creating PDF; pdfTeX and LuaTeX can also handle JBIG2. EPS must be converted which is now done automagically
- METAPOST: An extension of METAFONT which can create PostScript and SVG. It can be used for diagrams and is integrated into LuaTeX
- PGF/TikZ: A macro package for LaTeX and ConTeXt for creating very nice diagrams very easily
- PSTricks: A macro package for LaTeX which uses PostScript for the creation of diagrams and graphics
- Asymptote: Creates vector graphics like METAPOST, but the programming is more like C++

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Bibliographies

One of the strengths of LaTeX is the handling of bibliographies with BibTeX

- BibTeX: Can only handle 7 Bit and is difficult to program
- BibTeX8: Can only handle 8 Bit and is difficult to program
- Biber: A replacement of BibTeX used by BibLaTeX; XML support is planned. The style files are programmed in TeX
- BibLaTeX is the future (for LaTeX)

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Indexes

Good scientific books have indexes, so their creation also had to be automated

- MakeIndex: The standard solution since 1986; handles only 7 bit
- Xindy: Handles any language and unicode, sorting can be adapted, can handle arbitrary “page numbers” (e. g. “Genesis 1:31”), the markup can be configured
- Every generated index can be manipulated as needed by external programs

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Fonts

It is not enough to have programs that can handle OpenType fonts, we also need good free OpenType fonts:

- Latin Modern: An extended and improved version of Computer Modern, which supports all “roman” languages
- TEX Gyre: Extended and improved versions of the GhostScript PostScript default fonts
- Many polish fonts (Antykwa Toruńska, Kurier and Iwona, Cyklop)

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Math fonts

TEX of course needs math fonts and for decades has been the reference implementation for math typesetting, so math fonts (very few) were designed for TEX. With the advent of OpenType Microsoft designed OpenType math and created a math font (Cambria Math) for use with Office. Work is ongoing and mostly finished to extend the TEX engines (XƎTEX and LuaTEX) to handle OpenType math and to create free OpenType math fonts:

- Latin Modern and TEX Gyre: Work is ongoing on OpenType math
- Asana math: Free math font designed to complement Palatino. Beta.
- STIX/XITS: Free math fonts designed to complement Times. STIX is designed to handle *all* mathematical symbols included in Unicode; XITS is the OpenType version.

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TEX distributions

Since the installation of TEX was a real problem in the olden days (in the last millenium…), free and operating system independent TEX distributions were developed of which these two are still active:

TEX Live For Unix, MacOS and Windows. Has its own package management and offers online updates. All moden Unix distributions get their TEX from TEX Live. With TLContrib there is an additional package repository

MikTEX For Windows with a package management and online updates

Both would be impossible without CTAN (the Comprehensive TEX Archive Network), a network of FTP serves which offer software related to TEX

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Books

There are a lot of books on LaTeX and new ones are still published, but some deserve special attention

LaTeX Companion The LaTeX3 projects sole income is from the sale of the LaTeX Companion, the follow-up to the LaTeX manual by Leslie Lamport

DANTE books Since there were some books on LaTeX missing and publishers are not always interested (the german translation of Lamport's book is unavailable for some years) DANTE (the german TeX user group) has published some books on its own (e. g. on KOMA script and PSTricks)

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The community

The TEX community is quite active:

User groups There are a number of national (and one international: TUG) user groups, of which DANTE (for german speakers) is the largest with more then 2000 members

Own conferences DANTE organises two conferences every year and there are conferences by other user groups (of these the polish one is highly recommended), one european and one on ConTEXt

Conferences by others For some years we also participate in conferences by others (e. g. the LinuxTag, FrOSCon, or OpenRheinRuhr) with booths and presentations

Funding The developement of TEX et. al. is not funded by companies but mainly by the user groups (from their membership fees and contributions)

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Stackexchange

- `tex.stackexchange.com` aka TeX.SX
- Public online since November 2010
- Currently more than 23 000 registered users, ca. 40 000 questions and more than 60 000 answers; ca. 50 000 visitors per day
- Unique in features and interface
- Has become the first stop for online TEX support
- The complete content is released under the cc-wiki license, regular database dumps are freely available for download on `clearbits.net`
- More infos

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Summary

Although TEX is now nearly 35 years old, it is still actively developed. The main topics are Unicode input and the use of OpenType fonts. The programs developed today are XETEX and LuaTEX; both can and *should* be used (but one needs an up to date installation of TEX)

LATEX is still the standard and is being adapted to the new programs; ConTEXt is a very interesting “newcomer” which developes very fast

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