



# T<sub>E</sub>X@2015

T<sub>E</sub>X in the 21<sup>st</sup> Century – where are we and what is up

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# About me

- ▶ MS in CS, T<sub>E</sub>X and PDF expert, Java developer
- ▶ L<sup>A</sup>T<sub>E</sub>X user since 1989
- ▶ First level support at the LaTeX3 team (1998–2005)
- ▶ pdfT<sub>E</sub>X maintainer (2001–2008)
- ▶ Member of the LuaT<sub>E</sub>X team
- ▶ Developer of a number of L<sup>A</sup>T<sub>E</sub>X packages (since 1990)

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## Three types of booth visitors

- a) Does not know T<sub>E</sub>X
- b) Has used T<sub>E</sub>X 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*
- c) Currently typesets a larger document with T<sub>E</sub>X and needs help

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# Where we have been

1978	T <sub>E</sub> X78	1990	METAFONT 2.0
1979	METAFONT79	1994	METAPOST
1982	T <sub>E</sub> X82 (0)	1994	L <sup>A</sup> T <sub>E</sub> X 2 <sub>ε</sub>
1983	T <sub>E</sub> X82 (1.0)	1994–2006	teT <sub>E</sub> X
1984	METAFONT84 (0)	1996	T <sub>E</sub> X Live
1986	Computers & Typesetting (T <sub>E</sub> Xbook etc.)	1996	ConT <sub>E</sub> Xt
1986	METAFONT84 (1.0)	1997	pdfT <sub>E</sub> X
1986	T <sub>E</sub> X 2.0	2004	X <sub>Y</sub> T <sub>E</sub> X
1986	L <sup>A</sup> T <sub>E</sub> X	2007	LuaT <sub>E</sub> X
1990	T <sub>E</sub> X 3.0	2007	ConT <sub>E</sub> Xt MKIV

# Problems we are working on: Unicode input

1982 T<sub>E</sub>X82: 7 bit

1990 T<sub>E</sub>X 3.0: 8 bit

1991 Unicode

1991–2004 Omega: 16 bit

2004 X<sub>Y</sub>T<sub>E</sub>X: 32 bit

2007 LuaT<sub>E</sub>X: 32 bit

2010–today Unicode math (works with X<sub>Y</sub>T<sub>E</sub>X and LuaT<sub>E</sub>X,  
but we need more free fonts)

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# Problems we are working on: Fonts

T<sub>E</sub>X does not handle fonts itself but reads only metric information (t<sub>f</sub>m 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 T<sub>E</sub>X 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 T<sub>E</sub>X and pdfT<sub>E</sub>X, but then the special features of OpenType are ignored. Today we have X<sub>Y</sub>T<sub>E</sub>X and LuaT<sub>E</sub>X which make the usage of OpenType fonts very simple.

# Problems we are working on: PDF

T<sub>E</sub>X 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 pdfT<sub>E</sub>X (1997), which can write PDF directly.

pdfT<sub>E</sub>X is now the default engine of the T<sub>E</sub>X world.

X<sub>Y</sub>T<sub>E</sub>X and LuaT<sub>E</sub>X can also write PDF.

The problem now is tagged PDF – that works with LuaT<sub>E</sub>X and ConT<sub>E</sub>Xt since 2010, but not yet with L<sup>A</sup>T<sub>E</sub>X.

# Problems we are working on: PDF

$\text{\TeX}$  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 pdf $\text{\TeX}$  (1997), which can write PDF directly.

pdf $\text{\TeX}$  is now the default engine of the  $\text{\TeX}$  world.

X $\text{\TeX}$  and Lua $\text{\TeX}$  can also write PDF.

The problem now is tagged PDF – that works with Lua $\text{\TeX}$  and Con $\text{\TeX}$ t since 2010, but not yet with  $\text{\LaTeX}$ .

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# The engines

$\text{\TeX}$  the original by Donald Knuth

$\epsilon\text{-}\text{\TeX}$  small evolutionary extensions

$\text{pdf}\text{\TeX}$  can create PDF and offers  
microtypographical extensions

$\text{\XeTeX}$  handles Unicode input and OpenType fonts;  
uses operating system specific libraries for  
font handling

$\text{Lua}\text{\TeX}$  can create PDF and offers microtypographical  
extensions, handles Unicode input and  
OpenType fonts; integrates Lua as a  
programming language, but is still  
compatible to  $\text{\TeX}$ ; integrates METAPOST.  
Currently in stable beta (0.80); 1.0 is  
planned for 2016.

Much has changed since  $\text{\LaTeX}$  2.09 (1989):

- ▶  $\text{\LaTeX} 2_{\epsilon}$ : Planned as an intermediate version ( $\epsilon$ ) between  $\text{\LaTeX}$  2.09 and  $\text{\LaTeX}$  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)
- ▶  $\text{\LaTeX} 3$ : Develops slowly but now offers a good foundation for developers of classes and packages which is used by many new packages (e. g. for  $\text{\XeLaTeX}$  and  $\text{\LuaLaTeX}$ )

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To use the extensions of X<sub>Y</sub>TeX 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 $\text{\LaTeX}$

Presentations are one of the most popular uses of  $\text{\TeX}$ .  $\text{\LaTeX} 2_{\epsilon}$  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  $\text{\XeTeX}$

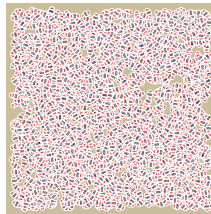
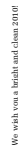
ConT<sub>E</sub>Xt is an alternative to L<sup>A</sup>T<sub>E</sub>X that now (with version Mk IV) makes extensive use of LuaT<sub>E</sub>X and PDF to offer features that are hard or impossible with L<sup>A</sup>T<sub>E</sub>X, e. g.:

- ▶ Multicolumn typesetting
- ▶ Integrated use of METAPOST (also possible with LuaL<sup>A</sup>T<sub>E</sub>X)
- ▶ Handling of XML
- ▶ Support of layers
- ▶ Typesetting on a grid
- ▶ Creation of tagged PDF, XML, ePUB

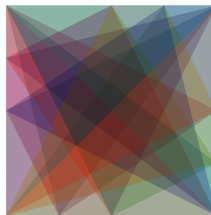
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- ▶ Inclusion of images: pdfTeX, XeTeX and LuaTeX can handle JPEG, PNG and PDF when creating PDF; pdfTeX and LuaTeX can also handle JBIG2. EPS must be converted which is now done automatically
- ▶ Some packages and programs for diagrams

An extension of METAFONT which can create PostScript and SVG. It can be used for diagrams and is integrated into Lua $\text{\TeX}$ .

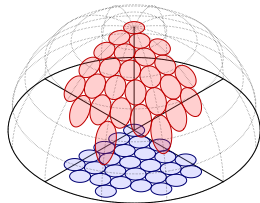
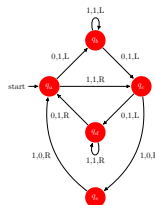


We wish you a good 2011!



**We wish you a colorful 2014!**

TikZ and PGF are T<sub>E</sub>X packages for creating graphics programmatically. TikZ is build on top of PGF and allows you to create sophisticated graphics in a rather intuitive and easy manner.

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A macro package for  $\text{\LaTeX}$  which uses PostScript for the creation of diagrams and graphics.

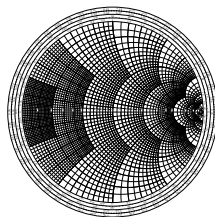
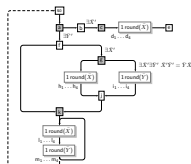
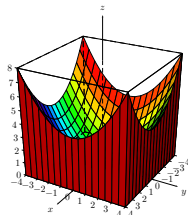
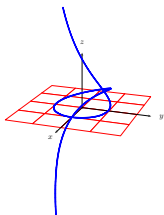


Figure 1: Reduction from Games to Dean-Frey Games (see J. FUKUMI, M. KUROKAWA, B. LEBLANC, *Total and Partial Well-Founded Database Games*, Proc. 4th Int. Conference on Database Theory (ICDT), Delft, 1997, LNCS 1146, Springer).

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# Bibliographies

One of the strengths of L<sup>A</sup>T<sub>E</sub>X is the handling of bibliographies with BibT<sub>E</sub>X

- ▶ BibT<sub>E</sub>X: Can only handle 7 Bit and is difficult to program
- ▶ BibT<sub>E</sub>X8: Can only handle 8 Bit and is difficult to program
- ▶ Biber: A replacement of BibT<sub>E</sub>X used by BibL<sup>A</sup>T<sub>E</sub>X; XML support is planned. The style files are programmed in T<sub>E</sub>X
- ▶ BibL<sup>A</sup>T<sub>E</sub>X is the future (for L<sup>A</sup>T<sub>E</sub>X)

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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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
- ▶ T<sub>E</sub>X Gyre: Extended and improved versions of the GhostScript PostScript default fonts
- ▶ Many polish fonts (Antykwa Toruńska, Kurier and Iwona, Cyklop)

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T<sub>E</sub>X of course needs math fonts and for decades has been the reference implementation for math typesetting, so math fonts (very few) were designed for T<sub>E</sub>X. 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 T<sub>E</sub>X engines (X<sub>Y</sub>T<sub>E</sub>X and LuaT<sub>E</sub>X) to handle OpenType math and to create free OpenType math fonts:

- ▶ Latin Modern and T<sub>E</sub>X 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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# T<sub>E</sub>X distributions

Since the installation of T<sub>E</sub>X was a real problem in the olden days (in the last millenium...), free and operating system independent T<sub>E</sub>X distributions were developed of which these two are still active:

**T<sub>E</sub>X Live** For Unix, MacOS and Windows. Has its own package management and offers online updates. All moden Unix distributions get their T<sub>E</sub>X from T<sub>E</sub>X Live.

**MikT<sub>E</sub>X** For Windows with a package management and online updates

Both would be impossible without CTAN (the Comprehensive T<sub>E</sub>X Archive Network), a network of FTP serves which offer software related to T<sub>E</sub>X

# Books

There are a lot of books on L<sup>A</sup>T<sub>E</sub>X and new ones are still published, but some deserve special attention

**L<sup>A</sup>T<sub>E</sub>X Companion** The L<sup>A</sup>T<sub>E</sub>X3 projects sole income is from the sale of the L<sup>A</sup>T<sub>E</sub>X Companion, the follow-up to the L<sup>A</sup>T<sub>E</sub>X manual by Leslie Lamport

**DANTE books** Since there were some books on L<sup>A</sup>T<sub>E</sub>X missing and publishers are not always interested (the german translation of Lamport's book is unavailable for some years) DANTE (the german T<sub>E</sub>X user group) has published some books on its own (e. g. on KOMA script and PSTricks)

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## The community

The T<sub>F</sub>X 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 than 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 ConT<sub>E</sub>Xt

**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 T<sub>E</sub>X et. al. is not funded by companies but mainly by the user groups (from their membership fees and contributions)



- ▶ `tex.stackexchange.com` aka TeX.SX
- ▶ Public online since November 2010
- ▶ Currently (2015-03-18) more than 59k registered users, ca. 83k questions and more than 114k answers; ca. 80k 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



# Summary

Although T<sub>E</sub>X is now nearly 36 years old, it is still actively developed. The main topics are Unicode input and the use of OpenType fonts. The programs developed today are X<sub>Y</sub>T<sub>E</sub>X and LuaT<sub>E</sub>X; both can and *should* be used (but one needs an up to date installation of T<sub>E</sub>X)

L<sup>A</sup>T<sub>E</sub>X is still the standard and is being adapted to the new programs; ConT<sub>E</sub>Xt is a very interesting “newcomer” which develops very fast