

About BasicTeX-2009

Richard Koch

November 8, 2009

1 Introduction

Until recently, TeX install packages for Mac OS X were based on teTeX by Thomas Esser. This included the distribution by Gerben Wierda using i-Installer, the distributions in Fink and MacPorts, and the MacTeX distribution by the MacTeX Technical Working Group, a subgroup of the TeX Users Group (TUG).

Thomas Esser announced in May, 2006 that he would no longer support teTeX and recommended that users switch to TeX Live, the distribution supported by an international consortium of User Groups, including TUG (TeX User Group for North America), DANTE e.V. (the German TeX Group), AsTeX (in France), TUGIndia, and a large number of other groups. TeX Live is a very large "reference distribution," distributed on DVD once a year. It runs on Mac OS X, Windows, Linux, and many Unix systems.

Most distributions have now migrated from teTeX to TeX Live. For instance, the 2007, 2008, and 2009 versions of MacTeX install the complete TeX Live 2007, TeX Live 2008, and TeX Live 2009. These packages are large, over a gigabyte in size (these packages install front ends, Ghostscript, and other utilities as well as the full TeX Live — everything needed to use TeX on the Mac).

2 Basic TeX

BasicTeX (80 MB) is an installation package for Mac OS X based on TeX Live 2009. Unlike MacTeX, this package is deliberately small. Yet it contains all of the standard tools needed to write TeX documents, including TeX, LaTeX, pdfTeX, MetaFont, dvips, ConTeXt, MetaPost, and XeTeX.

It would be dangerous to construct a new distribution by going directly to CTAN or the Web and collecting useful style files, fonts and so forth. Such a distribution would run

into support issues as the creators move on to other projects. Luckily, the TeX Live install script has its own notion of “installation packages” and collections of such packages to make “installation schemes.” BasicTeX is constructed by running the TeX Live install script and choosing appropriate packages and schemes. Thus it is a subset of the full TeX Live with exactly the TeX Live directory structure and configuration scripts. Moreover, BasicTeX contains tlmgr, the TeX Live Manager software introduced in TeX Live 2008, which can install additional packages over the network. So it will be easy for users to add missing packages if needed.

Since it is important that the install package come directly from the standard TeX Live distribution, I’m going to explain exactly how I installed TeX to produce the install package. First I renamed `/usr/local` so the TeX Live installer would create a virgin copy in this location. Apple’s PackageMaker then created the install package from `/usr/local`.

The latest version of TeX Live 2009 can be obtained over the web by going to <http://tug.org/texlive/svn/>. The “rsync” method listed first will download everything needed without using subversion.

To install TeX Live, issue the following commands:

```
cd "directory containing texlive"
sudo ./install-live
```

This will run the TeX Live install script, a straightforward script (kudos to the author). Do not accept the default choices; instead make the following changes before installing:

- Use the “S” option to choose the “TeX Live basic scheme”
- Use the “C” option to edit this scheme, adding “LaTeX recommended packages, ConTeXt format, MetaPost (and Metafont) drawing, PSTricks packages, and XeTeX macros.”
- Use the “D” option to change the TEXDIR from `/usr/local/texlive/2009` to
`/usr/local/texlive/2009basic`
- Use the “D” option to change TEXMFHOME from `$HOME/texmf` to
`$HOME/Library/texmf`

This is the local directory where users can add their own style files, fonts, bibtex files, etc., without running texhash. Most of the current TeX distributions for Mac OS X use this location.

- use the “O” option to tell the script not to install the macro/font doc tree or the macro/font source tree, to avoid building fmt files, and to configure for letter size

paper (this is later changed by the installer’s postflight script to the user’s default paper size).

Then install.

Now make small additions to the distribution by adding files which beta testers declare essential. The following commands show how this is done.

```
sudo tlmgr install synctex
sudo tlmgr install revtex
sudo tlmgr install times
```

We add synctex and revtex because testers requested them, and we add the following European hyphenation packages: hyphen-basque, hyphen-danish, hyphen-dutch, hyphen-finnish, hyphen-french, hyphen-german, hyphen-hungarian, hyphen-italian, hyphen-norwegian, hyphen-polish, hyphen-portuguese, hyphen-spanish, hyphen-swedish, and hyphen-ukenglish.

The default TeX Live configuration script adds files which we do not need. Remove files inside `/usr/local/texlive/2009basic` with the following commands:

```
rm -R /usr/local/texlive/2009basic/texmf/dvipdfm
rm -R /usr/local/texlive/2009basic/texmf/dvipdfmx
rm /usr/local/texlive/2009basic/bin/universal-darwin/dvipdfm
rm /usr/local/texlive/2009basic/bin/universal-darwin/dvipdfmx
rm -R /usr/local/texlive/2009basic/texmf-dist/fonts/pk
rm -R /usr/local/texlive/2009basic/texmf-var/web2c/luatex
rm -R /usr/local/texlive/2009basic/texmf-var/web2c/pdftex
rm -R /usr/local/texlive/2009basic/texmf-var/web2c/xetex
```

Finally we reset the default location where tlmgr looks for updates as follows:

```
sudo tlmgr option location http://mirror.ctan.org/systems/texlive/tlnet/2009
```

To get a working TeX, we need only configure papersize, make formats, and perform other initialization commands. The following commands would do the trick; here `$PAPER` is either “letter” or “a4”.

```
sudo bash
PATH=/usr/local/texlive/2009basic/bin/universal-darwin:$PATH; export PATH
texhash
sudo tlmgr paper $PAPER
sudo fmtutil-sys --all
```

Actually, we make the install package without running these commands, and then run them in the postinstall script. Thus the install package itself does not contain format files,

which are built at the end of the install process. The postinstall script determines the user's default paper size and configures TeX appropriately.

3 Testing These Packages

This package has been testing on PowerPC 10.3, 10.4, and 10.5 and on Intel 10.4, 10.5 and 10.6. My documents, including a 200 page set of lecture notes with extensive illustrations, typeset fine. I tested the distribution with AMS-LaTeX test files from the American Mathematical Society and there were no problems. A few other testers have discovered that their old documents usually typeset fine.

4 Worrying About Europe

Donald Knuth wrote the first version of TeX in 1978, and rewrote the program using Tangle and Weave in 1982. He wrote a final third version in 1989, mainly to increase font tables from 128 characters to 256 characters for better foreign language support. The current TeX is version 3.1415926.

From the beginning, TeX could typeset words with diacritical marks using escape sequences, but these escape sequences separated the word internally into pieces and hyphenation tables broke for Europeans. The move to 256 character fonts was designed to fix this problem. Accented characters are now characters in their own right and hyphenation tables can account for them.

Using this facility requires new fonts to replace Knuth's computer modern fonts. The BasicTeX package contains the original computer modern fonts (in Adobe type one format) and new Latin Modern fonts by Boguslaw Jackowski and Janusz M. Nowacki for European users. The creation of these very compact outline fonts is a relatively new development. BasicTeX also contains the babel and inputenc packages for dealing with these European characters. One of our fears has been that we would not be able to support European users with such a small package, but the Latin Modern package makes this support possible.

Readers who want to know more should consult Jackowski and Nowacki's article from EuroTeX2005: www.dante.de/dante/events/eurotex/papers/TUT09.pdf.

5 The PostInstall Script

TeX users on the Mac are often not familiar with Unix. The BasicTeX install package does not leave these users to fend for themselves; instead it configures TeX so it is ready to use. After installing TeX, a user need only download a suitable front end and begin working; many of these front ends will automatically configure themselves for BasicTeX.

The install package contains a postinstall script. This script does three things:

- It uses Apple routines to find the user’s default papersize, and configures TeX for that papersize.
- It modifies the PATH and MANPATH variables so they correctly point to the new TeX
- It installs a “TeX Distribution” data structure by Gerben Wierda and Jerome Laurens in `/Library/TeX`, and installs a new “TeX Distribution Control Panel” in `/Library/PreferencePanels`.

I’ll explain these operations in the following sections.

It is useful to know exactly where MacTeX installs files so there are no surprises later on. Here is a list:

<code>/usr/local/texlive/2009basic</code>	the actual TeX distribution
<code>/usr/local/bin/texdist</code>	a symbolic link to <code>/Library/TeX/.scripts/texdist</code>
<code>/usr/texbin</code>	a symbolic link to the active distribution’s binaries
<code>/Library/TeX</code>	the TeX distribution structure, mainly symbolic links
<code>/Library/PreferencePanels</code>	contains the TeXDistPrefPane preference pane

6 Setting Paper Size

When the TeX Live installation script finishes, it prints a message suggesting that the user configure papersize and reset PATH and MANPATH shell configuration variables by hand using command line arguments. This isn’t in the spirit of the Mac.

Since it is easy for a script to read off the user’s default papersize, the first of these steps can easily be done automatically.

```
sudo tlmgr paper letter
```

where “letter” will be “a4” in many countries.

7 Configuring PATH in Systems 10.3 and 10.4

There is a standard way of dealing with TeX paths in Systems 10.3 and 10.4, invented by Gerben Wierda for his original TeX distribution. Gerben directly modified `/etc/csh.login` and `/etc/profile`, adding the TeX binary location to the end of the PATH variable. He surrounded this with comments so it is easily visible. The script to make these changes is still used in Gerben's gwTeX, and it is used without modification in BasicTeX-2009.

Here, for example, is the end of my `/etc/csh.login`:

```
## TeX added /usr/texbin start at Sun Apr 15 14:18:37 PDT 2007
## Do not remove the previous line
if ("${uid}" != "0") then
    set path = ( ${path} "/usr/texbin" )
endif
## Do not remove the next line
## TeX added /usr/texbin end at Sun Apr 15 14:18:37 PDT 2007
```

Here is the end of my `/etc/profile`:

```
## TeX added /usr/texbin start at Sun Apr 15 14:18:37 PDT 2007
## Do not remove the previous line
if [ 'whoami' != "root" ]
then
    PATH="$PATH:/usr/texbin"
    export PATH
fi
## Do not remove the next line
## TeX added /usr/texbin end at Sun Apr 15 14:18:37 PDT 2007
```

It is important that Gerben in gwTeX and I in MacTeX use the same script, because some users install both distributions and the changes to PATH are then compatible.

Both Gerben in his distribution and MacTeX in its distributions set `/usr/texbin` to be a symbolic link to the binary directory of the active TeX distribution for the processor of the computer running this distribution. This makes it possible to configure front ends to point to `/usr/texbin` rather than the particular binary directory. Changing distributions is then easy, since only `/usr/texbin` needs to be modified.

8 Configuring MANPATH in Systems 10.3 and 10.4

Similar remarks apply to MANPATH. Gerben dealt with this in his original TeX distribution and the script he used is still used in all MacTeX packages.

If the user is installing on system 10.3, the script modifies `/etc/manpath.config`. On system 10.4, it modifies `/usr/share/misc/man.conf`. I'll only describe the second modification here. Gerben's addition is surrounded with comments to make it easily visible. Here is the end of my `/usr/share/misc/man.conf`:

```
## TeX modifications start at Mon Apr 23 12:46:25 PDT 2007
## Do not remove previous line
MANPATH /Library/TeX/Distributions/.DefaultTeX/Contents/Man
## Do not remove next line
## TeX modifications end at Mon Apr 23 12:46:25 PDT 2007
## TeXMap modifications start at Mon Apr 23 12:46:25 PDT 2007
## Do not remove previous line
MANPATH_MAP /usr/texbin /Library/TeX/Distributions/.DefaultTeX/Contents/Man
## Do not remove next line
## TeXMap modifications end at Mon Apr 23 12:46:25 PDT 2007
```

9 Configuring PATH and MANPATH in Leopard and Snow Leopard

When MacTeX is installed on Leopard and Snow Leopard, the modifications in the previous two sections are not made because these systems use a different method to extend PATH and MANPATH. We'll describe the changes for Leopard, and then explain minor modifications for Snow Leopard.

In Leopard, the global shell initialization scripts `/etc/csh.login` and `/etc/profile` call the helper script `/usr/libexec/path_helper`, which initializes PATH with the contents of `/etc/paths` and initializes MANPATH with the contents of `/etc/manpath`. Then it extends PATH with any additional paths listed in files within `/etc/paths.d` and extends MANPATH with additional manpaths listed in files within `/etc/manpaths.d`.

The path `/usr/local/bin` is one of the paths in `/etc/paths`, so it is no longer necessary to add this path when installing ghostscript and other programs. In the shipping version of Leopard, `/etc/paths.d` and `/etc/manpaths.d` each contain a single file named X11, and so PATH and MANPATH include entries for X11.

When the BasicTeX package installs on Leopard, it adds a file named `TeX` to `/etc/paths.d` containing the single entry

```
/usr/texbin
```

and adds a file named `TeX` to `/etc/manpaths.d` containing the single entry

```
/Library/TeX/Distributions/.DefaultTeX/Contents/Man
```

Thus TeX programs can be run from the command line, and TeX man pages can be read from the command line.

In Snow Leopard, `man` finds man pages by guessing based on locations in the `PATH` variable. Basic TeX also supports this method; the location `/usr/local/texlive/2009basic/bin/universal-darwin` contains a symbolic link named `"man"` which points to the directory `/usr/local/texlive/2009basic/texmf/doc/man`.

10 The TeX Distribution Data Structure

As mentioned earlier, BasicTeX-2009 installs a data structure by Gerben Wierda and Jerome Laurens to support multiple TeX distributions on a machine. This data structure is also by the full versions of MacTeX.

The data structure knows about almost all TeX distributions used on Mac OS X today, including Gerben Wierda's original teTeX-based distribution and his current gwTeX distribution, the Fink teTeX distribution and the MacPorts teTeX distribution, and the TeXLive distributions from 2006 through 2009. The data structure can easily be extended to cover future distributions.

None of these distributions are written to the same location, so a user may have multiple distributions installed. A new preference pane is installed for Apple's System Preferences; this "TeX Distributions" pane lists available distributions on a machine, and indicates which is the active distribution. To make another distribution active, click on its name in the panel.

Changing distributions with the pane automatically changes `PATH` and `MANPATH` variables, so interaction with TeX via the command line will use the appropriate distribution. It also automatically reconfigures GUI applications so they use the new active distribution. To make this happen, a new symbolic link named `/usr/texbin` has been created, pointing to the binary directory of the active distribution. Some GUI applications will need to be reconfigured to use this link, but after they are configured, they never need be touched again. For example, in past years, LaTeXIt had preferences which listed the paths to binaries for pdfLaTeX, xeTeX, etc. The default for the first was

```
/usr/local/teTeX/bin/powerpc-apple-darwin-current/pdflatex
```

This should be changed to

```
/usr/texbin/pdflatex
```

Actually LaTeXiT and most other TeX GUI programs now use `/usr/texbin` by default.

Why is this structure useful? Here is an example. Last year's TeX Live distribution installed in `/usr/local/texlive/2008`. This year's distribution installs in `usr/local/texlive/2009`. By using the TeX Distributions pane, users can confidentially install the 2009 distribution without worrying that it will break their current projects. If there are problems with the 2009 version, they can return to the 2008 version with a single preference pane click. When experiments show that the new distribution causes no problem, users can make it permanently active.

Another example: users who already have TeX can install BasicTeX to test it without worrying that it will overwrite their current distribution.

A more important example: suppose a new user installs BasicTeX, uses it more and more, and then wants a more complete TeX. At the TUG MacTeX site, they can find a similar install package for the complete TeX Live, which is 24 times larger than BasicTeX. This package installs exactly as BasicTeX. Neither of these distributions overwrite each other, and the user can easily switch back and forth until they are confident that the larger distribution works.

Incidentally, the data structure does not modify the actual TeX distribution in any way. It is ingeniously constructed so that, for instance, the preference pane needs to change only a single symbolic link to change the active TeX distribution. The data structure is very small, essentially a collection of symbolic links in `/Library/TeX`.

Users are free to use the data structure or ignore it. More and more front ends are likely to use it.

TeX distributions are installed in locations which are usually not displayed in the Finder. But it is possible to inspect the currently active distribution by going to `/Library/TeX/Root` with Finder. This is a symbolic link to the full currently active distribution. Similarly, `/Library/TeX/Documentation` is a symbolic link to all documentation folders for the currently active distribution.

The data structure contains features which future GUI programs may use. For example, a TeX interface program could offer to typeset some files with one distribution and others with another, or to display a list of documentation for the currently active distribution.

There is one complication. The TeX distribution data structure adds `/usr/texbin` to the end of the PATH variable. But Fink adds `/sw/bin` to the start of PATH and MacPorts

adds `/opt/local/bin` to the start, so commands issued from the Terminal will find the TeX in Fink or MacPorts TeX regardless of the active TeX chosen in the Preference Pane. This only applies to users who have Fink or MacPorts. For these users the problem is easily fixed. In the shell configuration script, which is probably `.profile` or `.bash_profile` or `.bash_login`, modify `PATH` so `/usr/texbin` comes first. For a bash shell, the required commands at the end of the script should be

```
export PATH=/usr/texbin:$PATH
export MANPATH=/Library/TeX/Distributions/.DefaultTeX/Contents/Man:$MANPATH
```

11 Summary

If you are using Gerben's old teTeX, or his new gwTeX, or MacTeX from 2006 through 2009, or Fink's teTeX, or MacPort's teTeX, you can safely install BasicTeX. The old distribution will remain and will be recognized by the TeX Distribution Preference Pane.

12 XeTeX

We managed to get a lot of functionality into BasicTeX. It has all of the standard programs and style files that one would expect: TeX, pdfTeX, LaTeX, pdfLaTeX, AMS-LaTeX, metafont, dvips, xdvi, metapost, PStricks, beamer, RevTeX, etc. It also has ConTeXt, an alternate macro language by Hans Hagen in the Netherlands that is used more and more often in the TeX world.

But our biggest coup is the inclusion of XeTeX, a new version of TeX by Jonathan Kew. A year ago, the description of TeXLive 2007 included the words "In 2006-2007, the major new addition to TeX Live was the XeTeX program."

XeTeX solves two of TeX's biggest problems: its inability to accept unicode input, and its dependence on special TeX fonts and inability to use system fonts. XeTeX first modifies TeX so it accepts source files written in UTF-8 format. Then it modifies TeX's font routines so that instead of consulting TeX Font Metric files to learn about character dimensions, kerning pairs, and the like, the program directly calls system font routines to find this information. The result is that XeTeX can use system fonts without preliminary processing. The program can mix these system fonts with ordinary TeX fonts; for instance mathematical formulas can be written with standard TeX fonts in a document using a system font for text.

The predecessor of XeTeX was written for Apple's System 9 and Quickdraw GX. When Mac OS X arrived, the TeX community gradually forgot about that program. As TeX matured,

various projects were begun to modify system fonts for TeX, construct font metric files for these fonts, and so forth. Then one amazing day, Jonathan announced XeTeX, solving completely this font problem.

Two years ago Kew released XeTeX with a public license, and ported the program from the Mac to Linux and Windows; it now runs on the full range of systems supported by TeX Live. This crucial step greatly expanded interest in the program, and it has a very active mailing list.

The next four pages contain the source and output for two XeTeX examples. The first uses the Zapfino font. Jonathan would probably not approve of this example because he doesn't like gee-whiz demonstrations, preferring to demonstrate XeTeX with real work and fonts which do not distract from the presentation. Notice how few lines are needed to activate the mechanisms of XeTeX.

The real advantage of XeTeX becomes apparent in the second example, showing text in a non-Latin foreign language. Many front ends on the Mac are written with Cocoa and fully support unicode, International input, right to left text input, and so forth. This makes it possible to use TeX for documents written partly or entirely in Chinese, Hebrew, Arabic, and a host of other languages, and directly type source text in these languages.

```
% These lines tell TeXShop to typeset with xelatex, and to open
% and save the source with Unicode encoding.
```

```
%!TEX TS-program = xelatex
%!TEX encoding = UTF-8 Unicode
```

```
\documentclass[12pt]{article}
\usepackage{geometry}
\geometry{letterpaper}
\usepackage{graphicx}
\usepackage{amssymb}
```

```
% Will Robertson's fontspec.sty can be used to simplify font choices.
% To experiment, open /Applications/Font Book to examine the fonts
% provided on Mac OS X, and change "Zapfino" to any of these choices.
```

```
\usepackage{fontspec,xltxtra,xunicode}
\defaultfontfeatures{Mapping=tex-text}
\setromanfont[Mapping=tex-text]{Zapfino}
\setsansfont[Scale=MatchLowercase,Mapping=tex-text]{Gill Sans}
\setmonofont[Scale=MatchLowercase]{Andale Mono}
```

```
\title{Brief Article}
\author{The Author}
```

```
\begin{document}
\maketitle
```

This is a standard \TeX document using Zapfino type. It uses \LaTeX and the standard \TeX graphic packages.

```
\begin{figure}[htbp]
\centering
\includegraphics[width=2in]{example.pdf}
\caption{from Mathematica}
\end{figure}
```

```
\end{document}
```

Brief Article

The Author

November 8, 2009

*This is a standard \TeX document using Zapfino type.
It uses $L^{\text{\TeX}}$ and the standard \TeX graphic packages.*

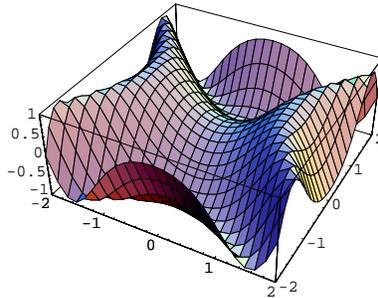


Figure 1: from Mathematica

% These lines tell TeXShop to typeset with xelatex, and to open and
% save the source with Unicode encoding.

%!TEX TS-program = xelatex
%!TEX encoding = UTF-8 Unicode

```
\documentclass[12pt]{article}
\usepackage{geometry}
\geometry{letterpaper}
\usepackage{graphicx}
\usepackage{amssymb}
```

% Will Robertson's fontspec.sty can be used to simplify font choices.
% To experiment, open /Applications/Font Book to examine the fonts
% provided on Mac OS X, and change "Hoefler Text" to any of these choices.

```
\usepackage{fontspec,xltxtra,xunicode}
\defaultfontfeatures{Mapping=tex-text}
\setromanfont[Mapping=tex-text]{Hoefler Text}
\setsansfont[Scale=MatchLowercase,Mapping=tex-text]{Gill Sans}
\setmonofont[Scale=MatchLowercase]{Andale Mono}
```

```
\title{Brief Article}
\author{The Author}
```

```
\begin{document}
\maketitle
```

This is a standard TeX document using Hoefler Text. It uses \LaTeX and
the standard \TeX graphic packages.

% For many users, the previous commands will be enough.
% If you want to directly input Unicode, add an Input Menu or Keyboard to the menu bar
% using the International Panel in System Preferences.
% Unicode must be typeset using a font containing the appropriate characters.

```
\newfontfamily{\A}{Geeza Pro}
\newfontfamily{\H}[Scale=0.9]{Lucida Grande}
\newfontfamily{\J}[Scale=0.85]{Osaka}
```

Here are some multilingual Unicode fonts: this is Arabic text: $\{\A السلام عليكم\}$,
this is Hebrew: $\{\H שלום\}$, and here's some Japanese: $\{\J 今日は\}$.

```
\end{document}
```

Brief Article

The Author

November 8, 2009

This is a standard TeX document using Hoefler Text. It uses \LaTeX and the standard TeX graphic packages.

Here are some multilingual Unicode fonts: this is Arabic text: السلام عليكم, this is Hebrew: שלום, and here's some Japanese: 今日は.