

## The MacTeX install package for OS X

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### Abstract

MacTeX installs everything needed to run TeX on a Macintosh, with a single click of the mouse. I'll discuss the history of this package — Wendy's conspiratorial lunch and Jonathan Kew's all-night coding session — modifications over the years, and important changes in the 2012 release.

### 1 A demo

MacTeX is a flat file available as a free download, linked from <http://tug.org/mactex>. It is a very large download, about 2.16 GB, but smaller versions are available for users with slow download links.

On the desktop, the file inherits an icon from Apple's Installer program.



Figure 1: MacTeX-2012

Double clicking this icon starts the installation process and the window shown at the top of the next page appears (fig. 2).

This window is familiar to Mac users because the same window appears when they install other packages, and (until recently) when they installed system updates. The installation process is summarized by the list of items on the left; this list is fixed by Apple and cannot be changed. Notice that the dialog background is a merging of the Mac OS X logo with a Duane Bibby drawing of the TeX lion and Donald Knuth. The idea of a TeX-related illustration goes back to Jonathan Kew's initial version of the package; this particular form was provided by Bob Kerstetter.

At the extreme top right of the window you'll notice a small padlock. It brings up a window listing the Developer ID Certificate issued by Apple to validate this package. Apple's Mountain Lion system refuses to install packages which lack an official Developer signature (although workarounds exist). An Apple engineer contacted me in May to make sure MacTeX would have this signature, so Apple knows about TeX.

When the user pushes Continue, a more detailed document is displayed; we don't show it here. Pushing Continue again leads to a pane listing licenses

governing the various pieces of MacTeX. This dialog is also shown on the next page (fig. 3).

(The abstract to this paper says that MacTeX installs TeX with a single button click. Are you counting clicks? By my count, we are up to four, not counting the double click which started the process.)

The next dialog (fig. 4) appears during what Apple calls the "Installation Type" portion of the process. This allows users to select the disk where the installation will appear. MacTeX always installs on the system disk in standard spots, so this dialog merely shows the available space required on the hard disk. A button at extreme left leads to a Custom installation panel.

That custom dialog is shown below the Installation Type dialog (fig. 5). One can see that MacTeX is separated into pieces: TeX Live, GUI applications, Ghostscript, Convert, the Latin Modern fonts, and the TeX Gyre fonts. Most users will install TeX Live, but users with a favorite editor may skip GUI Applications, and users who compile Ghostscript and ImageMagick themselves or obtain them as part of Fink or MacPorts will skip those packages. We provide two optional font packages; these packages install duplicates of certain TeX fonts in Apple's Font Directory, making them available to standard Macintosh programs like Adobe Illustrator.

A final click leads to a standard dialog (not shown) asking the user to supply an Administrator Password. This password is required because TeX Live will be installed in `/usr/local`, which is owned by root. On the Macintosh, standard users are Administrators and the Administrator Password is their own password rather than an actual root password.

Then installation occurs, with a progress dialog as shown (fig. 6), followed by a final success dialog (fig. 7). Not counting custom installation, the process requires six clicks and one password.

### 2 GUI applications

TeX is installed under `/usr/local/texlive`, a location not shown by Apple's Finder. Consequently, the only files commonly seen by users are those installed in `/Applications/TeX`. We install two editors, TeXShop and TeXworks, and we install  $\LaTeX$ It, a graphical application which allows users to input equations in TeX source format, convert them to PDF, and paste the PDF into standard Macintosh programs using drag-and-drop operations. We install the Excalibur spell checker, but we do not install the more commonly used cocoASpell by Anton Leuski because it has a special installer and extra dictionaries available from Leuski's web site, <http://cocoaspell.leuski.net/>.

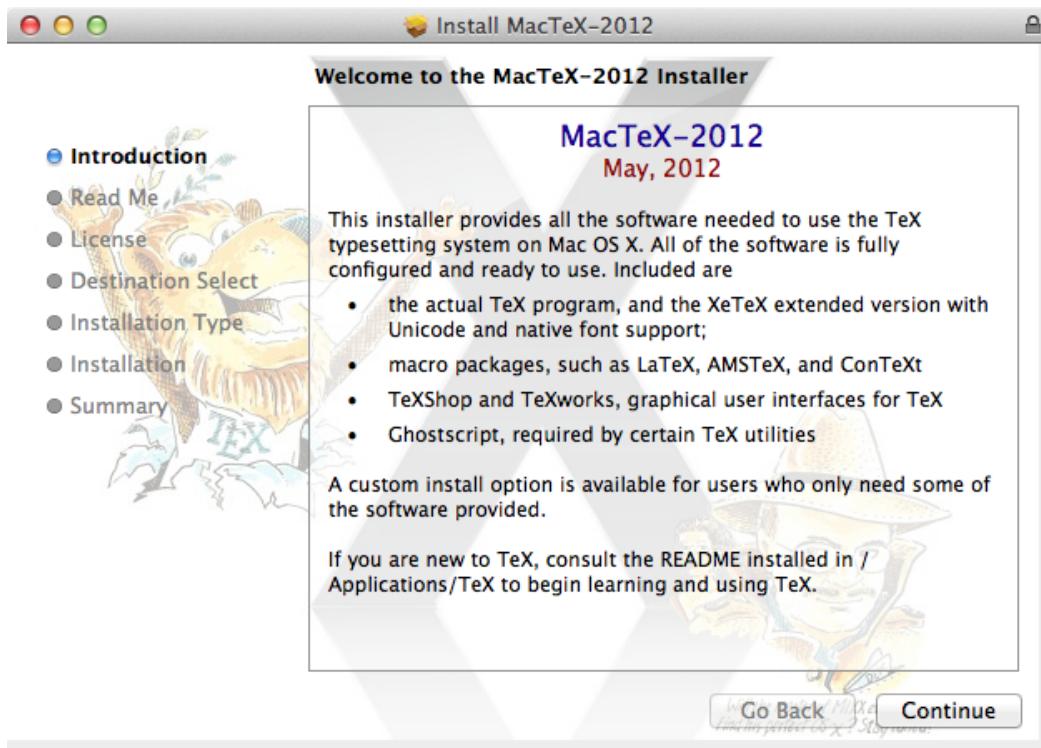


Figure 2: Initial Dialog

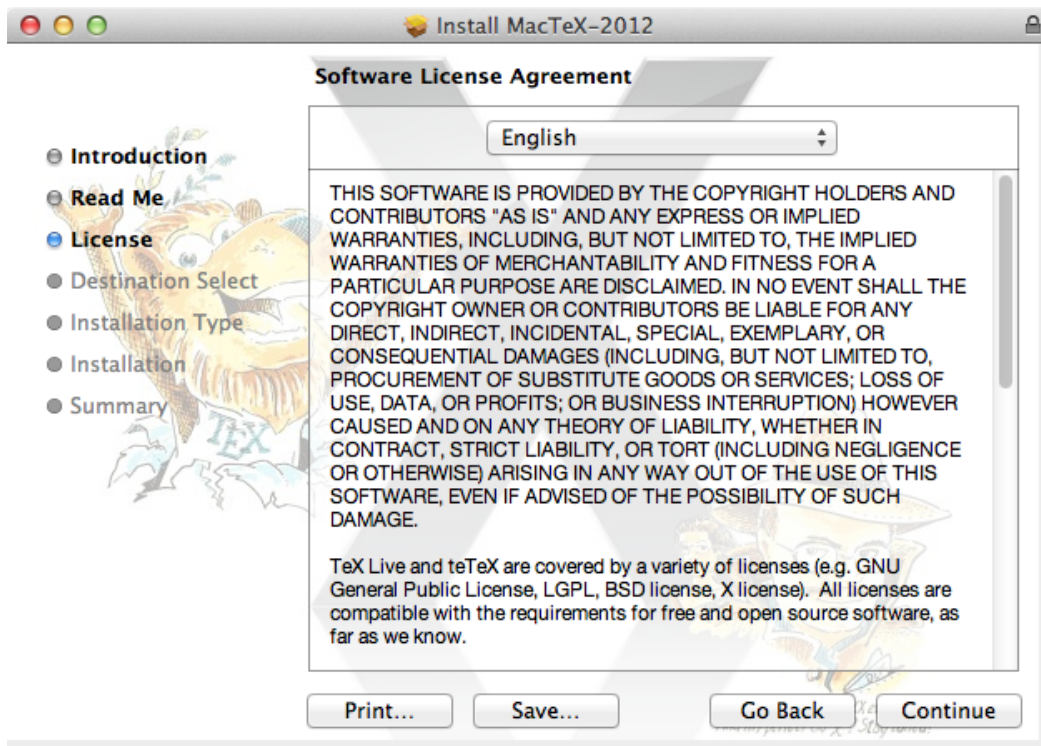


Figure 3: License Dialog

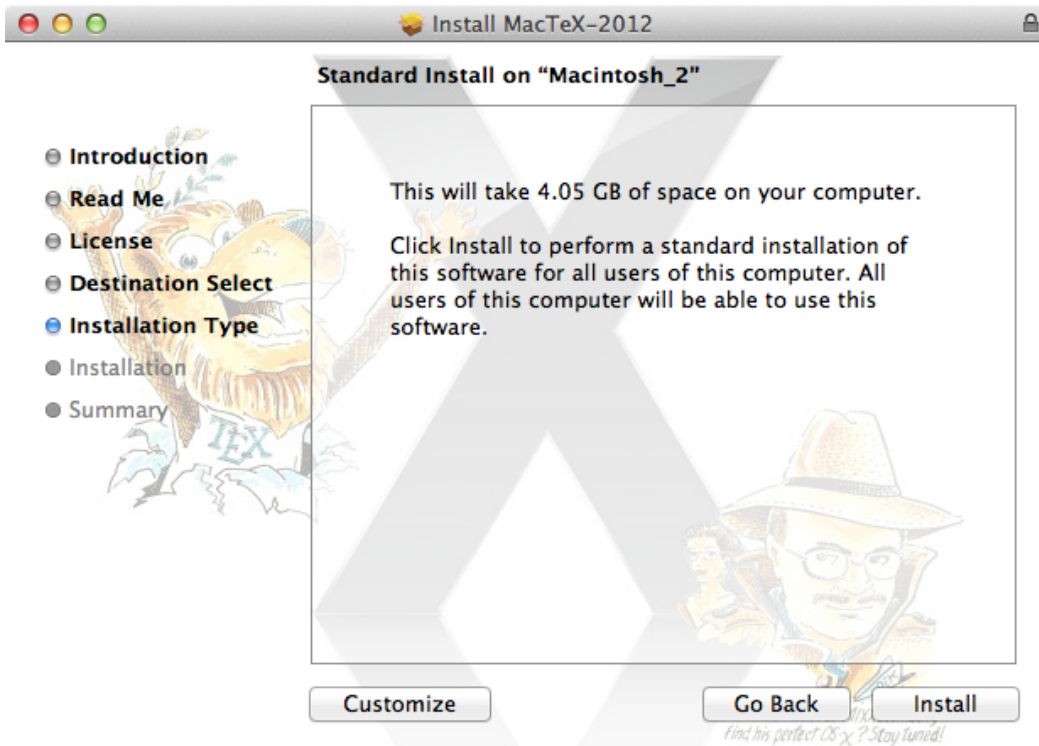


Figure 4: Installation Type Dialog

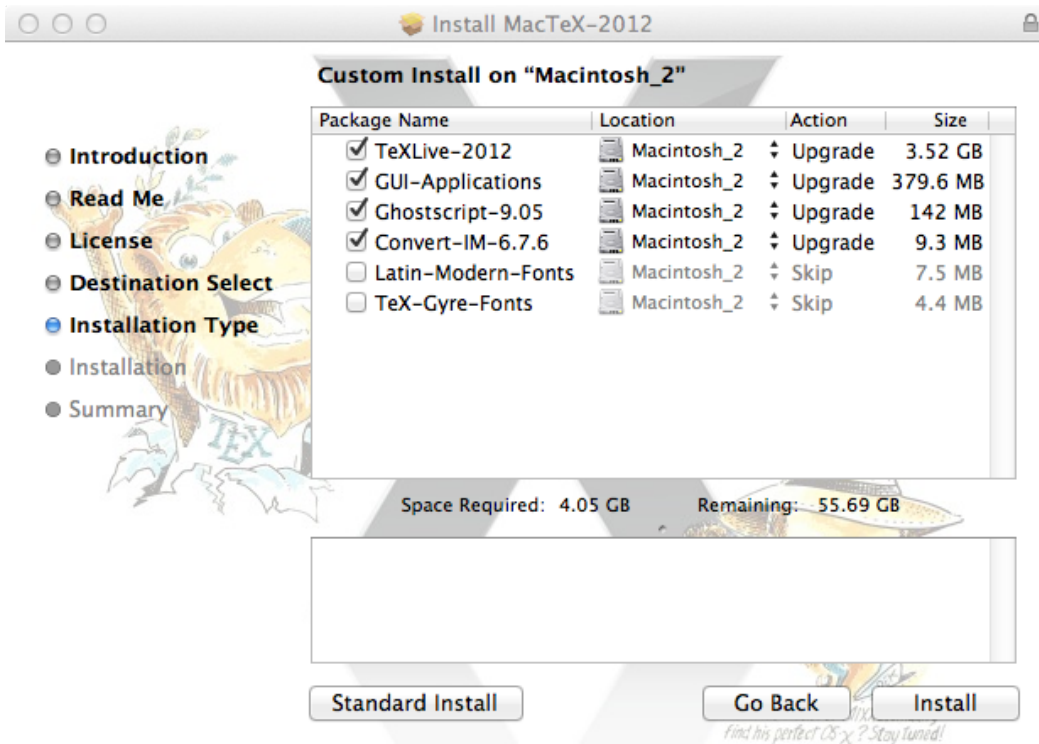


Figure 5: Custom Install Dialog

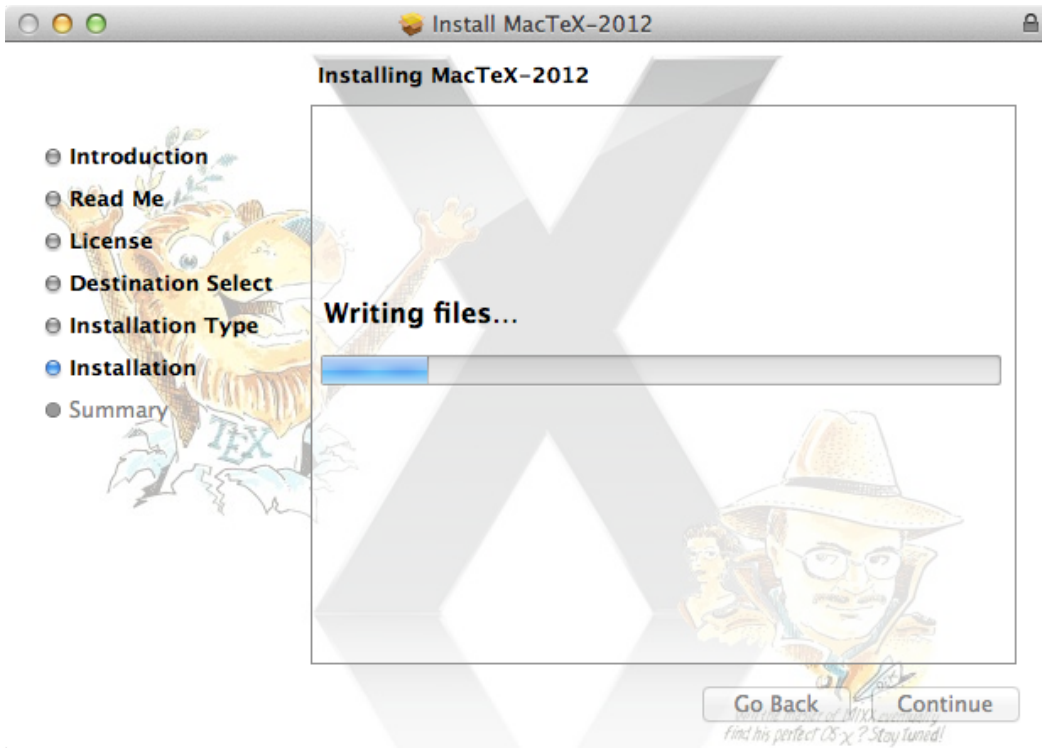


Figure 6: Actual Installation



Figure 7: Success Dialog

Finally, we install Adam Maxwell’s wonderful  $\text{\TeX}$  Live Utility, a program which gives a standard Macintosh interface on the  $\text{\TeX}$  Live `tlmgr`, allowing users to keep  $\text{\TeX}$  Live packages up to date, search for new packages, and configure paper size, among other things.

### 3 Configuring $\text{\TeX}$ Live and GUI applications

In a word, nothing is needed. The installer guesses the user’s desired paper size from Mac printer settings. It adds the  $\text{\TeX}$  binary location to the `PATH` variable, and makes  $\text{\TeX}$  man pages readable. All supplied GUI applications are already configured to find  $\text{\TeX}$ .

### 4 Getting started with $\text{\TeX}$

There is no standard spot for user documentation on the Macintosh, so we install a short `READ ME FIRST` document in `/Applications/TeX`. This document starts with a two-page introduction to  $\text{\TeX}$  for a first time user, leading the user through the process of writing and typesetting a short document with `TeXShop`. Since both pages contain half-page illustrations, the introduction is very short with only the essential steps. The user is also directed to a movie in the `TeXShop` help menu illustrating the typesetting job.

After that, the `READ ME FIRST` document lists links to information about other editors and GUI front ends on the Macintosh, to important  $\text{\TeX}$  information at TUG and elsewhere, to online tutorials about  $\text{\TeX}$  and  $\text{\TeX}$  Live with links that immediately bring up the information, and to the TUG web page for books about  $\text{\TeX}$ .

### 5 $\text{\TeX}$ Dist

`MacTeX` installs the  $\text{\TeX}$  Distribution data structure and Preference Pane by Gerben Wierda and Jérôme Laurens which makes it easy to use multiple  $\text{\TeX}$  distributions on Mac OS X. This structure is described in detail in my article *Support for multiple  $\text{\TeX}$  distributions in i-Installer and MacTeX*, *TUGboat* 28:3 (2007), <http://tug.org/TUGboat/tb28-3/tb90koch.pdf>.

Installing `MacTeX` does not erase distributions from past years. The  $\text{\TeX}$ Dist Pref Pane is added to the standard Apple System Preferences by `MacTeX`. It lists all available  $\text{\TeX}$  distributions on the present Mac, and lets the user choose the one to make active with a single button click. This click automatically reconfigures all GUI editors and utilities, and modifies `PATH` and `MANPATH` in shells. It isn’t even necessary to restart applications. You can typeset with  $\text{\TeX}$

Live 2011, keep your editor active, switch to  $\text{\TeX}$  Live 2012 with the Pref Pane, and typeset again with  $\text{\TeX}$  Live 2012.

`MacTeX` installs a link named `/usr/texbin` which points (indirectly) to the active  $\text{\TeX}$  distribution. Any GUI app configured to find  $\text{\TeX}$  at `/usr/texbin` can share in the advantages of the  $\text{\TeX}$ Dist structure.

### 6 The (nonexistent) special version of $\text{\TeX}$ Live installed by `MacTeX`

The key message of this section is that *there is no special version of  $\text{\TeX}$  Live for the Mac!* We have always strictly followed the rule that we install the full  $\text{\TeX}$  Live, completely unmodified.

On Unix machines,  $\text{\TeX}$  Live is generally installed by running the `install-tl` script in a shell. The  $\text{\TeX}$  Live portion of `MacTeX` is constructed by removing `/usr/local` from the machine creating it, installing  $\text{\TeX}$  Live to `/usr/local` on that machine with the  $\text{\TeX}$  Live install script, pointing Apple’s PackageMaker software to the install location, and asking it to construct an install package. Later when `MacTeX` installs this package on a user machine, it runs a postinstall script to configure paper size and do a few other things, but this script does not modify files in  $\text{\TeX}$  Live.

The `install-tl` script has a menu which allows users to change a few configuration options. We change just three things, namely setting `TEXMFVAR`, `TEXMFCONFIG`, and `TEXMFHOME` to (respectively):

- `~/Library/texlive/2012/texmf-var`
- `~/Library/texlive/2012/texmf-config`
- `~/Library/texmf`

On Unix machines, these variables point to “hidden” locations in the user’s home directory. The home directory on the Macintosh has a special folder named `Library` which is the standard place for configuration information, so we use it for  $\text{\TeX}$ .

In Apple’s latest operating systems, Lion and Mountain Lion, the `Library` folder is itself hidden. But by holding down the Option Key while pushing the Finder’s Go menu, the user can visit this folder.

### 7 Smaller install packages

`MacTeX` is a gigantic download. That is why we supply the much smaller install package `BasicTeX`, which is about 66 megabytes. This package installs most files needed for ordinary typesetting using  $\text{\TeX}$ ,  $\text{\LaTeX}$ , or  $\text{\XeTeX}$ . It contains the Computer Modern fonts and Latin Modern fonts. Many users report that all their documents typeset fine with this installation.

A new user can easily produce  $\TeX$  documents using only TeXShop or another GUI front end with Basic $\TeX$ .

In 2012, the subset of  $\TeX$  Live installed by Basic $\TeX$  became one of the install schemes for  $\TeX$  Live. Basic $\TeX$  is exactly the result of installing `scheme-small` with `install-tl`.

Basic $\TeX$  used to contain Con $\TeX$ t, but then Mojca Miklavc introduced a standalone Con $\TeX$ t distribution. Since Con $\TeX$ t is upgraded more often than once a year, and since this distribution can coexist with  $\TeX$  Live, it makes sense for Con $\TeX$ t users to install it separately. See [http://wiki.contextgarden.net/ConTeXt\\_Standalone](http://wiki.contextgarden.net/ConTeXt_Standalone).

We also distribute Mac $\TeX$  Additions, an install package containing everything in Mac $\TeX$  except  $\TeX$  Live: <http://tug.org/mactex/morepackages.html>.

## 8 A defective install on the NeXT machine

I am one of the few people who bought a NeXT computer. Software for this machine was not — let us say — abundant. So owners bought more or less everything released for the machine.

Early in the life of the NeXT, I bought software which came on a CD and was installed by the NeXT analogue of Apple's Installer program. As installation proceeded, icons in the dock began changing to question marks, and by the end only a couple of icons remained. Puzzled, I clicked on one of the question marks, but nothing happened. With some concern, I started the Terminal program to run a shell, but Terminal had vanished. Eventually I logged into the machine remotely and discovered that the entire Applications folder had been erased.

A few hours later, the company selling the CD issued a profound apology and explained that the NeXT installer didn't anticipate symbolic links in the Application directory, or maybe didn't anticipate hard links, or maybe it had nothing to do with links, but at any rate it didn't anticipate *something unusual*. I don't know the details, but I learned a lesson: installers are dangerous.

The memory of that event colors my life to this day. Every so often, users ask for a feature in Mac $\TeX$  which is not provided by Apple's Package-Maker utility. When I explain the problem, users often sketch a way to construct the package directly without using Apple's utility. I will *never* do that. There are a half dozen Apple engineers who know everything about pax files, compression algorithms, soft links, hard links, dangerous links, secret links, and everything else that could go wrong with an

install package. The thought that they'd lose their jobs if something went wrong is strangely reassuring.

## 9 Gerben Wierda's i-Installer

My first TUG conference was in 2001 in Delaware (<http://tug.org/tug2001>), where I met Hàn Thé Thành, the author of pdf $\TeX$ . Since pdf $\TeX$  outputs PDF files and the graphic system of Mac OS X is based on PDF, his software made creating an interface to  $\TeX$  a breeze.

TUG 2001 occurred only a few months after the first release of Mac OS X, version 10.0 on March 24, 2001. I talked about TeXShop, which had been running on an early beta version of the system, and about i-Installer, a program by Gerben Wierda which installed TeX, Ghostscript, ImageMagick, various font utilities, and other Unix software. Gerben's software worked over the Internet, downloading packages from servers as needed. The current web page at <http://ii2.sourceforge.net/> doesn't seem to contain an initial release date, but it must have been early in the beta period for Mac OS X. Gerben ceased supporting i-Installer in 2007, but Google searches lead to users who report trying to install  $\TeX$  with it as late as April of 2011.

During advance preparation for my 2001 talk, I noticed a situation when the Finder could become confused. Sure enough, I ran into that problem during the talk and I had to restart the Finder before proceeding. Afterward, someone came up to me and said "I couldn't care less about TeXShop, but I was very impressed when you restarted the Finder without rebooting the Macintosh".

## 10 Wendy's lunch

In Delaware, I also met Wendy McKay — a Mac fanatic with twice my enthusiasm and five times my energy. Mac $\TeX$  is really Wendy's invention.

Gerben's i-Installer was an ambitious project, able to install not just  $\TeX$  packages, but also more general Unix open source code. It had to deal with network issues like choosing an appropriate server, dealing with timeouts, and security matters. That made for a program with an industrial look which could be intimidating for new users. Wendy began lobbying for a "one-button  $\TeX$  installer". This lobbying extended over several TUG conferences.

Everything came to a head in North Carolina at the Practical  $\TeX$  2005 conference (<http://tug.org/practicaltex2005>). By then, Wendy was lugging suitcases full of electronic equipment to conferences, and had set up a long distance meeting of Mac folks on Thursday afternoon, in which Europeans not at the conference could participate remotely.

To prepare for the meeting, Wendy asked Mac folks to share the same table for Wednesday lunch. She soon began discussing a one button installer, said something like “who’s going to volunteer to make one”, and suddenly turned to Jonathan Kew and said “it looks like you, Jonathan”. Done. The sweetest maneuver I’ve ever witnessed.

### 11 Jonathan Kew

Jonathan had to leave the conference early on Friday. We wished him safe travels after the Thursday meeting, expecting an installer in a couple of months.

TUG conferences are fun, but information tends to come so fast that I’m exhausted after a couple of days. In North Carolina, I went to bed as soon as I could Thursday evening. When I got up the next morning, I read an email message from Wendy: “Jonathan just finished the installer.”

Jonathan programmed all night. And he didn’t have just a rough draft of an installer. He had a package which installed everything:  $\TeX$  (in those years we used  $\text{te}\TeX$ ), Ghostscript, ImageMagick, and font utilities. His installer displayed a custom Mac OS X image. It was constructed with elaborate shell scripts, so the entire process of creating it involved installing  $\text{te}\TeX$  and Ghostscript with Gerben’s *i-Installer* and then running a few scripts. The installer contained *postinstall* scripts to set the user’s `PATH` and `MANPATH` variables, using code which Jonathan found hidden inside *i-Installer*.

That morning at breakfast, Jonathan willed the project to me. I said “but I don’t even understand shell scripts” and he said “read what I have, it is self-explanatory.” And it was. When I need a shell script today, seven years later, I look up Jonathan’s scripts and carefully copy the syntax.

### 12 Herbert Schulz and Mac $\TeX$ tras

The next year, we put the install package on the  $\TeX$  Collection DVD. The DVD also contains extensive extra material curated by Herbert Schulz. This extra material includes the front ends Aquamacs,  $\text{i}\TeX$ Mac, LyX, and  $\TeX$ Maker. Information is provided about BBEdit, TextMate, and TextWrangler. It contains the Skim previewer, the CocoAspell spell checker, other useful utilities, and documentation and demos. All this extra material is also available on the Mac $\TeX$  web site in a package named Mac $\TeX$ tras.

For several years now, Herbert and I have been jointly responsible for the Macintosh portion of the DVD. Herb is an expert on features of  $\TeX$  Live I ignore: installing extra fonts, running `updmap` and `updmap-sys`, issues with restricted shell escape. People who attended the Boston conference learned

that Herb is also an expert on several features of  $\TeX$ Shop which I ignore.

### 13 Gerben’s surprise

The Mac $\TeX$  installer Jonathan wrote depended heavily on Gerben Wierda to do the heavy lifting. In May of 2006, Thomas Esser announced that  $\text{te}\TeX$  would no longer be upgraded, and suggested that users migrate to the  $\TeX$  Live project. Gerben began issuing warning messages to the  $\TeX$  on OS X mailing list which most of us ignored; after all, he had provided  $\TeX$  reliably since the beta days of Mac OS X.

After some grumbling, Gerben indeed developed a new  $\TeX$  distribution based on  $\TeX$  Live rather than  $\text{te}\TeX$ , called  $\text{gw}\TeX$ . He told us it would be officially released at TUG 2006 in Marrakesh (<http://tug.org/tug2006>), which started on November 9th, and to expect a surprise announcement there.

For the surprise, see <http://www.tug.org/twg/mactex/award/2007/gerben/aboutgwtex.html>. It shows a picture taken at this event; Gerben is holding a large sign with the text “I Quit”. To my knowledge, this is the first time that the announcement of a new software release was accompanied by the announcement that support for it would end in two months.

Gerben’s announcement caused some fast footwork on the Mac $\TeX$  front, and after several months of indecision we switched to providing an unmodified full  $\TeX$  Live in the package.

### 14 Mac $\TeX$ changes over the years

We provide Mac $\TeX$  to a small group of beta testers before releasing it to the Internet and for the DVD. I need to mention the most important beta tester, Bruno Voisin, who was at the Boston conference. Bruno is an even stronger Mac fanatic than Wendy, and he will complain bitterly if an interface behaves in a non-Mac fashion. The hidden files in  $\TeX$  Live are visible files in `~/Library` due to Bruno. In Mac $\TeX$  2012, the Ghostscript installation is improved over past years due to discoveries made by Bruno this spring. Thanks.

There have been a few significant changes in Mac $\TeX$  over the years. The first occurred when we added optional install packages, so that, for example, a user could install only  $\TeX$  Live, skipping other packages. This change was made to accommodate users who obtain Ghostscript and ImageMagick through MacPorts or Fink, or compile them directly from source. But it also made Mac $\TeX$  easier to maintain, since the various pieces can be created independently.

Originally, we installed a few libraries from ImageMagick and some font utilities to `/usr/local/lib`. A concerted effort has been made to get rid of these; today we install *no libraries*. This is a deliberate choice which will not change; it makes the lives of developers easier because they do not need to contend with foreign libraries on their machines.

When MacTeX was first provided on the DVD, it contained its own separate copy of TeX Live. TeX Live is enormous, so putting two separate copies on the DVD rapidly become untenable. Nowadays, we provide a special version of MacTeX for the DVD; this special version installs TeX Live by calling the `install-tl` script on the DVD. Therefore the DVD contains only one copy of TeX Live, used by MacTeX and by users on other platforms.

The most recent change occurred in 2012. Apple's Mountain Lion system requires that install packages be signed by a registered Apple Developer. Until this year we created MacTeX using the original PackageMaker, which created install packages which were actually folders in disguise. Such packages cannot be signed. So with some pain we switched to Apple's newest PackageMaker, which creates flat files. Since the interface did not change, most Mac users probably don't know that anything is different.

This more recent PackageMaker is poorly documented and contains several unfinished features. This caused two problems with the 2012 version of MacTeX, which I like to call *The Two Fiascos*.

## 15 The first fiasco

By design, MacTeX doesn't provide choices for the user. That's the whole point of the package: install and run.

But in the final days before release, we discovered that Apple's new PackageMaker constructs packages which allow users to change where software is installed. For example, our package installs TeX Live in the standard location, `/usr/local/texlive/2012`, but users can change this location to their home directory. If they do this, they will have a folder named 2012 in their home directory containing a gigantic number of files owned by root. And TeX won't work. *If you are a Mac user, don't change our default locations!*

Quiz: glance back at the pictures of installation shown at the start of this paper. What unexpected item in these pictures is an active element the user can manipulate to cause this fiasco?

## 16 The second fiasco

Some users trying to install from the DVD first copy the install package to their hard disk and eject the DVD. Installation won't work if they do this because the Install package reads TeX Live from the DVD. So we check for the problem by making certain that the directory `/Volumes/TEXCOL2012/texlive` exists. If not, we abort installation with an error dialog that the DVD must be mounted.

Apple's new PackageMaker makes this check very easy. It contains canned JavaScript modules which can be dragged into the project to test for various conditions. We dragged, and we dropped. Then we made a test DVD, and we tested by installing on Leopard and on Snow Leopard. Worked like a charm. At that point, TUG manufactured the DVD.

It turns out that the canned JavaScript doesn't work on Lion or Mountain Lion. So without help, the version of MacTeX on the DVD will not install on these systems. Users who want to install from the DVD should go to <http://tug.org/mactex> and download a very small fix for this problem.

## 17 A final glitch

MacTeX installs two Ghostscript binaries, `gs-noX11` without X11 support and `gs-X11` with X11 support. In a post-install phase, MacTeX determines whether X11 is installed on the Macintosh, and sets the symbolic link `gs` to point to the appropriate binary. Users who upgrade to Mountain Lion and then install MacTeX will have no problems.

Apple removes X11 during the Mountain Lion upgrade because it now wants users to obtain Xquartz directly from the open source developers. So users who install MacTeX and then upgrade will end up linked to the wrong version of Ghostscript. To fix this, either install Xquartz or use Terminal to run the following commands:

```
cd /usr/local/bin
sudo rm gs
sudo ln -s /usr/local/bin/gs-noX11 gs
```

## 18 Making MacTeX

The full documentation explaining how MacTeX is constructed is now part of TeX Live. It can be found in the TeX Live source repository available at [tug.org/texlive/svn/](http://tug.org/texlive/svn/) in the file `Master/source/mactexdoc.tar.xz`.

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