

# Support for multiple $\text{\TeX}$ distributions in i-Installer and Mac $\text{\TeX}$

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## Abstract

We discuss a data structure by Gerben Wierda and Jérôme Laurens which makes it easy to use multiple  $\text{\TeX}$  distributions on Mac OS X.

## 1 A confession

The wonderful data structure described below was designed by Gerben Wierda and Jérôme Laurens and implemented first in Gerben’s i-Installer package for gw $\text{\TeX}$  and then later in the various Mac $\text{\TeX}$  install packages I maintain. When I learned the details of the design, I was repulsed by its complexity, and opposed it with increasingly vitriolic emails. Then one day, an email from Jérôme led to a religious conversion on my part. The data structure now seems natural, and the Gods have condemned me to write this article as punishment for opposition.

## 2 The problem

$\text{\TeX}$  GUI applications on the Macintosh, like (my program) TeXShop,  $\text{\LaTeX}$ iT, i $\text{\TeX}$ Mac, BibDesk, and others, call command line programs to typeset. A year ago, the standard Mac  $\text{\TeX}$  distribution was te $\text{\TeX}$ , as packaged by Gerben Wierda. Therefore these GUI applications were configured to use that distribution, and so the applications *worked right out of the box without any configuration*.

But in May of 2006, Thomas Esser announced the end of his support for te $\text{\TeX}$ . This led to a mad scramble in the  $\text{\TeX}$  world — some users switched to the full unmodified  $\text{\TeX}$  Live and others continued to rely on te $\text{\TeX}$ . At the international TUG meeting in Marrakesh held in November 2006, Gerben introduced a new distribution named gw $\text{\TeX}$  based on  $\text{\TeX}$  Live. But alarmingly, he also announced the end of email support for his distribution, and modified i-Installer so the first dialog which appears says **Unsupported Software** in bold letters, followed by a paragraph of text which begins “I regret having to inform you that i-Installer is unsupported software as of Jan 1, 2007.” Gerben continues to maintain gw $\text{\TeX}$ , with a substantial following, and “unsupported” seems to mean merely that he has adopted Donald Knuth’s policy of not reading email. But his message puts new users into panic mode.

Meanwhile, TUG’s Mac OS X Working Group produced three one-button install packages for  $\text{\TeX}$ , all based on  $\text{\TeX}$  Live and differing mainly in size. These packages are available at <http://tug.org/mactex>. The first of these, Basic $\text{\TeX}$ , is a 39.7 MB package for users with slow download connections; it installs a surprisingly useful subset of  $\text{\TeX}$  Live 2007. The second, gw $\text{\TeX}$ , is a 321 MB package which installs gw $\text{\TeX}$ ; users can use i-Installer to maintain this distribution. The third,  $\text{\TeX}$  Live 2007, is a 619 MB package which installs the complete 2007 version of  $\text{\TeX}$  Live.

There are also independent distributions based on te $\text{\TeX}$  in Fink and in MacPorts.

All of these distributions install in different locations, so installing one does not overwrite the others. For example, Basic $\text{\TeX}$  is a subset of  $\text{\TeX}$  Live 2007, but installing  $\text{\TeX}$  Live 2007 creates a completely separate installation rather than upgrading the Basic $\text{\TeX}$  installation.

This proliferation of distributions confuses new users. In early June, a physics graduate student at the University of Oregon called me after switching from Windows to a Mac. He set aside a Saturday to install software. From the web he learned about the Mac $\text{\TeX}$  full  $\text{\TeX}$  Live distribution and installed it. Then his lab partners told him to get scientific applications with Fink, so he installed Fink. Fink asked him which programs to install, so he said “give me everything” and unknowingly got a second  $\text{\TeX}$  distribution. After that, friends suggested learning  $\text{\TeX}$  by starting with LyX, so he installed that. The LyX installer told him that it needed to put style files in /usr/local/gwTeX, so he searched the internet and found gw $\text{\TeX}$ . In the course of a single afternoon, he had managed to install three complete  $\text{\TeX}$  distributions on his portable. Everything went smoothly until a Fink web page explained how to reconfigure TeXShop for te $\text{\TeX}$ , and he couldn’t figure out what te $\text{\TeX}$  was.

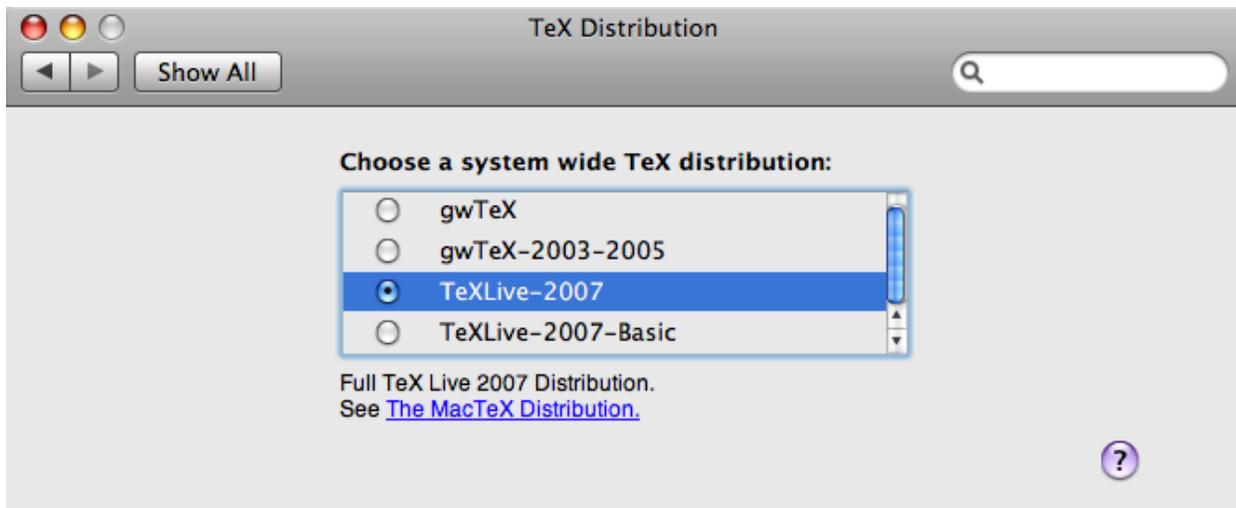
### 3 The solution

I'll get to the new data structure in a minute, but first let me tell you what Jérôme Laurens wrote in email which led to my religious conversion. Jérôme told me he had a preference pane for Apple's System Preferences which would list available  $\text{T}_{\text{E}}\text{X}$  distributions and allow users to switch from one to another.

Jérôme's pane lists distributions installed on a machine. The active distribution is marked in this list. Click on another distribution to make it active. This action automatically switches the `PATH` and `MANPATH` variables so Terminal and other shells use the correct binaries and man pages. It automatically reconfigures *all* GUI programs to use the appropriate distribution. For example, TeXShop,  $\text{L}_{\text{A}}\text{T}_{\text{E}}\text{X}_{\text{i}}\text{T}$ ,  $\text{iT}_{\text{E}}\text{XMac}$ , and BibDesk switch instantly to the new distribution. You can open a source file, typeset, switch distributions with the pane, and typeset again with the new distribution, all without restarting the GUI program or even reloading the source file.

All of the GUI programs I've listed are configured by default to use the new data structure, so they all *work right out of the box without any configuration*.

Here is the preference pane:



Do you remember our physics student? I told him “TeXShop is already configured; don't do anything. Go to System Preferences, open the TeX Distribution pane, and you'll see a list of your three distributions. Switch to the one you want to use.” Magical, huh?

Jérôme's panel is automatically installed by `i-Installer` when it installs `gwTeX`, and by all three `MacTeX` distributions. So of course the preference pane recognizes these distributions. But it also rec-

ognizes legacy distributions written before the pane existed: Fink's `teTeX`, MacPort's `teTeX`, Gerben's old `teTeX`, `TeX Live 2004`, `TeX Live 2005`, and—well, there wasn't any `TeX Live 2006`.

### 4 Another problem solved

Developers want the newest versions of computer software. But many  $\text{T}_{\text{E}}\text{X}$  users don't think that way. I've often heard variants of “I'm in the middle of two book projects and five papers with coauthors; don't talk to me about upgrading  $\text{T}_{\text{E}}\text{X}$ .” To some extent, interest in upgrading depends on the component of  $\text{T}_{\text{E}}\text{X}$  being used; `ConTeXt` and `XƎTeX` are undergoing rapid development and users of these programs upgrade regularly, while users of  $\text{L}_{\text{A}}\text{T}_{\text{E}}\text{X}$  and `pdfTeX` are more likely to desire stability over change.

The `TeX Live` distribution is upgraded once a year and each upgrade is installed in a different location. So `TeX Live` users can safely upgrade, knowing that it is easy to return to their older distribution. Nevertheless, I'm willing to bet that a very large percentage of TUG members put the `TeX Collection DVD` aside when it arrives because they are in the middle of a project. I also bet that most of these folks never retrieve the disk and upgrade.

The problem is that retreating to the old distribution is not foolproof. It is all too easy to reconfigure the GUI front end and leave the `PATH` in Terminal unchanged. Months later such a user might reconfigure  $\text{T}_{\text{E}}\text{X}$  with a Terminal command, only to discover that the change didn't “take” in the GUI program. This is a difficult bug to diagnose.

But Jérôme's panel completely solves the problem. Users can retreat to the old distribution with a

single panel click and be assured that all programs are configured correctly. Consequently, I'm hoping that Mac users get in the habit of upgrading as soon as the new TUG DVD arrives.

## 5 Some history

When Thomas Esser made his announcement, there was barely a ripple in the Mac world because “Gerben will take care of it.” But when Gerben announced end of support, there was an explosion of concern; several messages on the T<sub>E</sub>X on Mac OS X mailing list asked “is this the end of T<sub>E</sub>X on the Mac?”

At that point, several people began experimenting with T<sub>E</sub>X Live. I was one of them. It is common knowledge that T<sub>E</sub>X Live is difficult to install; its install script asks obscure questions like “does your compiler use BSD calling conventions.” Mind you, nobody ever told me about this difficulty, but I somehow knew. And as confirmation, I often talk to Karl Berry, who currently maintains the install script, at meetings and he never once asked “why don't you Mac guys use T<sub>E</sub>X Live?”

But anyway, I dug up an old TUG DVD and ran the script. Gosh. No obscure questions. Very few questions at all, and then poof, T<sub>E</sub>X Live was installed and it ran like a charm.

So I have a complaint about Karl: excessive modesty. Let me push this complaint by quoting a similar complaint about the inventor of the theory of electricity and magnetism. Freeman Dyson's great essay *Missed Opportunities*, Bulletin of the AMS, 1972, is about situations where mathematicians would have made faster progress if they had paid attention to the physicists. The first case he discusses is Maxwell's theory of electricity and magnetism. Dyson begins by quoting Maxwell himself, who said in a lecture “According to a theory of electricity which is making great progress in Germany, two electrical particles act on one another directly at a distance, but with a force which, according to Weber, depends on their relative velocity, and according to a theory developed by Riemann, Lorenz, and Neumann, acts not instantaneously, but after a time depending on the distance. The power with which this theory explains every kind of electrical phenomena must be studied in order to be appreciated. Another theory of electricity which I prefer . . .” and then described his own theory.

Dyson writes “It is difficult to read Maxwell's address without being infuriated by his excessive modesty, which led him to refer to his epoch-making discovery of nine years earlier as only ‘Another theory of electricity which I prefer.’ How different is his

style from that of Newton, who wrote at the beginning of the third book of his *Principia*: ‘It remains that, from the same principles, I now demonstrate the frame of the System of the World.’”

That's my complaint about Karl. If only we had known earlier that T<sub>E</sub>X Live is easy to install! But to get back to the story —

The three MacT<sub>E</sub>X install packages mentioned earlier are based on T<sub>E</sub>X Live. In particular, the MacT<sub>E</sub>X package T<sub>E</sub>X Live-2007 package the full T<sub>E</sub>X Live exactly as it would appear if installed directly with the T<sub>E</sub>X Live script. However, there are several reasons that Mac users should install using the MacT<sub>E</sub>X packages. First, the packages modify PATH and MANPATH, whereas the T<sub>E</sub>X Live install script asks users to do this themselves. MacT<sub>E</sub>X modifies these variables exactly as Gerben does from i-Installer and as required by the T<sub>E</sub>X distribution data structure, so the MacT<sub>E</sub>X method is compatible with both gwT<sub>E</sub>X and this structure.

In addition, the MacT<sub>E</sub>X packages automatically configure paper size, while the T<sub>E</sub>X Live scripts ask users to run a post-installation script.

Finally, the MacT<sub>E</sub>X packages install Jérôme's preference pane and the associated data structures, while the T<sub>E</sub>X Live script knows nothing about these features.

## 6 How the data structure came about:

### A small suggestion from me . . .

When I made MacT<sub>E</sub>X packages for T<sub>E</sub>X Live, I ran into a small problem. TeXShop and the other GUI programs no longer worked out of the box; they had to be configured first. To make this easy, I stole an idea from T<sub>E</sub>X Live and created a symbolic link `/usr/local/texprograms` pointing to the binary directory of the installed distribution. The idea was that GUI programs would have to be configured just once to use this link, and all installation packages on the Mac would set the link during installation. I wrote Gerben and casually asked him to support the link in i-Installer.

## 7 . . . and Gerben runs with it

Instead of making this change, Gerben began to look at the problem from a larger perspective. There are many things that a GUI application might like to know about the active T<sub>E</sub>X distribution. Certainly it will want to know where the binaries are. But each T<sub>E</sub>X distribution contains a lot of documentation, and the GUI app might well like to find and display that documentation. Perhaps the GUI app wants to display man pages too. And recall the LyX installer, which wanted to install style files in the distribution;

it needed to know the location of the distribution's main `texmf` tree.

Gerben proposed a data structure which would organize and locate all of this information and more.

Let's return to the simple issue of binary location. The trouble is that each distribution handles this in a slightly different way. In `gwTeX`, there are two binary directories, one for Intel binaries and one for PowerPC binaries. The Intel directory is `i386-apple-darwin-current` and the PowerPC directory is `powerpc-apple-darwin-current`. `TeX Live` works similarly, but the binary directories are named `i386-darwin` and `powerpc-darwin`. `Fink` contains universal binaries which work with both processors, located in `/sw/bin`. A GUI app might want to find the binary directory for the processor of the machine on which it is running; this GUI app shouldn't have to know these various naming conventions to do its job.

Once we get this far, the basic idea of Gerben and Jérôme's data structure will be clear. For each distribution, they create a small folder of symbolic links pointing to actual locations in the distribution. The names chosen for these links are common for all distributions rather than names used by a particular distribution. Thus a GUI app only needs to know the common names assigned by Gerben and Jérôme rather than the actual names chosen by a distribution. In addition, there is a link named `DefaultTeX` pointing to the folder of symbolic links for the active distribution.

Here is how this works in practice. The folder for each distribution has a subfolder `Programs` and inside that folder are two symbolic links `i386` and `powerpc`. These point to the actual directories containing the Intel and PowerPC binaries for that distribution. Putting this together, a GUI program running on an Intel processor will find the binaries for the currently active distribution in `DefaultTeX/Programs/i386`. If the active `TeX` happens to be `TeX Live 2007`, this will yield `/usr/local/texlive/2007/bin/i386-darwin`. If the active `TeX` is `Fink's teTeX`, it will be `/sw/bin`. That is the simple idea in a nutshell. (In this explanation I have left out a few details, so the paths to the links aren't exactly these.)

The path to binaries for the active `TeX` using the architecture of the current machine is of such importance that Gerben and Jérôme provide a shortcut: a link `/usr/texbin` points to `DefaultTeX/Programs/i386` on Intel machines and `DefaultTeX/Programs/powerpc` on PowerPC machines. Thus GUI apps can use `/usr/texbin` as a path to `TeX` binaries. (Thus `/usr/texbin` replaces my earlier

`/usr/local/texprograms`.) All the standard GUI apps on Mac OS X now use this as their default path. That is why they run right out of the box.

When the structure is installed by `i-Installer` or `MacTeX`, a technical description of the structure is installed in `/Library/TeX/Distributions`. It isn't necessary for me to give full details here, but let me say just a little more to indicate the range of possibilities opened up by the structure. The folder of links for a particular distribution contains subfolders named `Doc`, `Info`, `Man`, `Root`, `AllTexmf`, and others. `Doc` contains symbolic links to actual folders in the distribution containing documentation; the number of such links varies with distribution. For instance, for `TeX Live 2007` the links are called `texmf-dist-doc`, `texmf-doc`, `texmf-doc-doc`, and `texmf-var-doc`. Thus a GUI application can use `DefaultTeX/Doc` to discover the entire documentation tree for the active distribution.

`Info` contains links to the various GNU Info files; `Man` contains links to the various man pages, and `Root` contains a link to the folder containing the entire distribution. `AllTexmf` contains links to the various `texmf` trees of the distribution; for example, the `TeX Live 2007 AllTexmf` contains links named `texmf`, `texmf-dist`, `texmf-doc`, `texmf-local`, and `texmf-var`.

The Macintosh file system has a folder named `/Library` containing various Apple and Third Party data files which apply system wide. The `TeX` distribution data structure is installed in `/Library/TeX`, where `TeX` is a subfolder created by `i-Installer` or `MacTeX`. At the moment this folder only contains information about the `TeX` distribution data, but I understand that some developers are eyeing it for other uses. So I don't recommend throwing it away cavalierly. The actual distribution symbolic links are in folders in `/Library/TeX/Distributions`. There will be one such folder for each distribution installed on the machine, together with folders for legacy distributions even if those aren't installed.

It is not necessary to clean up the symbolic links in the data structure if the corresponding distribution is thrown away, because Jérôme Laurens' preference pane is smart and only shows distributions when the data structure points to something concrete. Thus, for instance, it is perfectly ok to entirely remove `TeX Live 2007` using the simple command

```
sudo rm -R /usr/local/texlive/2007
```

even though this will leave a stranded data structure behind. The data structure itself is tiny.

I have now explained all of the key ideas. The structure and preference pane are quite simple, but I

use them virtually every day. Because of this structure,

- GUI apps work right out of the box;
- T<sub>E</sub>X can safely be upgraded because it's trivial to revert if necessary;
- GUI T<sub>E</sub>X applications may display documentation in the future.

## 8 But give us the dirt

You may be saying “Look, I really don't care about the data structure. I don't even use a Mac. I'm here because I want to hear about the vitriolic email.” If so, this is the section for you.

Let me say from the start that the disagreements I'm going to describe are in the past — there was a battle, Gerben and Jérôme were right and I was wrong. But for your amusement —

When Gerben first designed the data structure, there was no hint of a preference pane. I didn't exactly know how users would switch the default distribution, but it looked like they were expected to directly open `/Library/TeX/Distributions` and manipulate the folders and data inside it. This made it urgent that this location contain straightforward data.

Initially, Gerben's design was simple, but then it took an unexpected turn. Gerben and Jérôme added an extension `.texdist` to the names of the folders which contain symbolic links describing actual distributions; for example, `TeXLive-2007` became `TeXLive-2007.texdist`. Inside this folder they placed a subfolder named `Contents`. Further investigation revealed that most of the `.texdist` folders were associated with mirror images in a hidden folder; for example, the folder `TeXLive-2007.texdist` had a mirror named `TeXLive-2007` in a hidden folder inside `/Library/TeX/Distributions`. This mirror folder also contained a `Contents` folder, and the `Contents` in the original `TeXLive-2007.texdist` folder proved to be a symbolic link to this `Contents` folder in the mirror `TeXLive-2007`. That is, the actual symbolic links which described the distribution were inside the `Contents` folder in the mirror folder living in a hidden directory.

Around this time, I realized that I could no longer explain the data structure in a few sentences and became alarmed. I have never met Gerben or Jérôme (or most of my other collaborators), but Gerben and I have been in email contact for years — really since the start of OS X — and all of this email has been pleasant or better. So as I realized the baroque nature of the developing data, I began complaining.

In growing frustration, I wrote a few people who weren't involved in the design and must have wondered what the heck I was talking about. One of those folks was Jonathan Kew, and here's what I wrote him:

I shouldn't be writing you, but I need someone to "kvetch" to and I don't want to pollute the mailing lists. I have just seen Gerben's final "link" design. I think it is a mess. Am I supposed to support the design in MacT<sub>E</sub>X?

Gerben will end support of his packages in January, so we face the possibility of dealing with multiple TeX distributions on the Mac. With multiple packages, we need an easy way to configure GUI applications. A couple of weeks ago I introduced MacT<sub>E</sub>X packages for three distributions and had each package set a symbolic link `/usr/local/texprograms`. When I asked Gerben to set `/usr/local/texprograms` in i-Installer packages, he decided to design a more complete solution. Fair enough.

KVETCH:

But when it came time to implement these changes, Gerben lost all sense of proportion. Am I expected to support his new baroque design in MacT<sub>E</sub>X? Should I use Gerben's data structure or just give up and make my own. Am I taking this too personally? Do I need to get a life?

Jonathan is a very intelligent fellow. He didn't answer this email.

## 9 A Macintosh secret

Why was the new data structure so complicated?

On the Macintosh, it is possible to trick the Finder so that it displays a folder as just another file. The program XCode, which developers use to write applications, saves projects in this way; each saved project appears to be a simple file, but if you hold down the control key while clicking on the file name, a menu will appear offering to open up the file and display its contents.

What makes a folder magical in this way? Well, its name must have an extension, and it must contain a subfolder named `Contents`.

If such a magical folder lives on a computer, it will look like any other folder *until* it is claimed

by an application which understands its extension. When such an application is installed, the magical folder will suddenly obtain an icon, and clicking on it will open the associated application instead of opening the folder. Thus magical folders are like the pods growing in the basements of houses in *Invasion of the Body Snatchers*. They are faceless and asleep until a governing alien application is installed, when they suddenly obtain a face, wake up, and do the application's bidding.

Gerben and Jérôme had decided that the folders in `/Library/TeX/Distributions` would be such magic folders. This explained every complication in their data structure. But immediately it led to a key question: *what was the alien application they intended to claim these magical folders?* I asked Gerben this question in an email, and he replied "I'm just designing the data structure; it is up to other people to use it."

## 10 A suspicion

If you don't come from the Macintosh world, there is a key fact in this story that you may not know. I am the author of a front end for T<sub>E</sub>X named TeXShop. Jérôme Laurens is the author of a competing front end named iT<sub>E</sub>XMac. Jérôme is my rival. Suddenly I knew what the alien application was intended to be! Gerben and Jérôme are both Europeans; clearly the Europeans were planning to pull the T<sub>E</sub>X rug right out from under me!

## 11 I fight

In a series of increasingly angry emails, I argued that no front end should interfere with the underlying T<sub>E</sub>X distribution. Gerben was so caught up in

the data structure design that he found my email distracting and irritating, and Jérôme ignored me completely. But suddenly I had an idea. I modified two lines of code in TeXShop, and suddenly TeXShop became the alien application claiming the magical folders. I wrote a final email explaining what I had done, ending with, "Why can't you see that no front end should do what I have done?"

## 12 Paranoia doesn't pay

At that point, a magical thing happened. I had been getting email from Gerben, but nothing from Jérôme. Now Jérôme managed to get in contact by an indirect route; and he wrote "Did you know that the University of Oregon email system has been rejecting my mail?"

Next Jérôme told me that he always believed front ends shouldn't claim `.texdist`.

After that, Jérôme he told me for the first time about his TeXDist Preference Pane, which in my opinion is the key ingredient which makes the data structure usable by everyone. Finally he said that he had written a small application which claimed the magical folders, but all it did was to open the TeXDist Preference Pane when the user clicked on a magical folder.

So in a single email, I learned that users could avoid learning of `/Library/TeX/Distributions` altogether, that the magic folders were benign, and that a preference pane existed which met Apple's high standards for simplicity and usability. It was an exciting day.

First moral: there are fewer evil people in the world than you may think.

Second moral: Your rivals also have good ideas.