The trace package*

Frank Mittelbach

2014/10/28

1 Introduction

When writing new macros one often finds that they do not work as expected (at least I do :-). If this happens and one can’t immediately figure out why there is a problem one has to start doing some serious debugging. TEx offers a lot of bells and whistles to control what is being traced but often enough I find myself applying the crude command \texttt{\textbackslash tracingall} which essentially means “give me whatever tracing information is available”.

In fact I normally use \texttt{\textbackslash e-TEx} in such a case, since that TEx extension offers me a number of additional tracing possibilities which I find extremely helpful. The most important ones are \texttt{\textbackslash tracingassigns}, which will show you changes to register values and changes to control sequences when they happen, and \texttt{\textbackslash tracinggroups}, which will tell you what groups are entered or left (very useful if your grouping got out of sync).

So what I really write is

\texttt{\textbackslash tracingassigns=1\textbackslash tracinggroups=1\textbackslash tracingall}

That in itself is already a nuisance (since it is a mouthful) but there is a worse catch: when using \texttt{\textbackslash tracingall} you do get a awful lot of information and some of it is really useless.

For example, if \texttt{\textbackslash e-TEx} has to load a new font it enters some internal routines of NFSS which scan font definition tables etc. And 99.9% of the time you are not at all interested in that part of the processing but in the two lines before and the five lines after. However, you have to scan through a few hundred lines of output to find the lines you need.

Another example is the \texttt{calc} package. A simple statement like \texttt{\textbackslash setlength \textbackslash linewidth \{1cm\}} inside your macro will result in

\texttt{\textbackslash setlength ->\textbackslash protect \textbackslash setlength \{\textbackslash relax\} \textbackslash setlength ->\textbackslash calc\textbackslash assign\textbackslash skip}

*This file has version number v1.1d, last revised 2014/10/28.
Do you still remember what I was talking about?

No? We’re trying to find a problem in macro code without having to scan too many uninteresting lines. To make this possible we have to redefine a number of key commands to turn tracing off temporarily in the hope that this will reduce
the amount of noise during the trace. For example, if we change one of the \texttt{calc} internals slightly, the above tracing output can be reduced to:

\begin{verbatim}
\setlength ->\protect \setlength
{\relax}
\setlength ->\calc\assign\skip
\calc\assign\skip ->\calc\assign\generic \calc\assign\skip \calc\assign\skip
\calc\assign\generic \#1\#2\#3\#4->\let \calc\A \#1\let \calc\B \#2\expandafter \calc
\open \expandafter (#4!\global \calc\A \calc\B \endgroup #3\calc\B
\#1<-\calc\A\skip
\#2<-\calc\B\skip
\#3<-\linewidth
\#4<-1cm
{\let}
{\let}
{\expandafter}
{\expandafter}
\calc\open (->\begingroup \conditionally@traceoff \aftergroup \calc\initB \begingroup \aftergroup \calc\initB \calc\pre@scan \begingroup
\conditionally@traceoff ->\tracingrestores \z@ \tracingcommands \z@ \tracingpages \z@ \tracingmacros \z@ \tracingparagraphs \z@
{\tracingrestores}
{\tracingcommands}
{\restoring \tracingrestores}=1\}
\calc\initB ->\calc\B \calc\A
{\skip44}
{\dimen27}
\end{verbatim}

Still a lot of noise but definitely preferable to the original case.

I redefined those internals that I found most annoyingly noisy. There are probably many others that could be treated in a similar fashion, so if you think you found one worth adding please drop me a short note.

\texttt{∗∗∗}

The package defines the two macros \texttt{\traceon} and \texttt{\traceoff} to unconditionally turn tracing on or off, respectively. \texttt{\traceon} is like \texttt{\tracingall} but additionally adds \texttt{\tracingassigns} and \texttt{\tracinggroups} if the \TeX{} program (in extended mode) is used. And \texttt{\traceoff} will turn tracing off again, a command which is already badly missing in plain \TeX{}, since it is often not desirable to restrict the tracing using extra groups in the document.

There are also two internal macros that turn tracing on and off, but only if the user requested tracing in the first place. These are the ones that are used internally within the code below.

Since the package overwrites some internals of other packages you should load it as the last package in your preamble using \texttt{\usepackage{trace}}.

The package offers the option \texttt{logonly} that suppresses terminal output during tracing (unless \texttt{\tracingall} is used). This is useful if the \TeX{} implementation used gets rather slow when writing a lot of information to the terminal.

It also offers the option \texttt{full} in which case \texttt{\traceon} will trace all parts of the code, i.e., essentially work like \texttt{\tracingall}.

3
2 A sample file

The following small test file shows the benefits of the trace package. If one uncomments the line loading the package, the amount of tracing data will be drastically reduced. Without the trace package we get 6594 lines in the log file; adding the package will reduce this to 1618 lines.

\documentclass{article}
\usepackage{calc}
%\usepackage{trace} % uncomment to see difference
\begin{document}
\ifx\traceon\undefined \tracingall \else \traceon \fi
\setlength\linewidth{1cm}
\$\text{foo=\bar a}$
\small \texttt{\$} \stop

3 Implementation

This package is for use with \LaTeX\ (though something similar could be produced for other formats).

\NeedsTeXFormat{LaTeX2e}[1998/12/01]

The package has a option that suppresses tracing on the terminal, i.e., if used will not set \texttt{\textbackslash tracingonline} to one. This has been added in version 1.1a since some \TeX\ implementations get rather slow when outputting to a terminal.

\DeclareOption{logonly}{
\let\tracingonline@p\z@
}

The default is showing the tracing information on the terminal.

\DeclareOption{full}{
\AtEndOfPackage{\let\conditionally@traceoff\@empty
\let\conditionally@traceon\@empty
\let\traceon\tr@ce@n
}}
\ProcessOptions\relax

We need a switch to determine if we want any tracing at all. Otherwise, if we use \texttt{\traceoff...\traceon} internally, we would unconditionally turn on tracing even when no tracing was asked for in the first place.
\traceon  This macro ensures that \conditionally@traceoff is actually turning off switches (since \tracinall might have disabled it) and then calls \tr@ce@n to setup tracing.
\def\traceon{\let\conditionally@traceoff\unconditionally@traceoff \tr@ce@n}

\tr@ce@n \conditionally@traceoff  As stated in the introduction, the amount of tracing being done should depend on the formatter we use. So we first test if we are running with ε-TEX in extended mode. In the latter case the command \tracinggroups is defined.\footnote{If some package writer has defined that command name for some reason—too bad—then we make the wrong deduction from this fact and as a result the package will fail.}
\ifx\tracinggroups\undefined
  If we are using standard TEX then \tr@ce@n is more or less another name for \tracingall. The only differences are that we set the above @tracing switch to true and reorder the assignments within it somewhat so that it will output no tracing information about itself. In contrast, \tracingall itself produces

{\@tracingtrue
  \tracingstats\tw@
  \tracingpages\@ne
  \tracinglostchars\@ne
  \tracingparagraphs\@ne
  \tracinglostchars\@ne
  \tracingstresores\@ne
  \tracingcommands\tw@
}

\showoutput ->\tracingoutput \@ne \showboxbreadth \maxdimen \showboxdepth \maxdimen \errorstopmode \showoverfull
\tracingoutput
\showboxbreadth
\showboxdepth
\errorstopmode
\showoverfull ->\tracingonline \@ne
\tracingonline

Which is quite a lot given that none of it is of any help to the task at hand. In contrast \tr@ce@n will produce nothing whatsoever since the noise generating switches are set at the very end.
\def\tr@ce@n{%

We start by setting the @tracing switch to signal that tracing is asked for. This is then followed by setting the various tracing primitives of TEX.
\@tracingtrue
\tracingstats\tw@
\tracingpages\@ne
\tracinglostchars\@ne
\tracingparagraphs\@ne
\errorcontextlines\maxdimen
\tracingoutput\@ne
\showboxbreadth\maxdimen
\showboxdepth\maxdimen
\errorstopmode
\tracingmacros\tw@
\tracingrestores\@ne
\tracingcommands\tw@
The setting of `\tracingonline` depends on the option `logonly`:

\begin{verbatim}
\tracingonline\tracingonline@p
\end{verbatim}

Now what should `conditionally@traceoff` do in this case? Should it revert all settings changed by `\trace@n`? It should not, since our goal is to shorten the trace output, thus setting all of the uninteresting values back makes the output unnecessarily longer. Therefore we restrict ourselves to those `\tracing...` internals that really contribute to listings like the above.

And one additional point is worth mentioning. The order in which we turn the tracing internals off has effects on the output we see. So what needs to be turned off first? Either `\tracingrestores` or `\tracingcommands`; it makes no difference which, as long as they both come first. This is because those two are the only tracing switches that produce output while tracing the command `conditionally@traceoff` itself (see example on page 3).

In principle we would need to test the `@tracing` switch to see if there is anything to turn off; after all, this is the conditional trace off. However this would lead to extra output if we are currently tracing so we skip the test and instead accept that in case we are not doing any tracing we unnecessarily set the tracing primitives back to zero (i.e., the value they already have).

\begin{verbatim}
\def\conditionally@traceoff{%
  \tracingrestores@z@\tracingcommands@z@\tracingpages@z@\tracingmacros@z@
  \tracingparagraphs@z@\tracingoutput@z@\showboxbreadth@m@ne\showboxdepth@m@ne
  \tracingstats@one%\tracinglostchars@z@

  As remarked above there are more tracing switches set by `\trace@n`, however there is no point in resetting `\tracinglostchars` so we leave it alone.
  \tracingstats@one%\tracinglostchars@z@

  Since this is the command that only conditionally turns off tracing we do not touch the `@tracing` switch. This way a `conditionally@traceon` will be able to turn the tracing on again.
%
}
\end{verbatim}

That covers the case for the standard \TeX program. If `\tracingsgroups` was defined we assume that we are running with \eTeX in extended mode.

\begin{verbatim}
\def\tracer@ce@n{%
  \tracingtrue\tracingstats@tw@%\tracingassigns%\tracingscommands@z@\tracingsgroups%\tracingall

  In that case `\trace@n` does more than `\tracingall`: it also turns on tracing of assignments and tracing of grouping.\footnote{These are my personal preference settings; \eTeX does in fact offer some more tracing switches and perhaps one or more of them should be added here as well.} To keep tracing at a minimum `\tracingassigns` should be turned on last (in fact like before we disassemble `\tracingall` and reorder it partially).

  \def\tracer@ce@n{%
    \tracingtrue\tracingstats@tw@%

\end{verbatim}

6
When turning tracing off again we now also have to turn off those additional tracing switches. But what to turn off in what order? Since `\tracingassigns` is quite noisy (two lines of output per assignment) and the whole command expansion consists of assignments, we had best start with this switch and follow it again by `\tracingrestores` and `\tracingcommands`. The rest can be in any order, it doesn't make a difference.

With the same reasoning as before we omit testing for the \tracing switch and always set the primitives back to zero.

\def\conditionally@traceoff{\%\tracingassigns\z@\tracingrestores\z@\tracingcommands\z@\tracingpages\z@\tracingmacros\z@\tracingoutput\z@\showboxbreadth\m@ne\showboxdepth\m@ne\tracingstats\@ne\tracingparagraphs\z@\tracinggroups\z@}\}

This concludes the part that depends on the formatter being used.

\unconditionally@traceoff A saved version of whatever \conditionally@traceoff was defined to be. We need this since the latter might get disabled by \tracingall or by the full option.
\let\unconditionally@traceoff\conditionally@traceoff

\tracingall We redefine \tracingall to trace the same stuff than \tr@ce@n (i.e., more when \e-\TeX is being used) and ensure that everything gets traced by disabling \conditionally@traceoff. And, of course, \tracingall should always report on the terminal.
\def\tracingall{\let\conditionally@traceoff\@empty\let\tracingonline\@p\one\tr@ce@n\}

\unconditionally@traceoff
\tracingall
Above we have defined \texttt{\conditionally@traceoff} and \texttt{\traceon} so now we have to define their counterparts.

To stop tracing unconditionally we call \texttt{\unconditionally@traceoff} and then reset the \texttt{@tracing} switch to false.

\begin{verbatim}
\def\traceoff{\unconditionally@traceoff \@tracingfalse}
\end{verbatim}

Now the \texttt{\conditionally@traceon} command will look at the \texttt{@tracing} switch and if it is true it will call \texttt{\traceon} to restart tracing (note that the latter command unnecessarily sets the switch to true as well). The reason for the \texttt{\expandafter} is to get rid of the \texttt{\fi} primitive which would otherwise show up in the tracing output (and perhaps puzzle somebody).

\begin{verbatim}
\def\conditionally@traceon{\if@tracing \expandafter \traceon \fi}
\end{verbatim}

The rest of the package now consists of redefinitions of certain commands to make use of \texttt{\conditionally@traceoff}.

### 3.1 Taming \texttt{calc}

\begin{verbatim}
\def\calc@open(){\begingroup \conditionally@traceoff \aftergroup\calc@initB \begingroup\aftergroup\calc@initB \calc@pre@scan}
\end{verbatim}

### 3.2 Making NFSS less noisy

\begin{verbatim}
\def\define@newfont{%
 \begingroup \conditionally@traceoff \let\typeout\@font@info \escapechar\m@ne \expandafter\expandafter\expandafter
 \split@name\expandafter\string\font@name\@nil \try@load@fontshape % try always \expandafter\ifx \csname\curr@fontshape\endcsname \relax \\wrong@fontshape\else \extract@font\fi \endgroup}
\end{verbatim}

\frozen@everymath \frozen@everydisplay At the beginning of every math formula NFSS will check whether or not the math fonts are properly set up and if not will load whatever is needed.
4 Checking for italic corrections

When executing \textit or its friends, \LaTeX looks ahead to determine whether or not to add an italic correction at the end. This involves looping through the \nocorrlist which outputs a lot of tracing lines we are normally not interested in. So we disable tracing for this part of the processing.

\begin{verbatim}
\def \maybeic { %
  \ifdim \fontdimen\@ne\font>\z@ 
  \else 
  \conditionally@traceoff
  \maybeictrue
  \expandafter\@tfor\expandafter\reserved@a\expandafter=\expandafter=%
  \nocorrlist
  \do \t@stic
  \if\maybeic \sw@slant \fi
  \conditionally@traceon
  \fi
  \fi
}
\end{verbatim}