Using LuaTEx the hard way

How to use the internal node structure of LuaTEx to create a PDF document without using \backslashes

Patrick Gundlach
speedata
gundlach@speedata.de
What I like about \TeX

The Book of Tea

in others. The average Westerner, in his sleek complacency, will see in the tea ceremony but another instance of the thousand and one oddities which constitute the quaintness and childishness of the East to him. He was wont to regard Japan as barbarous while she indulged in the gentle arts of peace: he calls her civilised since she began to commit wholesale slaughter on Manchurian battlefields. Much comment has been given lately to the Code of the Samurai,—the Art of Death which makes our soldiers exult in self-sacrifice; but scarcely any attention has been drawn to Teaism, which represents so much of our Art of Life. Fain would we remain barbarians, if our claim to civilisation were to be based on the gruesome glory of war. Fain would we await the time when due respect shall be paid to our art and ideals.

When will the West understand, or try to understand, the East? We Asiatics are often appalled by the curious web of facts and fancies which has been woven concerning us. We are pictured as living on the perfume of the lotus, if not on mice and cockroaches. It is either impotent fanaticism or else abject voluptuousness. Indian spirituality has been decried as ignorance, Chinese sobriety as stupidity. Japanese patriotism as the result of fatalism. It has been said that we are less sensible to pain and wounds on account of the callousness of our nervous organisation!

Why not amuse yourselves at our expense? Asia returns the compliment. There would be further food for merriment if you were to know all that we have imagined and written about you. All the glamour of the perspective is there, all the unconscious homage of wonder, all the silent resentment of the new and undefined. You have been loaded with
What I like about TEx

Vorwort

Wie sonderbar, dass ich, der ich die Welt beherrsche, mit 32 Schachfiguren nicht fertig werde.

HARUN AL-RASCHID (763–809), abbasidischer Kalif

11. ... e5!

<table>
<thead>
<tr>
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<th>12</th>
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<td>♗e2</td>
<td>♗f4</td>
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<td>♗d4</td>
<td>♗d4</td>
<td>♗d4</td>
</tr>
</tbody>
</table>

12. ♗h7 ♗h7 \(\equiv\) Tab. 9, S. 250.
What I don’t like about T\TeX{}

\cs_new_protected:Npn \__xparse Declare_cmd_mixed_aux:Nn #1#2
\{
  \__xparse Flush_m_args:
  \cs_generate_from_arg_count:cNnn
  { \l\__xparse Function_tl \c_space_tl code }
  \cs_set_protected:Npn \l\__xparse Current_arg_int {#2}
  \cs_set_protected_nopar:Npx #1
  { \int_zero:N \l\__xparse Processor_int
    \tl_set:Nn \exp_not:N \l\__xparse Args_tl
    { \exp_not:c \{ \l\__xparse Function_tl \c_space_tl code \} }
    \tl_set:Nn \exp_not:N \l\__xparse Fn_tl
    { \exp_not:c \{ \l\__xparse Function_tl \c_space_tl \} }
    \exp_not:o \l\__xparse Signature_tl
    \exp_not:N \l\__xparse Args_tl
  }
\}

self explaining, of course
What I don’t like about \TeX

(sorry, David)
My Conclusion (I)

I like to use \TeX, but I am afraid of programming it.
How can I visualize boxes?

This question led to a new package:
lua-visual-debug

Some of you may know the Web Developer Toolbar for Firefox that can outline the block level elements of a page like this:

TeX, LaTeX and Friends

Is there a way to do something similar with TeX boxes for a complete document?

{boxes}
Let me give you a short introduction to visual debugging in \TeX

\begin{verbatim}
\input supp-vis \showmakeup
\end{verbatim}

For those who want to take a closer look at all those kerns, skips and penalties, this articles can be of some help. Although this kind of stuff often attracts the more hacking type of reader, the module described here can be of great help and provide a lot of fun to all \TeX users, whatever macropackage they use.

When \TeX builds paragraphs and pages, it takes a lot into account. Even after years of writing macros the interference of skips, kerns, penalties, boxes and rules sometimes surprises me. One must always be aware of interline skips, top of page skips, good breaks and no breaks, either user supplied or system generated.

The idea to build some visualization macros was born while I was documenting the source of \textsc{Con}\TeX. Because this package is quite complete, the full documentation will be laid down in thousands of pages. Such technical documentation cannot go without showing how things are done. Because most macros at the user level have some visual impact, I decided to build a visualization tool. After having written this bunch of macros, their second purpose soon became visual debugging.

The concept is rather simple: replace the primitives \texttt{\textbackslash box}, \texttt{\textbackslash skip}, \texttt{\textbackslash kern}, \texttt{\textbackslash penalty}, \texttt{\textbackslash glue}, \texttt{\textbackslash ss}, \texttt{\textbackslash fil} and \texttt{\textbackslash fil.neg} by macros that makes them visible. Most advanced \TeX tutorials give examples of adapting the primitive \texttt{\textbackslash par}, but somehow tampering with other \TeX primitives is considered more tricky. Although the name primitive suggest that they are somehow fixed, even primitives can be \texttt{\textbackslash let’d} or \texttt{\textbackslash def’d} to something
Second answer
1 A short story

A wonderful serenity has taken possession of my entire soul, like these sweet mornings of spring which I enjoy with my whole heart. I am alone, and feel the charm of existence in this spot, which was created for the bliss of souls like mine. I am so happy, my dear friend, so absorbed in the exquisite sense of mere tranquil existence, that I neglect my talents.

- one
- two
- three

Hello

World

\[ \int_e^{\infty} = mc^2 \]
I. A short story.

A wonderful serenity has taken possession of my entire soul, like these sweet mornings of spring which I enjoy with my whole heart. I am alone, and feel the charm of existence in this spot, which was created for the bliss of souls like mine. I am so happy, my dear friend, so absorbed in the exquisite sense of mere tranquil existence, that I neglect my talents.

- one.
- two.
- three.

Hello.

World.

\[\int \dop x = mc^2\]
Detail
A wonderful serenity has taken possession of my entire soul, like these sweet mornings of spring which I enjoy with my whole heart. I am alone, and feel the charm of existence in this spot, which was created for the bliss of souls like mine. I am so happy, my dear friend, so absorbed in the exquisite sense of mere tranquil existence, that I neglect my talents.

\begin{itemize}
\item one
\item two
\item three
\end{itemize}

\bgroup\fontsize{30}{34}\selectfont
\centerline{\TeX}
\egroup

\vbox{\strut Hello}\kern .5cm\vbox{\strut World}

\begin{equation}
\int_e^\infty = mc^2
\end{equation}
Intermediate format

- Data structure: lists of nodes

![Diagram of node structure]

- Example: glyph node (letter “H”)

```
n = node.new("glyph")
n.char = 72
n.font = 0
n.lang = 1
```

**Glyph node “H”**
A wonderful serenity has taken possession of my entire soul, like these sweet mornings of spring which I enjoy with my whole heart. I am alone, and feel the charm of existence in this spot, which was created for the bliss of souls like mine.
Detail
Detail
Detail

PDF

1 0 0 RG 0 0 10 5 res

red
# PDF instructions

<table>
<thead>
<tr>
<th>pdf_literal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>data</strong></td>
</tr>
<tr>
<td><strong>mode</strong></td>
</tr>
<tr>
<td><strong>next</strong></td>
</tr>
<tr>
<td><strong>prev</strong></td>
</tr>
</tbody>
</table>

```lua
node.new("whatsit","pdf_literal")
node.data = "1 0 0 RG 0 0 10 5 re s"
node.mode = 0
node.next = ...
node.prev = ...
```
current node := beginning of list
while current node is not a valid node
    if current node is a kern, then insert pdf code
    set current node to the next node
end
current node := beginning of list
while current node is not nil
    if current node is a hbox/vbox then
        do the same with the contents of the list
    look at current node and insert pdf code
    set current node to the next node
end
In Lua

current_node = head
while current_node do
    if current_node.id == node.id("kern") then
        rectangle = node.new("whatsit","pdf_literal")
        rectangle.data = "1 0 0 RG 0 0 5 10 re s"
        node.insert_before(head,current_node,rectangle)
    elseif current_node.id == node.id("penalty") then
        ....
    end
    current_node = current_node.next
end
\usepackage{atbegshi}
\AtBeginShipout{
directlua{
    analyze_box(
        tex.box["AtBeginShipoutBox"]
    )
}
}
My Conclusion (II)

Writing Lua-code is super simple, once you understand the underlying data structure.
Part II

How to write \TeX text without any* backslashes

Demo time!

(*) six backslashes are the minimum?!?
A first document

document.tex

\directlua{
    dofile('document.lua')
}
\bye

document.lua

g = node.new("glyph")
g.char = string.byte('H')
g.font = 1

h = node.hpack(g)
node.write(h)