The LuauL package*

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1 User-level interface

LuauL uses new capabilities of the LuaTeX engine to provide underlining/strikethrough/highlighting etc. support without breaking ligatures, kerning or restricting input. The predefined user-level commands are `\underLine`, `\highLight`, and `\strikeThrough`. (`\highLight` will only work correctly if the `luacolor` package is loaded) They are used as

```
\documentclass{article}
\usepackage{luaul}
\begin{document}
This package is \strikeThrough{useless}\underLine{awesome}!
\end{document}
```

This package is ~~useless~~awesome!

For limited compatibility with `soul`, the `soul` package option allows you to use the traditional macro names from `soul` instead:

```
\documentclass{article}
\usepackage[soul]{luaul}
\begin{document}
This package is \st{useless}\ul{awesome}!
\end{document}
```

2 Expert interface

`\newunderlinetype` Sometimes, you might try to solve more interesting problems than boring un-

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derlining, strikethrough or highlighting. Maybe you always wanted to be your own spell checker, want to demonstrate your love for ducks or you think that the traditional `\strikeThrough` is not visible enough. For all these cases, you can define your own "underlining" command based on a TEX `\[cxg]leaders` command.

For this, use

`\newunderlinetype`⟨*macro name*⟩`[`⟨*context specifier*⟩`]{`⟨`\leaders` *command*⟩`}`

First, you have to pass the name of the command which should enable your new kind of underlining. (If you want to have an additional command which takes an argument and underlines this argument, you will have to define this manually.) The optional argument provides a "context": This "context" has to expand to a string (something that can appear in a csname) which changes if the leaders box should be recalculated. The leader will be chached and reused whenever the context evaluates to the same string. So if your leaders should depend on the fontsize, the expansion of the context should contain the font size. If you leaders contain text in the current font, your context should include `\fontname`. The default context includes the current size of `1ex` and the current color if luacolor is loaded.

The final argument contains the actual leader command. You should omit the final glue normally passed to `\leaders`, so e.g. write `\leaders\hbox{ . }` without appending `\hfill` or `\hskip1pt` etc. The height and depth of your leaders is ignored to ensure that adding underlines etc. does not change the general text layout. It is your responsibility to ensure that you are not too high or too low and intercept other lines. On the other hand, running dimensions work fine if you use a rule.

For example, the special underline commands demonstrated above are implemented as

```
\usepackage{luacolor,tikzducks,pict2e}
\newunderlinetype\beginUnderDuck{\cleaders\hbox{%
  \begin{tikzpicture}[x=.5ex,y=.5ex,baseline=.8ex]%
    \duck
  \end{tikzpicture}%
}}
\newcommand\underDuck[1]{{\beginUnderDuck#1}}
\newunderlinetype\beginUnderWavy[\number\dimexpr1ex]{\cleaders\hbox{%
    \setlength\unitlength{.3ex}%
    \begin{picture}(4,0)(0,1)
      \thicklines
      \color{red}%
      \qbezier(0,0)(1,1)(2,0)
      \qbezier(2,0)(3,-1)(4,0)
    \end{picture}%
}}
\newcommand\underWavy[1]{{\beginUnderWavy#1}}
\newunderlinetype\beginStrikeThough{\leaders\hbox{%
    \normalfont\bfseries/%
}}
```

```
\newcommand\StrikeThough[1]{{\beginStrikeThough#1}}
```

Here `\underWavy` uses a custom context because it doesn't change depending on the current font color.

If you only want to use `\newunderlinetype` and do not want to use the predefined underline types, you can use the `minimal` package option to disable them.

3 The implementation

3.1 Helper modules

First we need a separate Lua module `pre_append_to_vlist_filter` which provides a variant of the `append_to_vlist_filter` callback which can be used by multiple packages. This ensures that we are compatible with other packages implementing `append_to_vlist_filter`. First check if an equivalent to `pre_append_to_vlist_filter` already exists. The idea is that this might eventually get added to the kernel directly.

```
if luatexbase.callbacktypes.pre_append_to_vlist_filter then
  return
end

local call_callback = luatexbase.call_callback
local flush_node = node.flush_node
local prepend_prevdepth = node.prepend_prevdepth
local callback_define
```

HACK: Do not do this at home! We need to define the engine callback directly, so we use the debug library to get the "real" `callback.define`:

```
for i=1,5 do
  local name, func = debug.getupvalue(luatexbase.disable_callback, i)
  if name == 'callback_register' then
    callback_define = func
    break
  end
end
if not callback_define then
  error[[Unable to find callback.define]]
end

local function filtered_append_to_vlist_filter(box,
                                               locationcode,
                                               prevdepth,
                                               mirrored)
  local current = call_callback("pre_append_to_vlist_filter",
                                box, locationcode, prevdepth,
```

```
                                mirrored)
  if not current then
    flush_node(box)
    return
  elseif current == true then
    current = box
  end
  return call_callback("append_to_vlist_filter",
                       box, locationcode, prevdepth, mirrored)
end

callback_define('append_to_vlist_filter',
                filtered_append_to_vlist_filter)
luatexbase.callbacktypes.append_to_vlist_filter = nil
luatexbase.create_callback('append_to_vlist_filter', 'exclusive',
                           function(n, _, prevdepth)
                             return prepend_prevdepth(n, prevdepth)
                           end)
luatexbase.create_callback('pre_append_to_vlist_filter',
                           'list', false)
```

3.2 Lua module

Now we can define our main Lua module:

```
local hlist_t = node.id'hlist'
local vlist_t = node.id'vlist'
local kern_t = node.id'kern'
local glue_t = node.id'glue'

local char_given = token.command_id'char_given'

local underlineattrs = {}
local underline_types = {}
local saved_values = {}
local function new_underline_type()
  for i=1,#underlineattrs do
    local attr = underlineattrs[i]
    saved_values[i] = tex.attribute[attr]
    tex.attribute[attr] = -0x7FFFFFFF
  end
  local b = token.scan_list()
  for i=1,#underlineattrs do
    tex.attribute[underlineattrs[i]] = saved_values[i]
  end
  local lead = b.head
  if not lead.leader then
    tex.error("Leader required", {"An underline type has to \z
      be defined by leader. You should use one of the", "commands \z
      \\leaders, \\cleaders, or \\xleader, or \\gleaders here."})
```

```
  else
    if lead.next then
    tex.error("Too many nodes", {"An underline type can only be \z
        defined by a single leaders specification,", "not by \z
        multiple nodes. Maybe you supplied an additional glue?",
        "Anyway, the additional nodes will be ignored"})
    end
    table.insert(underline_types, lead)
    b.head = lead.next
    node.flush_node(b)
  end
  token.put_next(token.new(#underline_types, char_given))
end
local function set_underline()
  local j
  for i=1,#underlineattrs do
    local attr = underlineattrs[i]
    if tex.attribute[attr] == -0x7FFFFFFF then
      j = attr
      break
    end
  end
  if not j then
    j = luatexbase.new_attribute(
        "luaul" .. tostring(#underlineattrs+1))
    underlineattrs[#underlineattrs+1] = j
  end
  tex.attribute[j] = token.scan_int()
end
local functions = lua.get_functions_table()
local new_underline_type_func =
    luatexbase.new_luafunction"luaul.new_underline_type"
local set_underline_func =
    luatexbase.new_luafunction"luaul.set_underline_func"
token.set_lua("LuauLNewUnderlineType", new_underline_type_func)
token.set_lua("LuauLSetUnderline", set_underline_func, "protected")
functions[new_underline_type_func] = new_underline_type
functions[set_underline_func] = set_underline

local add_underline_h
local function add_underline_v(head, attr)
  for n in node.traverse(head) do
    if head.id == hlist_t then
      add_underline_h(n, attr)
    elseif head.id == vlist_t then
      add_underline_v(n.head, attr)
    end
  end
end
function add_underline_h(head, attr)
```

```
  local used = false
  node.slide(head.head)
  local last_value
  local first
  for n in node.traverse(head.head) do
    local new_value = node.has_attribute(n, attr)
    if n.id == hlist_t then
      new_value = nil
      add_underline_h(n, attr)
    elseif n.id == vlist_t then
      new_value = nil
      add_underline_v(n.head, attr)
    elseif n.id == kern_t and n.subtype == 0 then
      if n.next and not node.has_attribute(n.next, attr) then
        new_value = nil
      else
        new_value = last_value
      end
    elseif n.id == glue_t and (
        n.subtype == 8 or
        n.subtype == 9 or
        n.subtype == 15 or
    false) then
      new_value = nil
    end
    if last_value ~= new_value then
      if last_value then
        local width = node.rangedimensions(head, first, n)
        local kern = node.new(kern_t)
        kern.kern = -width
        local lead = node.copy(underline_types[last_value])
        lead.width = width
        head.head = node.insert_before(head.head, first, lead)
        node.insert_after(head, lead, kern)
      end
      if new_value then
        first = n
      end
      last_value = new_value
    end
  end
  if last_value then
    local width = node.rangedimensions(head, first)
    local kern = node.new(kern_t)
    kern.kern = -width
    kern.next = node.copy(underline_types[last_value])
    kern.next.width = width
    node.tail(head.head).next = kern
  end
end
```

```
local function filter(b, loc, prev, mirror)
  for i = 1, #underlineattrs do
    add_underline_v(b, underlineattrs[i])
  end
  return true
end
require'pre_append_to_vlist_filter'
luatexbase.add_to_callback('pre_append_to_vlist_filter',
                           filter, 'add underlines to list')
```

3.3 TEX support package

Now only some LATEX glue code is still needed Only LuaLATEX is supported. For other engines we show an error.

```
\ifx\directlua\undefined
  \PackageError{luaul}{LuaLaTeX required}%
  {LuauL requires LuaLaTeX.
   Maybe you forgot to switch the engine in your editor?}
\fi
\directlua{require'luaul'}
\RequirePackage{xparse}
```

We support some options. Especially `minimal` will disable the predefined commands `\underLine` and `\strikeThrough` and allow you to define similar commands with your custom settings instead, `soul` tries to replicate names of the `soul` package.

```
\newif\ifluaul@predefined
\newif\ifluaul@soulnames
\luaul@predefinedtrue
\DeclareOption{minimal}{\luaul@predefinedfalse}
\DeclareOption{soul}{\luaul@soulnamestrue}
\ProcessOptions\relax
```

Just one more tiny helper.

```
\protected\def\luaul@maybedefineuse#1#2{%
  \unless\ifcsname#1\endcsname
    \expandafter\xdef\csname#1\endcsname{#2}%
  \fi
  \csname#1\endcsname
}
```

The main macro.

```
\NewDocumentCommand\newunderlinetype{mO{\luaul@defaultcontext}m}{%
  \newcommand#1{}% "Reserve" the name
  \protected\def#1{%
    \expandafter\luaul@maybedefineuse
      \expanded{{\csstring#1@@#2}}%
      {\LuauLSetUnderline
        \LuauLNewUnderlineType\hbox{#3\hskip0pt}%
```

```
  }}%
}
\ifluaul@predefined
  \newcommand\luaul@defaultcontext{%
    \number\dimexpr1ex
    @\unless\ifx\undefined\LuaCol@Attribute
      \the\LuaCol@Attribute
    \fi
  }
  \newunderlinetype\@underLine%
    {\leaders\vrule height -.65ex depth .75ex}
  \newcommand\underLine[1]{{\@underLine#1}}
  \newunderlinetype\@strikeThrough%
    {\leaders\vrule height .55ex depth -.45ex}
  \newcommand\strikeThrough[1]{{\@strikeThrough#1}}
  \newunderlinetype\@highLight[\number\dimexpr1ex]%
    {\color{yellow}\leaders\vrule height 1.75ex depth .75ex}
  \newcommand\highLight[1]{{\@highLight#1}}
  \ifluaul@soulnames
    \let\textul\underLine \let\ul\textul
    \let\textst\strikeThrough \let\st\textst
    \let\texthl\highLight \let\hl\texthl
  \fi
\fi
```