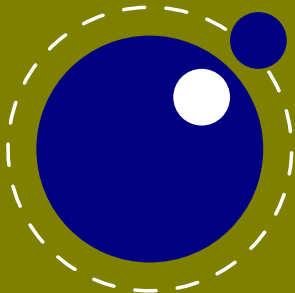


루아텍 노드와 콜백

LuaTeX Nodes and Callbacks



남수진

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고려대학교

오늘 이야기할 내용

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노드 Nodes

콜백 Callbacks

노드와 콜백 사용 예제

맷음말



루아텍 다시 보기

2016년 학술대회, LuaTeX 활용, 프로그래밍 언어와 조판 시스템의 콜라보

루아텍을 사용하는 이유가 단지 텍에서 루아 스크립트를 사용하기 위해서라면, 알아야 할 것은 다음 한 줄로 충분하다.

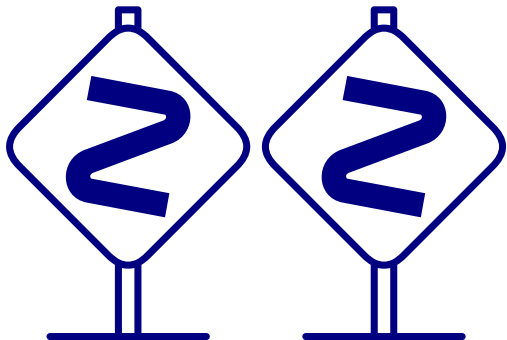
```
\directlua{tex.print("안녕하세요")}
```

루아텍은 그동안 감춰져있던 텍의 내부를 속속들이 공개하여 루아 스크립트로 그들을 다룰 수 있게 하였다.

텍의 내부와 동작 원리¹를 이해한다면 루아텍을 통하여 텍의 진수를 맛볼 수 있다.

¹The TeXbook과 TeX by Topic을 읽어 볼 것을 권한다.



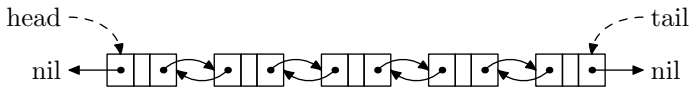


노드: 프로그래밍 관점에서

노드는 여러 속성들을 가지고 있는 객체이다.

노드는 `next`, `prev` 라고 불리우는 두 개의 포인터로 서로 연결되어 노드 리스트(doubly linked list)를 이룬다.

포인터 `head` 는 노드 리스트의 첫번째 노드를 가리키고, `tail` 포인터는 맨 마지막 노드를 가리킨다.



노드: 루아텍 관점에서

페이지를 구성하는 원자(atom), 텍은 노드들을 조합하여 하나의 페이지를 만든다.

하나의 페이지는 여러 개의 문단으로 구성되어있고, 하나의 문단(vbox)은 라인(hbox)들과 `penalty`, `glue` 노드들로 이루어져있고, 각 라인(hbox)은 대부분 `glyph`와 `glue` 노드로 구성된다.

```
\hsize 90pt  
A long time ago in a galaxy  
far, far away $\ldots$.  
\par
```



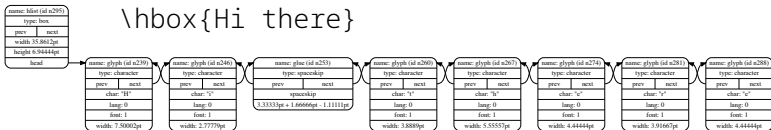
노드의 종류

ID	NAME	ID	NAME	ID	NAME	ID	NAME
0	hlist	1	vlist	2	rule	3	ins
4	mark	5	adjust	6	boundary	7	disc
8	whatsit	9	local_par	10	dir	11	math
12	glue	13	kern	14	penalty	15	unset
16	style	17	choice	18	noad	19	radical
20	fraction	21	accent	22	fence	23	math_char
24	sub_box	25	sub_mlist	26	math_text_char	27	delim
28	margin_kern	29	glyph	30	align_record	31	pseudo_file
32	pseudo_line	33	page_insert	34	split_insert	35	expr_stack
36	nested_list	37	span	38	attribute	39	glue_spec
40	attribute_list	41	temp	42	align_stack	43	movement_stack
44	if_stack	45	unhyphenated	46	hyphenated	47	delta
48	passive	49	shape				

node.types(), This is LuaHBTeX, Version 1.15.0 (TeX Live 2022)



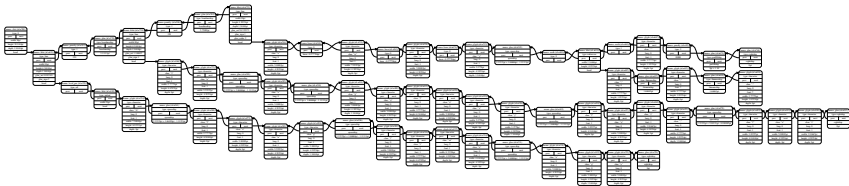
노드 리스트



`\hsize 90pt`

A long time ago in a galaxy
far, far away \ldots .

`\par`



노드 리스트 순회 방법

노드 리스트 안의 노드들을 방문하면서 여러가지 일을 할 수 있다.

포인터 **head**로 노드 리스트의 첫번째 노드를 알 수 있고, 그 노드의 **next** 포인터를 따라가면 다음 노드로 이동하고, 또 그 노드의 **next** 포인터를 따라가고

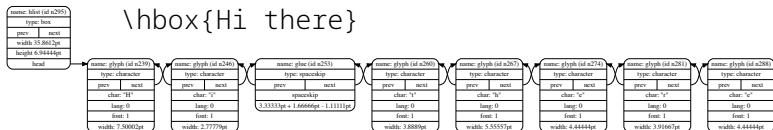
노드_포인터 := 리스트의 시작 노드;

while 노드_포인터가 *nil* 이 아니다 **do**

 노드_포인터가 가리키는 노드를 방문한다;

 노드_포인터를 현재 노드의 next 포인터로 변경한다;

end



노드 리스트 순회 방법

노드_포인터 := 리스트의 시작 노드;

while 노드_포인터가 *nil* 이 아니다 **do**

if 노드_포인터가 가리키는 노드가 *hlist/vlist* 노드 이다 **then**

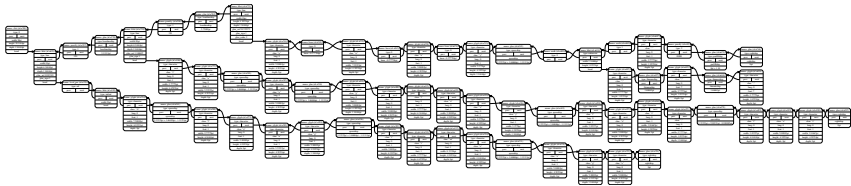
 그 노드의 리스트를 순회 한다;

end

 노드_포인터가 가리키는 노드를 방문한다;

 노드_포인터를 현재 노드의 *next* 포인터로 변경한다;

end



노드 리스트 순회 방법

```
visit_node = function (head)
  local curr = head
  while curr ~= nil do
    if curr.id == 0 or curr.id == 1 then -- hlist/vlist
      visit_node(curr.head)
    elseif curr.id == 29 then -- glyph
      do_something_with_glyph(curr)
    elseif curr.id == 12 then -- glue
      do_something_with_glue(curr)
    end
    curr = curr.next
  end
  return head
end
```



노드 리스트 순회 방법

```
visit_node = function (head)
  local curr = head
  while curr ~= nil do
    if curr.id == node.id("hlist")
      or curr.id == node.id("vlist") then
      visit_node(curr.head)
    elseif curr.id == node.id("glyph") then
      do_something_with_glyph(curr)
    elseif curr.id == node.id("glue") then
      do_something_with_glue(curr)
    end
    curr = curr.next
  end
  return head
end
```



노드 리스트 순회 방법

```
visit_glyph_node = function (head)
  for curr in node.traverse_id(node.id("glyph"), head) do
    do_something_with_glyph(curr)
  end
  return head
end
```

```
visit_hlist_node = function (head)
  for curr in node.traverse_id(node.id("hlist"), head) do
    do_something_with_hlist(curr)
  end
  return head
end
```



노드 라이브러리

노드 또는 노드 리스트를 쉽게 다룰 수 있도록 여러가지 유틸리티를 제공

```
node.id(), node.new(), node.remove(),  
node.copy(), node.free(), node.flush_node(),  
node.traverse(), node.traverse_id(),  
node.traverse_char(), node.traverse_glyph(),  
node.traverse_list(), node.slide(),  
node.tail(),  
node.insert_before(), node.insert_after(),  
node.hpack(), node.vpack(),  
node.ligatureing(), node.kerning(),  
node.lastnode(),  
...
```



콜백: 프로그래밍 관점에서

콜백은 함수인데 주로 다른 함수의 인수로 사용된다. 콜백을 넘겨받는 함수는 특정 이벤트가 발생하거나 어떤 조건을 만족하면 콜백을 호출하여 실행한다.

*A nice way of imagining how a callback function works is that it is a function that is **called at the back** of the function it is passed into.*

훅(Hooks): 프로그램의 실행 흐름에서 특정 단계의 전, 후에 추가되거나 그 단계를 대체하여 실행하는 코드(함수)에 관한 프로그래밍 기법이다.

훅에서 실행되는 코드나 함수를 **핸들러(handler)**라고 하고, 이때 사용되는 개념이 콜백이다.

핸들러를 특정 단계 전/후에 추가하거나 대체하는 과정을 "**핸들러를 등록(register)한다**" 라고 한다.



콜백: 루아텍 관점에서

루아텍의 콜백은 앞서 설명한 훅의 핸들러에 해당한다.

텍 처리 과정인 **입력**, **확장**, **실행**, **조판**의 단계에서 원하는 곳에 콜백을 등록하여 텍 동작을 수정하거나 갈아 치울 수 있다.

콜백은 텍이 입력 버퍼를 처리하는 데서 부터 문단을 만들거나 오프타입 폰트를 로딩하는 부분까지 다양하다.

콜백 등록과 해제

```
my_cb = function (an_arg)
    do_something_with(an_arg)
end
callback.register("some_callback", my_cb)
callback.register("some_callback", nil)
```



Centred last lines

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Centred last lines

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Centred last lines

```
centred_lastline = function (head)
  local myglue = node.new(node.id("glue"))
  myglue.width = 0 -- 0pt plus 1fil
  myglue.stretch = 1*2^16
  myglue.stretch_order = 2

  local line = node.tail(head) -- last line
  node.insert_before(line.head, line.head, myglue)
  line.head = myglue

  line.head = node.hpack(line.head, line.width, "exactly")
  return head
end
luatexbase.add_to_callback("post_linebreak_filter",
                           centred_lastline,
                           "centred_lastline")
```



Centred last lines

T_EX by Topic 18.3.1 Centred last lines

```
\leftskip=0cm plus 0.5fil \rightskip=0cm plus -0.5fil  
\parfillskip=0cm plus 1fil
```



Raggedright

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Justified

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Between raggedright and justified

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Between raggedright and justified

```
eatlines = function (head)
  for line in node.traverse_id(node.id("hlist"), head) do
    if line.glue_order == 0      -- finite glue
      and line.glue_sign == 1 -- stretching
      and line.glue_set > .2    -- ratio
    then
      line.head = node.hpack(line.head)
    end
  end
  return head
end
luatexbase.add_to_callback("post_linebreak_filter",
                           eatlines, "eatlines")
```



Between raggedright and justified

T_EX by Topic 5.9.6 Dissecting paragraphs with \lastbox

```
\newbox\linebox \newbox\snapbox
\def\eatlines{
  \setbox\linebox\lastbox      % check the last line
  \ifvoid\linebox
  \else                        % if it's not empty
  \unskip\unpenalty           % take whatever is
  {\eatlines}                 % above it;
                              % collapse the line
  \setbox\snapbox\hbox{\unhcopy\linebox}
                              % depending on the difference
  \ifdim\wd\snapbox<.98\wd\linebox
    \box\snapbox % take the one ore the other,
  \else \box\linebox \fi
  \fi}
```



Fadelines

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Fadelines

```
fadelines = function (head)
  local graycolor = node.new("whatsit", "pdf_colorstack")
  local gvalue = 0
  for line in node.traverse_id(node.id("hlist"), head) do
    graycolor.data = gvalue .. " g"
    node.insert_before(head, line, node.copy(graycolor))
    gvalue = math.min(gvalue+0.06, 1)
  end
  return head
end
luatexbase.add_to_callback("post_linebreak_filter",
                           fadelines, "fadelines")
```



다양한 예제

- CHICKENIZE
- Three things you can do with Lua \TeX that would be extremely painful otherwise
- gist.github.com/dohyunkim/drawcharbox.lua
- github.com/dohyunkim/colorjamo
- github.com/dohyunkim/luatexko
- <https://tex.stackexchange.com/search?q=%5Bluatex%5D+call-back>



LuaTeXnician 이 되는 방법

간단하다. 아래의 책들을 순서대로 읽는다.

1. [The TeXbook](#) by Donald E. Knuth
2. [TeX by Topic, A TeXnician's Reference](#) by Victor Eijkhout
3. [The ε-TeX manual](#) by The NTS Team
4. [The pdfTeX user manual](#) by Han The Thanh and friends
5. [Programming in Lua](#) by Roberto Ierusalimschy
6. [The LuaTeX Reference Manual](#) by LuaTeX development team

루아테크니션이 되었다면, [LuaTeX-ko 개발](#)에 참여한다.



- 루아텍은 노드와 콜백으로 그동안 다루기 힘들었던 텍 내부에 접근 할 수 있게 되었다.
- 루아텍을 통하여 텍의 진수를 맞볼 수 있다.
- 패키지 개발할때 루아텍을 이용하는 것이 더욱 직관적이고 코드도 이해하기 쉽고, 버그를 줄일 수 있다.
- 루아텍은 패키지 개발자 뿐만 아니라, 일반 사용자에게도 많은 이로움을 제공한다. 특히 한글 문서는 LuaTeX-ko를 사용하는 것을 권한다.
- 일반 (라)텍 사용자를 넘어 루아테크니션이 되자.

