

# The lualibs package

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2019/07/04 v2.66

## Abstract

Additional Lua functions taken from the `l-*` and `util-*` files of Con $\TeX$ t. For an introduction on this package (among others), please refer to the document `lualatex-doc.pdf`.

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## I Package Description

### 1 OVERVIEW

Lua is a very minimal language, and it does only have a minimal standard library. The aim of this package is to provide an extended standard library, to be used by various Lua $\TeX$  packages. The code is specific to Lua $\TeX$  and depends on Lua $\TeX$  functions and modules not available in regular lua.  
The code is derived from Con $\TeX$ t libraries.

## 2 USAGE

You can either load the `lualibs` module, which will in turn load one of two sets of libraries provided by this package: `require("lualibs")`, or explicitly load the modules you need, e.g.: `require("lualibs-table")`, please note that some modules depend on others.

### 2.1 *Loading Library Collections*

The libraries are split into a basic and an extended collection. Though neither initialization time nor memory consumption will be noticeably impacted,<sup>1</sup> the `lualibs` package can skip loading of the latter on demand. The `config` table needs to be present prior to loading the package for this to work (in the future this may be achieved by an option of `\usepackage` for  $\TeX$  users). In the `lualibs` field, set `load_extended` to false:

```
\directlua{
  --- 1) create config table safely
  config          = config or { }
  config.lualibs   = config.lualibs or { }

  --- 2) unset the load_extended entry
  config.lualibs.load_extended = false

  --- 3) load the lualibs
  require "lualibs"
}
```

However, there is no guarantee that the extended set remains permanently excluded. Re-loading the package at a later point will cancel this option and possibly add the missing libraries.

### 2.2 *Loading libraries Individually*

In order to load the table module you would actually have to prepare it as follows:

```
require"lualibs-lua"
require"lualibs-lpeg"
require"lualibs-table"
```

If your code is run by the `texlua` interpreter, you will need to initialize `kpse` library so that `require()` can find files under `TEXMF` tree: `kpse.set_program_name("luatex")`.

---

<sup>1</sup>Note that in terms of code this is only a small fraction of what Con $\TeX$ t loads with every run.

---

Table 1: The basic set.		
lua <sub>libs</sub> name	ConT <sub>E</sub> Xt name	primary purpose
lua <sub>libs</sub> -lua.lua	l-lua.lua	compatibility
lua <sub>libs</sub> -package.lua	l-package.lua	Lua file loaders
lua <sub>libs</sub> -lpeg.lua	l-lpeg.lua	patterns
lua <sub>libs</sub> -function.lua	l-function.lua	defines a dummy function
lua <sub>libs</sub> -string.lua	l-string.lua	string manipulation
lua <sub>libs</sub> -table.lua	l-table.lua	serialization, conversion
lua <sub>libs</sub> -boolean.lua	l-boolean.lua	boolean converter
lua <sub>libs</sub> -number.lua	l-number.lua	bit operations
lua <sub>libs</sub> -math.lua	l-math.lua	math functions
lua <sub>libs</sub> -io.lua	l-io.lua	reading and writing files
lua <sub>libs</sub> -os.lua	l-os.lua	platform specific code
lua <sub>libs</sub> -file.lua	l-file.lua	filesystem operations
lua <sub>libs</sub> -gzip.lua	l-gzip.lua	wrapper for lgzip
lua <sub>libs</sub> -md5.lua	l-md5.lua	checksum functions
lua <sub>libs</sub> -dir.lua	l-dir.lua	directory handling
lua <sub>libs</sub> -unicode.lua	l-unicode.lua	utf and unicode
lua <sub>libs</sub> -url.lua	l-url.lua	url handling
lua <sub>libs</sub> -set.lua	l-set.lua	sets

---

### 3 FILES

The lua<sub>libs</sub> bundle contains files from two ConT<sub>E</sub>Xt Lua library categories: The generic auxiliary functions (original file prefix: l-) together form something close to a standard library. Most of these are extensions of an existing namespace, like for instance l-table.lua which adds full-fledged serialization capabilities to the Lua table library. They were imported under the lua<sub>libs</sub>-prefix and are contained in the basic collection. (For a list see table 1.)

The extended category comprises a selection of files mostly from the utilities namespace (util-; cf. table 2). Their purpose is more specific and at times quite low-level. Additionally, the file trac-inf.lua has been included because it is essential to some of the code loaded subsequently.

### 4 PACKAGING

By default, lua<sub>libs</sub> will not load the libraries individually. Instead, it includes two *merged packages* that have been compiled from the original files. This is achieved by means of mt<sub>x</sub>-package, a script for bundling Lua code shipped with ConT<sub>E</sub>Xt. This concatenates the code of several Lua files into a single file that is both easier to distribute and loading marginally faster. mt<sub>x</sub>-package ensures that the code from each file gets its own closure and strips newlines and comments, resulting in a smaller payload. Another package that relies on it heavily is the font loader as contained in luaotfload and luatex-fonts. Luaot-

---

Table 2: The extended set.

lualibs name	ConT <sub>E</sub> Xt name	primary purpose
lualibs-util-str.lua	util-str.lua	extra string functions
lualibs-util-fil.lua	util-fil.lua	extra file functions
lualibs-util-tab.lua	util-tab.lua	extra table functions
lualibs-util-sto.lua	util-sto.lua	table allocation
lualibs-util-prs.lua	util-sto.lua	miscellaneous parsers
lualibs-util-dim.lua	util-dim.lua	conversion between dimensions
lualibs-trac-inf.lua	trac-inf.lua	timing, statistics
lualibs-util-lua.lua	util-lua.lua	operations on bytecode
lualibs-util-deb.lua	util-deb.lua	extra debug functionality
lualibs-util-tpl.lua	util-tpl.lua	templating
lualibs-util-sta.lua	util-sta.lua	stacker (e. g. for PDF)
lualibs-util-jsn.lua	util-jsn.lua	conversion to and from json

---

`fload`, a port of the ConT<sub>E</sub>Xt fontloader for Plain and L<sup>A</sup>T<sub>E</sub>X, has a hard dependency on the functionality provided by the Lualibs package. The packages should not be updated independently.

If ConT<sub>E</sub>Xt is installed on the system, the merge files can be created by running:

```
mtxrun --script package --merge lualibs-basic.lua
mtxrun --script package --merge lualibs-extended.lua
```

Of course there is a make target for that:

```
make merge
```

will take care of assembling the packages from the files distributed with lualibs.

For this to work, the syntax of the Lua file needs to be well-formed: files that should be merged must be included via a function `loadmodule()`. It doesn't matter if the function actually does something; a dummy will suffice. Also, the argument to `loadmodule()` must be wrapped in parentheses. This rule is quite convenient, actually, since it allows excluding files from the merge while still using `loadmodule()` consistently.

```
...
loadmodule("my-lua-file.lua") -- <= will be merged
loadmodule('my-2nd-file.lua') -- <= will be merged
loadmodule "my-3rd-file.lua"  -- <= will be ignored
...
```

## II lualibs.lua

```

1 lualibs = lualibs or { }
2
3 lualibs.module_info = {
4   name      = "lualibs",
5   version   = 2.66,
6   date      = "2019-07-04",
7   description = "ConTeXt Lua standard libraries.",
8   author    = "Hans Hagen, PRAGMA-ADE, Hasselt NL & Elie Roux & Philipp Gesang",
9   copyright  = "PRAGMA ADE / ConTeXt Development Team",
10  license    = "See ConTeXt's mreadme.pdf for the license",
11 }
12

```

The behavior of the lualibs can be configured to some extent.

- Based on the parameter `lualibs.prefer_merged`, the libraries can be loaded via the included merged packages or the individual files.
- Two classes of libraries are distinguished, mainly because of a similar distinction in ConTeXt, but also to make loading of the less fundamental functionality optional. While the “basic” collection is always loaded, the configuration setting `lualibs.load_extended` triggers inclusion of the extended collection.
- Verbosity can be increased via the `verbose` switch.

```

13
14 config      = config or { }
15 config.lualibs = config.lualibs or { }
16
17 if config.lualibs.prefer_merged ~= nil then
18   lualibs.prefer_merged = config.lualibs.prefer_merged
19 else
20   lualibs.prefer_merged = true
21 end
22
23 if config.lualibs.load_extended ~= nil then
24   lualibs.load_extended = config.lualibs.load_extended
25 else
26   lualibs.load_extended = true
27 end
28
29 if config.lualibs.verbose ~= nil then
30   config.lualibs.verbose = config.lualibs.verbose
31 else
32   config.lualibs.verbose = false
33 end
34

```

The lualibs may be loaded in scripts. To account for the different environment, fallbacks for the luatexbase facilities are installed.

```

35
36 local dofile      = dofile

```

```

37 local kpsefind_file = kpse.find_file
38 local stringformat = string.format
39 local texiowrite_nl = texio.write_nl
40
41 local find_file, error, warn, info
42 do
43   local _error, _warn, _info
44   if luatexbase and luatexbase.provides_module then
45     _error, _warn, _info = luatexbase.provides_module(lualibs.module_info)
46   else
47     _error, _warn, _info = texiowrite_nl, texiowrite_nl, texiowrite_nl
48   end
49
50   if lualibs.verbose then
51     error, warn, info = _error, _warn, _info
52   else
53     local dummylogger = function ( ) end
54     error, warn, info = _error, dummylogger, dummylogger
55   end
56   lualibs.error, lualibs.warn, lualibs.info = error, warn, info
57 end
58
59 local info = status.list()
60 if info.kpse_used == 0 then
61   kpse.set_program_name("luatex")
62 end
63
64 find_file = kpsefind_file
65

```

The lualibs load a merged package by default. In order to create one of these, the meta file that includes the libraries must satisfy certain assumptions mt<sub>x</sub>-package makes about the coding style. Most important is that the functions that indicates which files to include must go by the name `loadmodule()`. For this reason we define a `loadmodule()` function as a wrapper around `dofile()`.

```

66
67 local loadmodule = loadmodule or function (name, t)
68   if not t then t = "library" end
69   local filepath = find_file(name, "lua")
70   if not filepath or filepath == "" then
71     warn(stringformat("Could not locate %s \"%s\".", t, name))
72     return false
73   end
74   dofile(filepath)
75   return true
76 end
77
78 lualibs.loadmodule = loadmodule
79

```

The separation of the “basic” from the “extended” sets coincides with the split into luat-bas.mkiv and luat-lib.mkiv.

```

80
81 if lualibs.basic_loaded      ~= true
82 or config.lualibs.force_reload == true
83 then
84   loadmodule"lualibs-basic.lua"
85   loadmodule"lualibs-compat.lua" --- restore stuff gone since v1.*
86 end
87
88 if lualibs.load_extended     == true
89 and lualibs.extended_loaded   ~= true
90 or config.lualibs.force_reload == true
91 then
92   loadmodule"lualibs-extended.lua"
93 end
94
95 --- This restores the default of loading everything should a package
96 --- have requested otherwise. Will be gone once there is a canonical
97 --- interface for parameterized loading of libraries.
98 config.lualibs.load_extended = true
99
100 -- vim:tw=71:sw=2:ts=2:expandtab
101

```

### III lualibs-basic.lua

```

1 lualibs          = lualibs or { }
2 local info       = lualibs.info
3 local loadmodule = lualibs.loadmodule
4
5 local lualibs_basic_module = {
6   name       = "lualibs-basic",
7   version    = 2.66,
8   date       = "2019-07-04",
9   description = "ConTeXt Lua libraries -- basic collection.",
10  author      = "Hans Hagen, PRAGMA-ADE, Hasselt NL & Elie Roux & Philipp Gesang",
11  copyright   = "PRAGMA ADE / ConTeXt Development Team",
12  license     = "See ConTeXt's mreadme.pdf for the license",
13 }
14
15 local loaded = false --- track success of package loading
16
17 if lualibs.prefer_merged then
18   info"Loading merged package for collection "basic"."
19   loaded = loadmodule('lualibs-basic-merged.lua')
20 else
21   info"Ignoring merged packages."

```

```

22 info"Falling back to individual libraries from collection "basic"."
23 end
24

```

mtx-package expects the files to be included by loadmodule. If run on this file, it will create lualibs-basic-merged.lua from all the files mentioned in the next block.

```

25
26 if loaded == false then
27   loadmodule("lualibs-lua.lua")
28   loadmodule("lualibs-package.lua")
29   loadmodule("lualibs-lpeg.lua")
30   loadmodule("lualibs-function.lua")
31   loadmodule("lualibs-string.lua")
32   loadmodule("lualibs-table.lua")
33   loadmodule("lualibs-boolean.lua")
34   loadmodule("lualibs-number.lua")
35   loadmodule("lualibs-math.lua")
36   loadmodule("lualibs-io.lua")
37   loadmodule("lualibs-os.lua")
38   loadmodule("lualibs-file.lua")
39   loadmodule("lualibs-gzip.lua")
40   loadmodule("lualibs-md5.lua")
41   loadmodule("lualibs-dir.lua")
42   loadmodule("lualibs-unicode.lua")
43   loadmodule("lualibs-url.lua")
44   loadmodule("lualibs-set.lua")
45 end
46
47 lualibs.basic_loaded = true
48 -- vim:tw=71:sw=2:ts=2:expandtab
49

```

#### IV lualibs-extended.lua

```

1 lualibs = lualibs or { }
2

```

Loading the *extended* set requires a tad more effort, but it's well invested.

Since we only want the functionality, we have to simulate parts of a running ConTeXt environment, above all logging, that some of the more involved libraries cannot be loaded without. Also, one utility file cannot be packaged because it returns a table which would preclude loading of later code. Thus, we remove it from the natural loading chain (it is not critical) and append it at the end.

```

3
4 local lualibs_extended_module = {
5   name      = "lualibs-extended",
6   version   = 2.66,
7   date      = "2019-07-04",
8   description = "ConTeXt Lua libraries -- extended collection.",

```



```

 9  author      = "Hans Hagen, PRAGMA-ADE, Hasselt NL & Elie Roux & Philipp Gesang",
10  copyright   = "PRAGMA ADE / ConTeXt Development Team",
11  license      = "See ConTeXt's mreadme.pdf for the license",
12 }
13
14
15 local stringformat = string.format
16 local loadmodule   = luaLlibs.loadmodule
17 local texiowrite    = texio.write
18 local texiowrite_nl = texio.write_nl
19

```

Here we define some functions that fake the elaborate logging/tracking mechanism Con-  
text provides.

```

20
21 local error, logger, mklog
22 if luatexbase and luatexbase.provides_module then
23   --- TODO test how those work out when running tex
24   local __error, ___, __logger =
25     luatexbase.provides_module(luaLlibs_extended_module)
26   error = __error
27   logger = __logger
28   mklog = function ( ) return logger end
29 else
30   mklog = function (t)
31     local prefix = stringformat("[%s] ", t)
32     return function (...)
33       texiowrite_nl(prefix)
34       texiowrite    (stringformat(...))
35     end
36   end
37   error = mklog"ERROR"
38   logger = mklog"INFO"
39 end
40
41 local info = luaLlibs.info
42

```

We temporarily put our own global table in place and restore whatever we overloaded afterwards.

ConTeXt modules each have a custom logging mechanism that can be enabled for debugging. In order to fake the presence of this facility we need to define at least the function `logs.reporter`. For now it's sufficient to make it a reference to `mklog` as defined above.

```

43
44 local dummy_function = function ( ) end
45 local newline        = function ( ) texiowrite_nl"" end
46
47 local fake_logs = function (name)
48   return {

```

```

49     name      = name,
50     enable    = dummy_function,
51     disable   = dummy_function,
52     reporter  = mklog,
53     newline   = newline
54 }
55 end
56
57 local fake_trackers = function (name)
58     return {
59         name      = name,
60         enable    = dummy_function,
61         disable   = dummy_function,
62         register  = mklog,
63         newline   = newline,
64     }
65 end
66
67 local backup_store = { }
68
69 local fake_context = function ( )
70     if logs      then backup_store.logs      = logs      end
71     if trackers then backup_store.trackers = trackers end
72     logs        = fake_logs"logs"
73     trackers    = fake_trackers"trackers"
74 end
75
76

```

Restore a backed up logger if appropriate.

```

77 local unfake_context = function ( )
78     if backup_store then
79         local bl, bt = backup_store.logs, backup_store.trackers
80         if bl then logs      = bl      end
81         if bt then trackers = bt      end
82     end
83 end
84
85 fake_context()
86
87 local loaded = false
88 if lualibs.prefer_merged then
89     info"Loading merged package for collection "extended"."
90     loaded = loadmodule('lualibs-extended-merged.lua')
91 else
92     info"Ignoring merged packages."
93     info"Falling back to individual libraries from collection "extended"."
94 end
95
96 if loaded == false then

```

```

97  loadmodule("lualibs-util-str.lua")--- string formatters (fast)
98  loadmodule("lualibs-util-fil.lua")--- extra file helpers
99  loadmodule("lualibs-util-tab.lua")--- extended table operations
100 loadmodule("lualibs-util-sto.lua")--- storage (hash allocation)
101 -----("lualibs-util-pck.lua")---!packers; necessary?
102 -----("lualibs-util-seq.lua")---!sequencers (function chaining)
103 -----("lualibs-util-mrg.lua")---!only relevant in mtx-package
104 loadmodule("lualibs-util-prs.lua")--- miscellaneous parsers; cool. cool cool cool
105 -----("lualibs-util-fmt.lua")---!column formatter (rarely used)
106 loadmodule("lualibs-util-dim.lua")--- conversions between dimensions
107 loadmodule("lualibs-util-jsn.lua")--- JSON parser
108
109 -----("lualibs-trac-set.lua")---!generalization of trackers
110 -----("lualibs-trac-log.lua")---!logging
111 loadmodule("lualibs-trac-inf.lua")--- timing/statistics
112 loadmodule("lualibs-util-lua.lua")--- operations on lua bytecode
113 loadmodule("lualibs-util-deb.lua")--- extra debugging
114 loadmodule("lualibs-util-tpl.lua")--- templating
115 loadmodule("lualibs-util-sta.lua")--- stacker (for writing pdf)
116 end
117
118 unfake_context() --- TODO check if this works at runtime
119
120 lualibs.extended_loaded = true
121 -- vim:tw=71:sw=2:ts=2:expandtab
122

```