R package structure

Sophie Schmidt

What is a package?

What makes a package a package?

5 different “states” of a package:

- source = directory of files with a specific structure
- bundled = compressed into a single file (.tar.gz = “tarball”)
- binary = compressed in one file, platform specific (Mac: .tgz, Windows: .zip), used by `install.packages()`
- installed = binary package that’s been decompressed into a package library
- in-memory = after library()

What do we do with a package?

create:

- source = directory of files with a specific structure

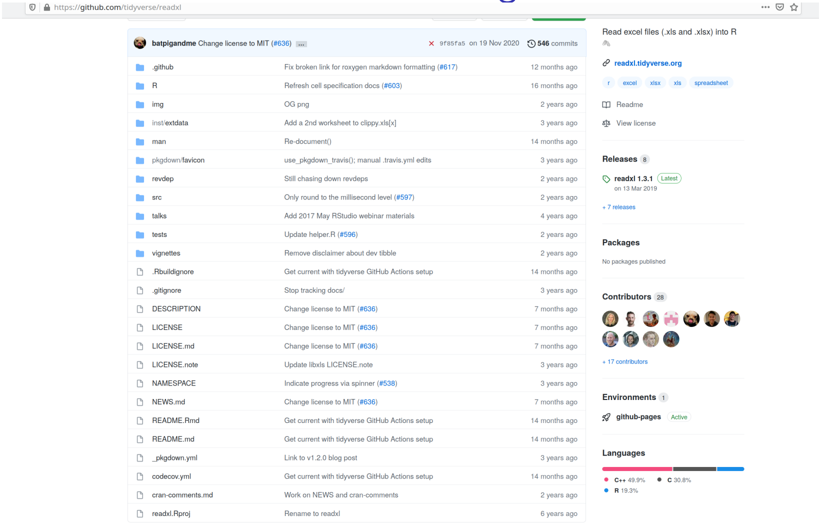
build:

- bundled = compressed into a single file (.tar.gz = "tarball")
- binary = compressed in one file, platform specific (Mac: .tgz, Windows: .zip), used by install.packages()

use:

- installed = binary package that's been decompressed into a package library
- in-memory = after library()

Source Package


https://github.com/tidyverse/readxl

batpigandme Change license to MIT (#636) … 9f85fa5 on 19 Nov 2020 546 commits

.github	Fix broken link for roxygen markdown formatting (#617)	12 months ago
R	Refresh cell specification docs (#603)	16 months ago
img	OG png	2 years ago
inst/extdata	Add a 2nd worksheet to clippy.xls[x]	3 years ago
man	Re-document()	14 months ago
pkgdown/favicon	use_pkgdown_travis(); manual .travis.yml edits	3 years ago
revdep	Still chasing down revdeps	2 years ago
src	Only round to the millisecond level (#597)	2 years ago
talks	Add 2017 May RStudio webinar materials	4 years ago
tests	Update helper.R (#596)	2 years ago
vignettes	Remove disclaimer about dev tibble	2 years ago
.Rbuildignore	Get current with tidyverse GitHub Actions setup	14 months ago
.gitignore	Stop tracking docs/	3 years ago
DESCRIPTION	Change license to MIT (#636)	7 months ago
LICENSE	Change license to MIT (#636)	7 months ago
LICENSE.md	Change license to MIT (#636)	7 months ago
LICENSE.note	Update libxls LICENSE.note	3 years ago
NAMESPACE	Indicate progress via spinner (#538)	3 years ago
NEWS.md	Change license to MIT (#636)	7 months ago
README.Rmd	Get current with tidyverse GitHub Actions setup	14 months ago
README.md	Get current with tidyverse GitHub Actions setup	14 months ago
_pkgdown.yml	Link to v1.2.0 blog post	3 years ago
codecov.yml	Get current with tidyverse GitHub Actions setup	14 months ago
cran-comments.md	Work on NEWS and cran-comments	2 years ago
readxl.Rproj	Rename to readxl	6 years ago

Read excel files (.xls and .xlsx) into R

readxl.tidyverse.org

r excel xlsx xls spreadsheet

Readme

View license

Releases 8

readxl 1.3.1 Latest
on 13 Mar 2019

+ 7 releases

Packages

No packages published

Contributors 28

+ 17 contributors

Environments 1

github-pages Active

Languages

● C++ 49.9% ● C 30.8% ● R 19.3%

Figure 1: screenshot of github of readxl package

most important elements of a source package

- /R folder
- DESCRIPTION file
- NAMESPACE file

R/

- the “heart” of the package: all your beautiful functions live here
- each script ends on .R
- what goes in one file?
  - if a function is very large, it may live alone
  - often: one important function + its helpers
  - often: a family of functions
- “utils.R” often contains “helpers” needed in several other functions
- the functions are defined, when the package builds –> make everything a function!

DESCRIPTION

- We <3 Metadata!
  - human&machine readable
  - shows up on CRAN
  - it's what makes a package a package
- a text file that follows DCF, the Debian control format
- each line consists of a field name with a : (colon) behind it and the value

bare bones DESCRIPTION:

```
Package: myexample
Title: What the Package Does (One Line, Title Case)
Version: 0.0.0.9000
Authors@R:
    person(given = "xxx",
           family = "yyy",
           role = c("aut", "cre"),
           email = "first.last@example.com"
Description: What the package does (one paragraph).
Encoding: UTF-8
LazyData: true
```

most important DESCRIPTION parts

`Title` is a one line description of the package, plain text (no markup), capitalised like a title, does NOT end in a period, $<$ 65 characters

`Description` is more detailed than the title, one paragraph. If your description spans multiple lines (each line $<=$ 80 characters), indent subsequent lines with 4 spaces

`Authors@R`: That's you and your collaborators. Think about your roles.

- aut: author, cre: creator <- must have
- ctb: contributors, cph: copyright holder, ... <- might have
- one person may have more than one role, several ppl may have the same role
- give at least one email

Dependencies

Dependencies management

- we need to manage how to deal with our functions relying on other functions
- Linux users now nod sagely please
- everyone, who ever used library() or require() please nod sagely
- in package building we need to do things differently than in scripts

in CODE:

- DO: `package::function()`
- DON'T `library()` or `require()` !
- add packages to your DESCRIPTION using `usethis::use_package("pkgname")`
- use the namespace

in DESCRIPTION

manually add (or using `use_package()` leads to)

```
Imports:
    dplyr (>= 0.2),
    ggplot2
```

- packages listed under imports
  - are the ones that MUST be there or your package won't work
  - will be installed if your package is installed and they are missing
- specific version of a package in () behind the name should be minimum version ($>=$ not just $=$)
  - (otherwise things get complicated fast)
  - have a reason for the minimum version, ppl might have to install it
  - giving a minimum version leads to better error messages for ppl who may not have the needed version installed
- packages listet under `Suggests` are not necessary for the code, but e.g. example data sets, to build the vignette, . . .

what to do about tidyverse pipe

- `magrittr::%>%` ??
- `usethis::use_pipe(export = TRUE)`
  - requires roxygen (see later)
  - adds magrittr to Imports in DESCRIPTION
  - imports the pipe specifically
  - exports the pipe (if `export = TRUE`) so that `%>%` is available to the users of your package −> adds the file `R/utils-pipe.R`, which provides the roxygen template to import and re-export `%>%`

NAMESPACE

- NAMESPACE is another txt just chilling in the project directory
- listed are (most important):
- imports and importFrom: packages & functions you want to load
- exports: functions you define to be used outside of your package

```
# Generated by roxygen2 (4.0.2): do not edit by hand
importFrom(methods,setRefClass)
export(myfunc)
```

- just added underneath each other
- usually done by Roxygen2 (see later)

Pack the package!

Create the package

naming problems

- name may contain numbers, letters and periods.
- name must start with a letter and mustn't end with a period
- recommendation: just don't use periods
- have fun and read the blog post here: *https://www.njtierney.com/post/2018/06/20/naming-things/*
- check whether the name is available:

```
library(available)


available("doofus")
```

make it so (mighty wizard usethis)

```
usethis::create_package("path/to/package/amazingpkgname")
```

This path should not lead to your lib or anywhere near your installed packages!

- now we have a package at the given path which contains the “most important parts”: DESCRIPTION, R/, NAMESPACE
- Rstudio users will notice .Rbuildignore is being created and Rproj-files added to it
- in .Rbuildignore we can add file names, that will be ignored when it’s time to build the pkg
- using an R project makes the workflow a bit easier, but isn’t necessary

Tweaking workflow

- “lather, rinse, repeat” cycle of package development:
  1. Tweak a function
  2. `devtools::load_all()`
  3. Try out the change -> run a small example / test
- in Rstudio you can do `load_all()` using:
  - Keyboard shortcut: Cmd+Shift+L (macOS), Ctrl+Shift+L (Windows, Linux)
  - Build pane’s More ... menu
  - Build > Load All

load_all does:

```
# with devtools attached and
# working directory = top-level of the source package ...

load_all()
```

- simulates the process of building, installing and attaching the package
- load_all "sources" the script files safely for you
- `source()` is not a good idea, because paths change during package development
- no need to :: your own package "under development"

check that package

R CMD CHECK

- once you're happy the functions work
- and you think you did all the right documentation steps, and added packages to DESCRIPTON etc
- check your package! run: `devtools::check()` or press Ctrl/Cmd + Shift + E (in Rstudio)

```
devtools::check()
```

- ensures that the documentation is up-to-date by running devtools::document().
- bundles the package before checking it
- sets the NOT_CRAN environment variable to TRUE. This allows you to selectively skip tests on CRAN
- checks a lot: metadata of the package, package-structure, DESCRIPTION & NAMESPACE (esp. dependencies), Code for non-ASCII characters, syntax errors. . .
- for a list see: *https://r-pkgs.org/r-cmd-check.html*

messages

- ERROR: needs to be adressed!
- WARNING: needs probably to be fixed if the pckg should go to CRAN
- NOTE: mild problems (will be checked by humans for CRAN submission)

3 typical error messages and warnings

- “there is no package” –> forgot to add a package to DESCRIPTION
- “Undocumented code objects” –> forgot to add documentation
- “no visible binding for global variable a” –> happens when using dplyr

```r
# option 1 (then you should also put utils in Imports)
utils::globalVariables(c("a"))
# option 2
a <- NULL
```

Build the package

No more error messages?!

Congrats! Time to build using `devtools::build()`

- `devtools::build(binary = FALSE)` –> tar.gz (should be usable by anyone)
- `devtools::build(binary = TRUE)` –> platform specific (zip or tgz) to your own platform

Using `devtools::install()` (re-)installs your package right away on your system and attaches it.

excercise

excercise

follow this tutorial:

https://github.com/sslarch/caa2021_Rpackage_workshop/blob /main/exercises/exercise_build_package.Rmd