R-Packages

Statistics, Visualization and more using R

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I. The Theory

Figure 1: Package Universe

1.1 What's a package?

- R packages are collections of functions and data sets
- they extend the basic functionalities or add new ones
- mostly developed by the community itself

1.2 Why Packages?

- easy method for sharing your code with others
- recurring tasks - no need to reinvent the wheel
  - to load data
  - to manipulate data
  - to visualize data
  - etc. (more than 19.000 packages exist)
- packages form interfaces to:
  - other software and their file formats (foreign, caffe, RQGIS, ...)
  - databases (RODBC, RPostgreSQL, ...)
  - other programming languages (Rcpp, RPython, ...)
  - webservices (Rfacebook, RGoogleAnalytics, ...)

1.3 Where can you find packages?

- CRAN - The Comprehensive R Archive Network

  https://cran.r-project.org
- BioConductor

  http://bioconductor.org/
- GitHub

  https://github.com/
- The most comfortable way is to use *RDocumentation*, because you can search more than 19.000 CRAN, Bioconductor and GitHub packages at onces.

  https://www.rdocumentation.org/ also available as a package

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1.4 Install, Deinstall, Update

Install:

install.packages("xyz")

install.packages(c("xyz", "123"))

Deintall:

remove.packages("xyz")

Update:

old.packages() $\rightarrow$ check what packages need an update

update.packages() $\rightarrow$ update packages

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1.4.1 Installing packages via devtools

- one big problem: each repository has its own way to install a package from them
- to simplify this process you can use the package "devtools"
- but you might also need to install:
  - "Rtools" for Windows
  - "Xcode" for Mac
  - "r-devel and r-devel" for Linux

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1.4.2 Installing packages via devtools

After devtools is installed, you will be able to use the utility functions to install another packages. Some options are:

- install_bioc() from Bioconductor
- install_cran() from CRAN
- install_github() from GitHub
- install_local() from a local file
- install_url() from a URL

Example: devtools::install_github("hadley/babynames")

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2. Making our own package

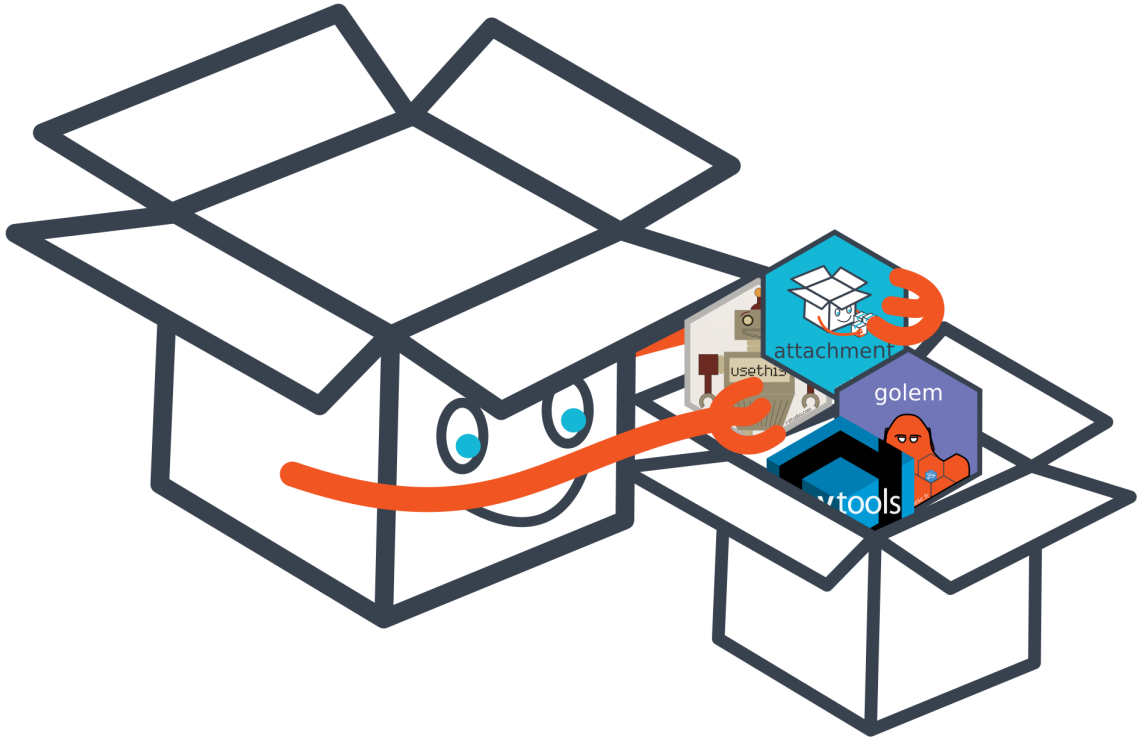

Figure 2: pack a pack

2.1 Making our own package

- Hadley Wickham - Chief Scientist at RStudio, Adjunct Professor of Statistics at the University of Auckland, Stanford University, and Rice University
- Free to read Book "R Packages": **http://r-pkgs.had.co.nz/**
- https://cran.r-project.org/doc/manuals/r-release/R-exts.html

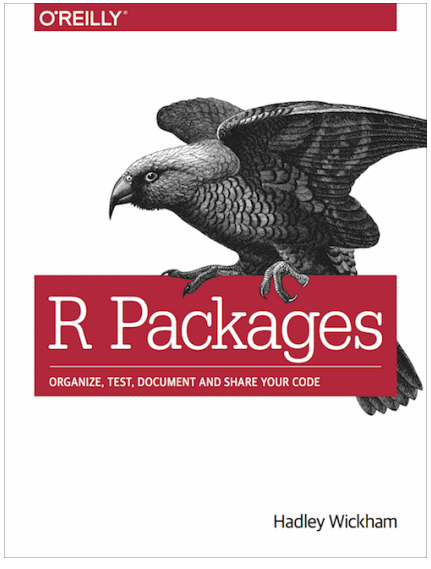

Figure 3: H. Wickham and his Book

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2.2 Components of a package

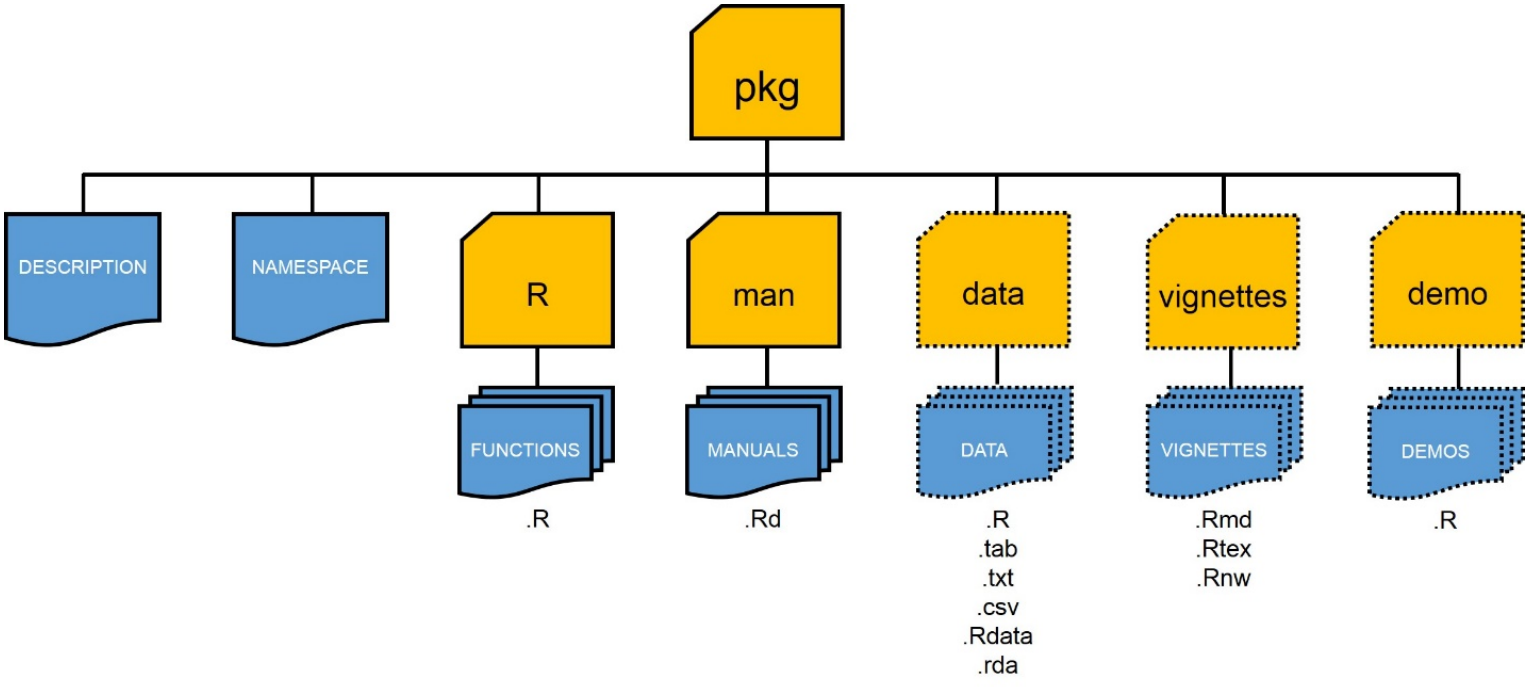

Figure 4: package structure

2.3 Description File

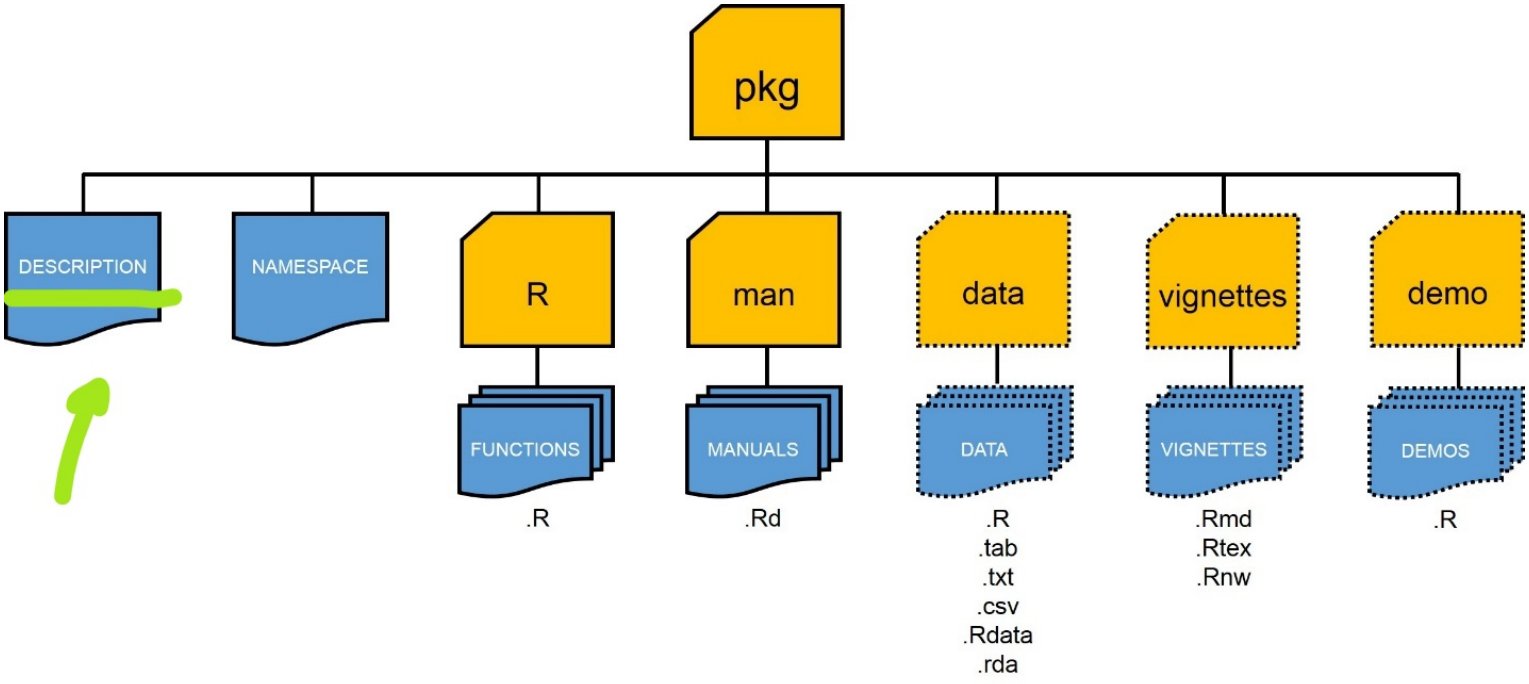

Figure 5: Description File

2.3 Description File

- Title
- Description
- Dependencies
  - list of necessary packages (and also package versions)
  - "LinkingTo" a Package - if you want to use c or c++ code from another package
- Author
- License (MIT, GPL-2, ...)

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2.4 Namespace

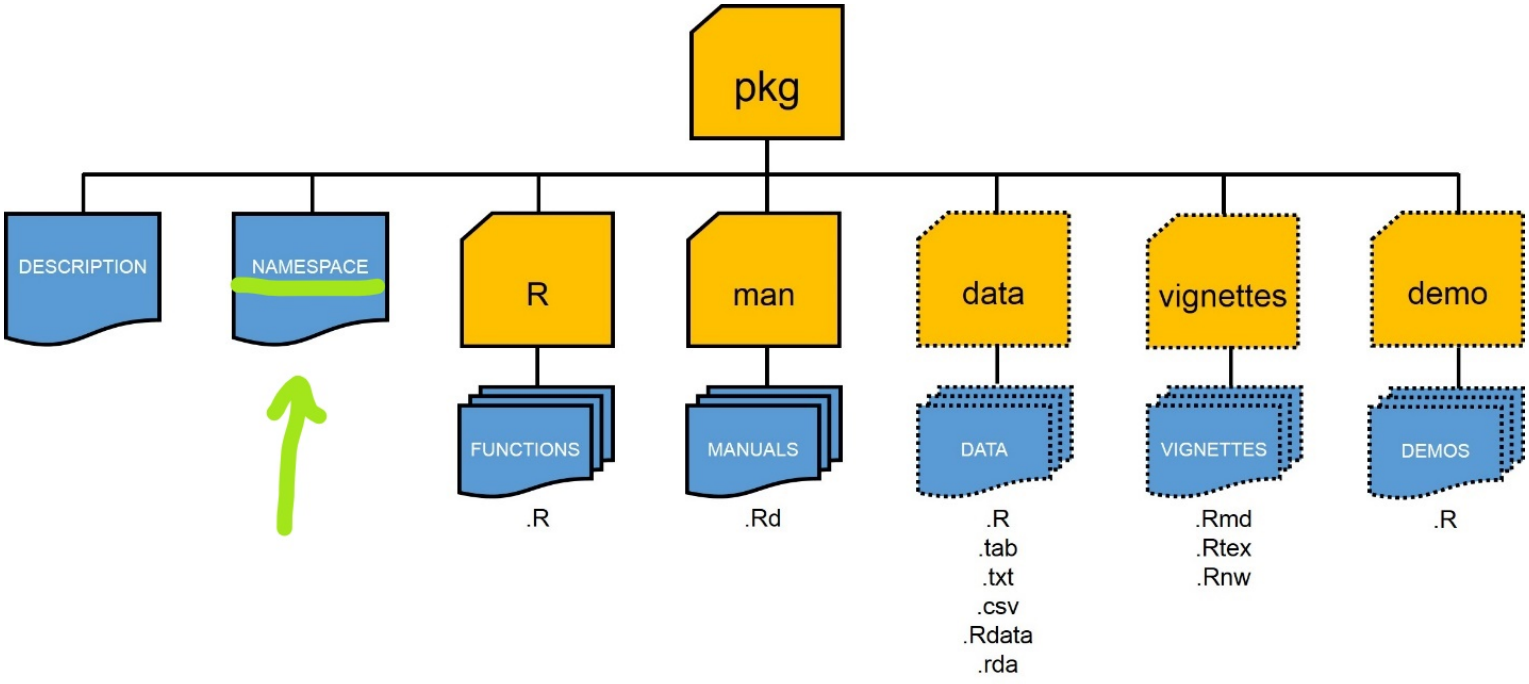

Figure 6: Namespace

2.4 Namespace

- With NAMESPACE you define the way in which your package interacts with other packages. For Example, to:
  - ensure that other packages won't interfere with the code you include
  - your code won't interfere with other packages
  - and that your package works regardless of the environment in which it's run
- Practical example: You are using two packages with "::" operator" and both have the summarize() function. Then it does matter in which order the packages are loaded in your code.

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2.5 R-Functions

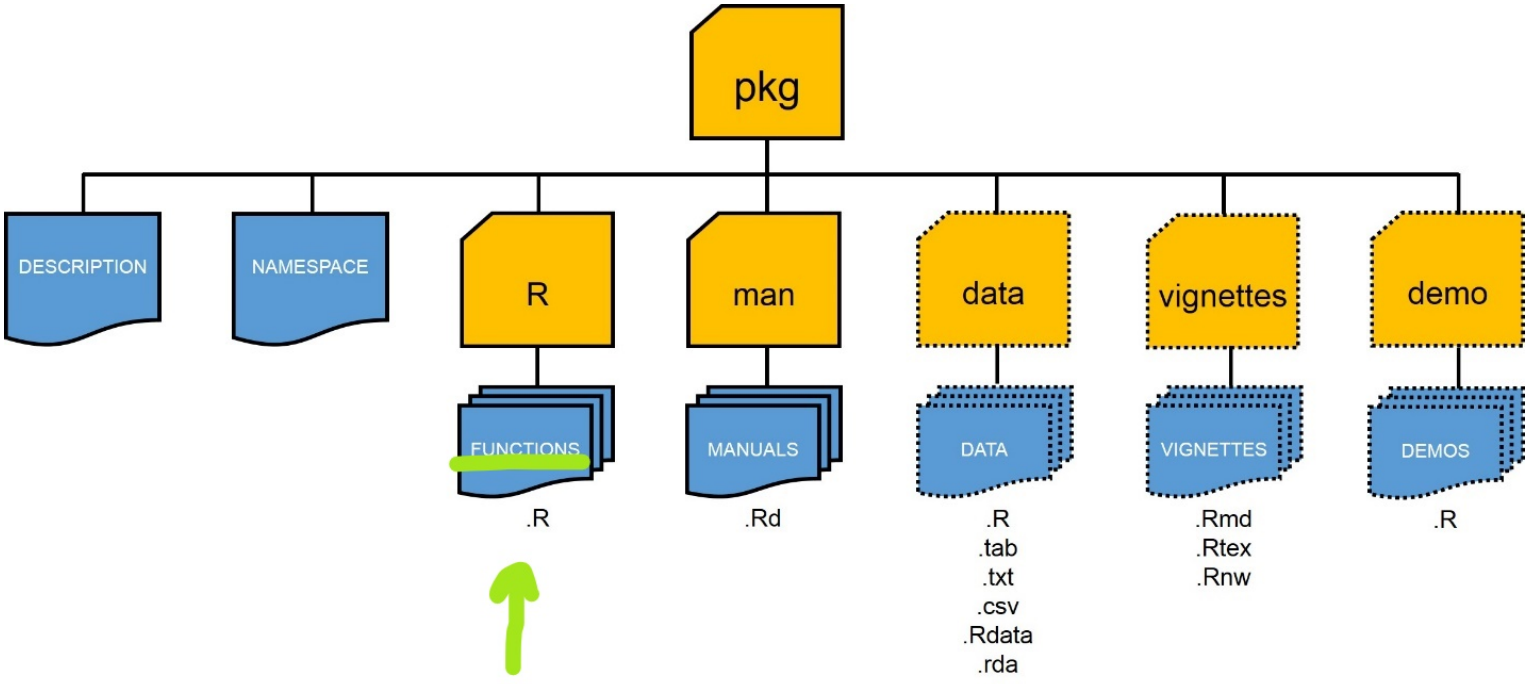

Figure 7: R-Functions

2.5 R-Functions

- include the functions and the R-Code itself
- with rcpp-package its posible to write C or C++ Code

2.6 Object Documentation and Manuals

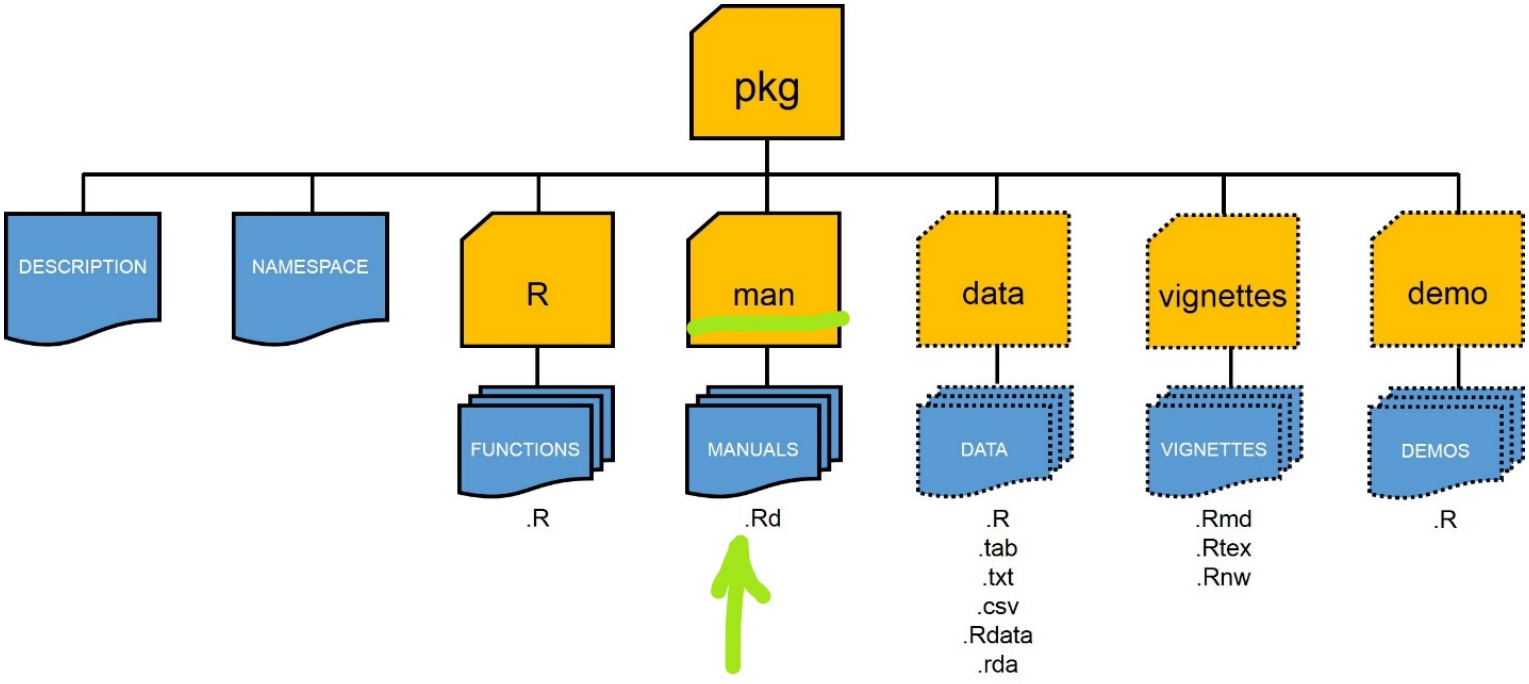

Figure 8: Object Documentation and Manual

2.6 Object Documentation and Manuals

- Good Documentation is one of the most important aspects of a good package
  - Documenting Functions, Classes, Generics and Methods
  - Documenting Datasets
  - Documenting Packages
  - ...
- R provides a standard way of documenting the objects in a package: you write .Rd files in the man/ directory.
- These files use a custom syntax, loosely based on LaTeX, and are rendered to HTML, plain text, and PDF for viewing.
- there are two ways to do this:
  - writing these files by hand
  - use the package "roxygen2" (recommended)

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2.7 Data, Vignettes, Demo

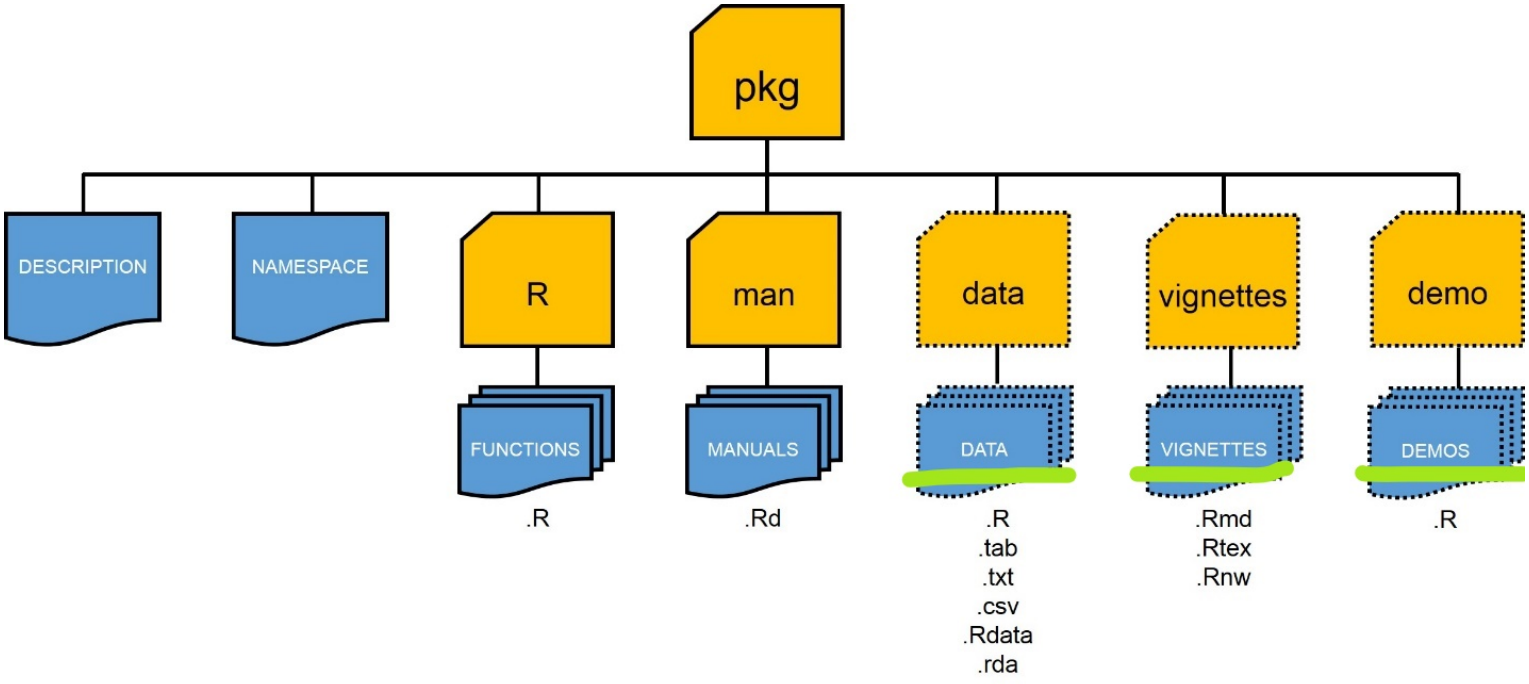

Figure 9: Data, Vignettes, Demo

2.7 Data - External Input (optional)

- to include own data in a package
- three main ways to include data in your package:
  - store binary data (available for the user) in **data/**
  - store parsed data (not available for the user) in **R/sysdata.rda**
  - store raw data in **inst/extdata**

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2.7 Vignettes (optional)

- vignettes are a long-form guide to your package
- describes a problem like a book chapter or an academic paper
- For Example: https://cran.r-project.org/web/packages/dplyr/vignettes/colwise.html
- The elegant way to build a vignette is to use RMarkdown and Knitr.
- Workflow:
    1. 1. Create a vignettes/ directory.
    2. Add the necessary dependencies to DESCRIPTION
    3. Draft a vignette, vignettes/my-vignette.Rmd.

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2.7 Demo (optional)

- Demos are like examples
- A demo is an .R file that lives in **demo/**
- Fuseful to the introduction of vignettes

3. Sources

Fig.1: https://www.elasticfeed.com/ab4da588234cfa0cabc5373f0b69ae5e/

Fig.2: https://rtask.thinkr.fr/wp-content/uploads/user2019_create_package_with_pkg.png

Fig.3: http://r-pkgs.had.co.nz/cover.png

Fig.3: https://www.mango-solutions.com/wp-content/uploads/2018/03/Hadley-Wickham_web.png

Fig.4-9: https://methodsblog.files.wordpress.com/2015/11/stott-1.jpg?w=1024&h=464

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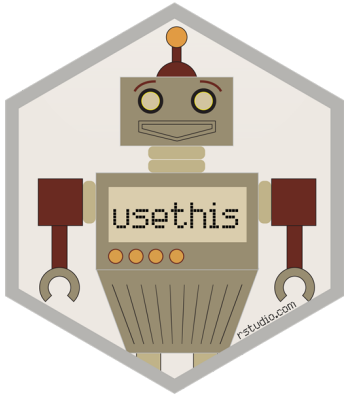
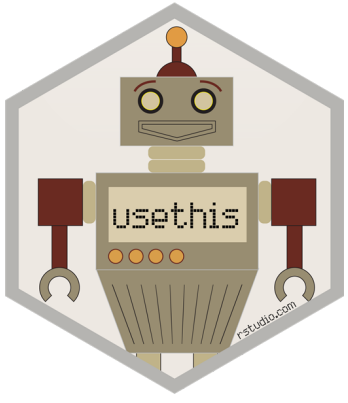
II. Creating a Package Yourself

Packages we will be using



Packages we will be using



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