Reproducibility in government

The RAP initiative

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What is reproducibility?

- **Reproducibility** is a feature of a data-driven project by which if it is repeated using the same data and methods identical/consistent results are obtained.
- Ideally a reproducible project should also be **replicable**: if the study is repeated with new data and alternative computations consistent results are obtained.

Point and click analytics do not contribute to reproducibiity

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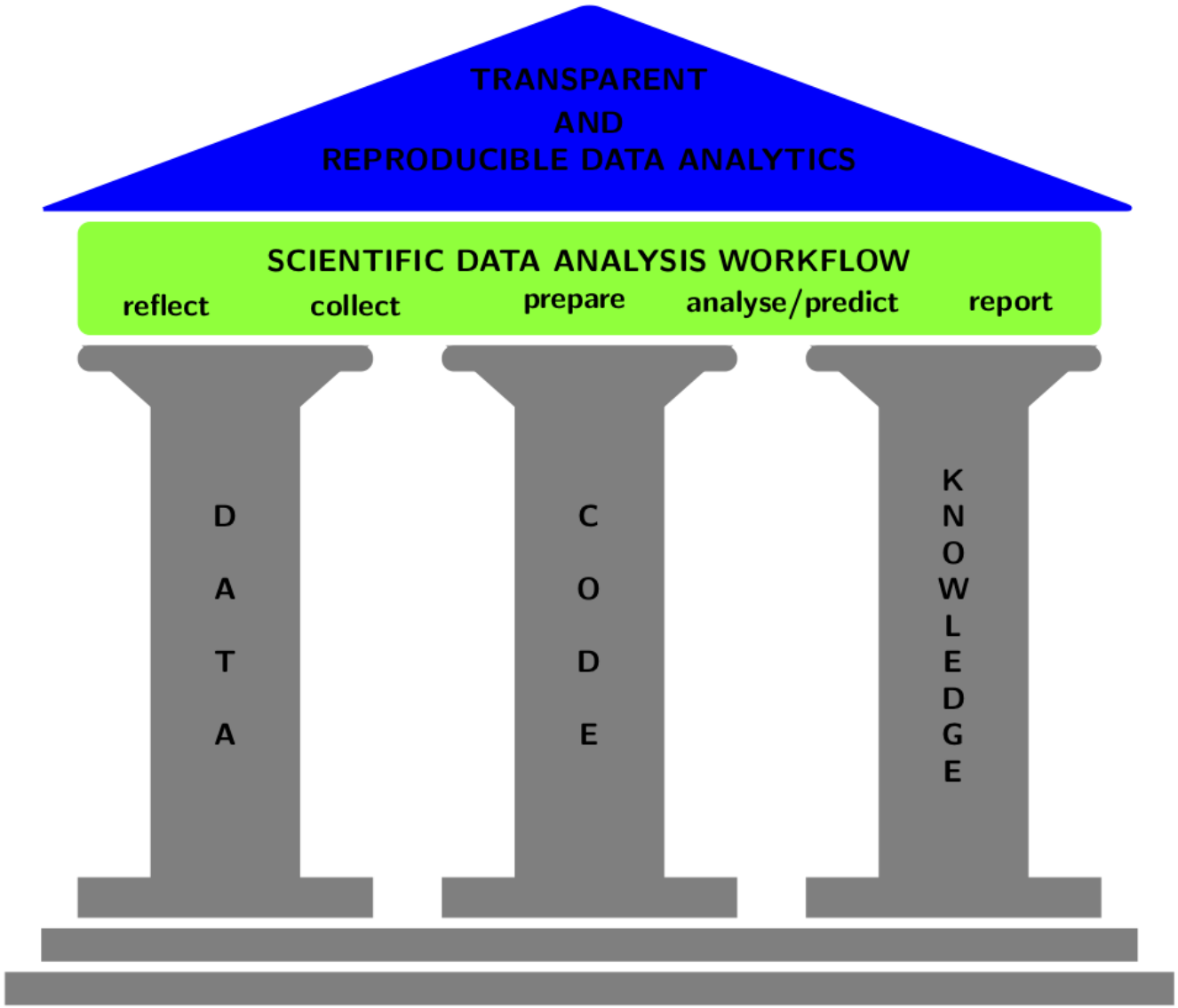
How to achieve reproducibility



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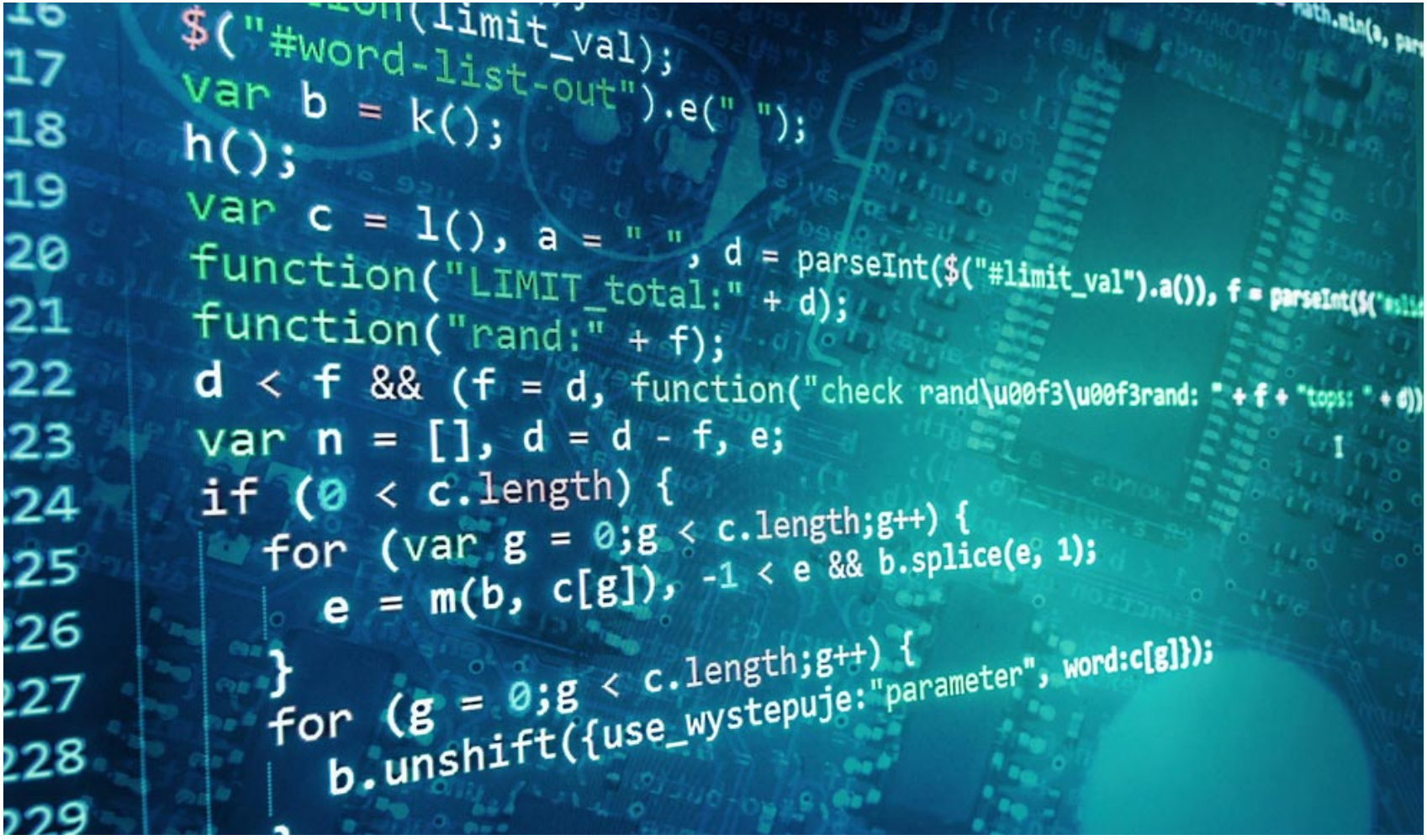
Code is a key tool to reproduce analysis



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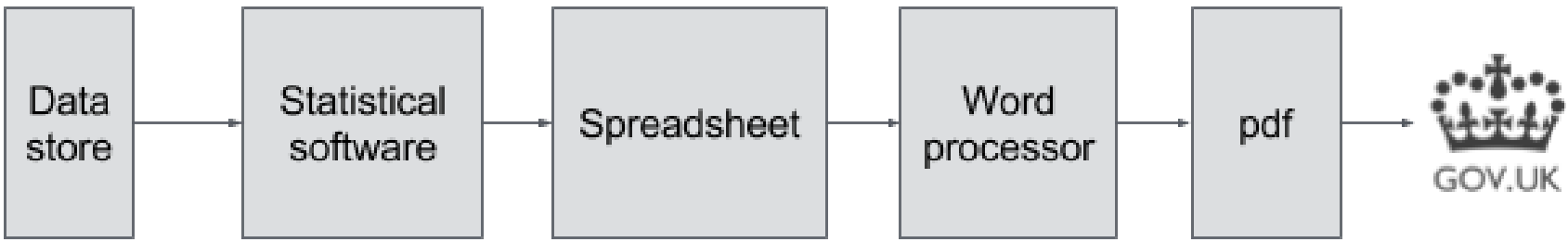
Reproducible Analytical Pipelines (RAP)

- RAP focuses on "code" and the deployment of software engineering tools for report production
- The process for official statistics production in Government:



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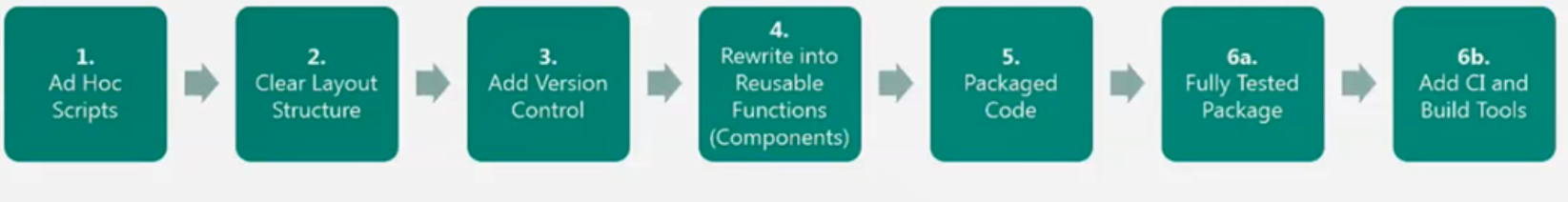
RAP in action

- In a RAP, a report is produced entirely by writing code. A report is the output of bespoke software.
- Tools from software engineering will create reproducibility features.

Levels of RAP (by DAP)



Level	Description	Output Produced using R/Python	Coding Standards	Version Control	Peer Review	Documentation of Functions	Automated Data QA	Dependency Packages Managed	Unit Testing of Functions	Unit Testing Guaranteed
1	Ad hoc Scripts	✓	×	×	×	×	×	×	×	×
2	Clear Layout Structure	✓	✓	×	×	×	×	×	×	×
3	Add Version Control	✓	✓	✓	✓	×	×	×	×	×
4	Rewrite into Reusable Functions (Components)	✓	✓	✓	✓	✓	✓	×	×	×
5	Packaged Code	✓	✓	✓	✓	✓	✓	✓	×	×
6a	Fully Tested Package	✓	✓	✓	✓	✓	✓	✓	✓	×
6b	CI and Build	✓	✓	✓	✓	✓	✓	✓	✓ (+75%)	✓

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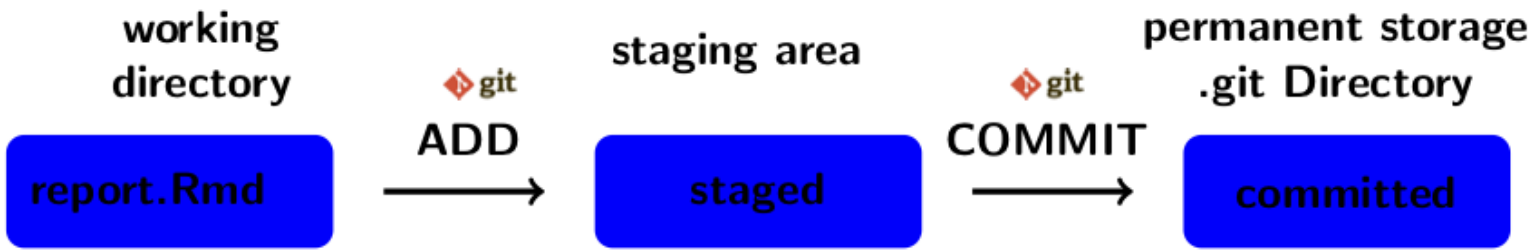
Using version control for reproducibility

- One important tool for code quality and code sharing is a version control system (VCS).
- A version control system is a tool that manages changes made to the files and directories in a project.
- Git, together with GitHub, is one such VCS tool.
- Git was built to manage development of the Linux kernel (2005), which is probably very different from what the present day users do.

How does VC work?

LOCALLY IN YOUR COMPUTER



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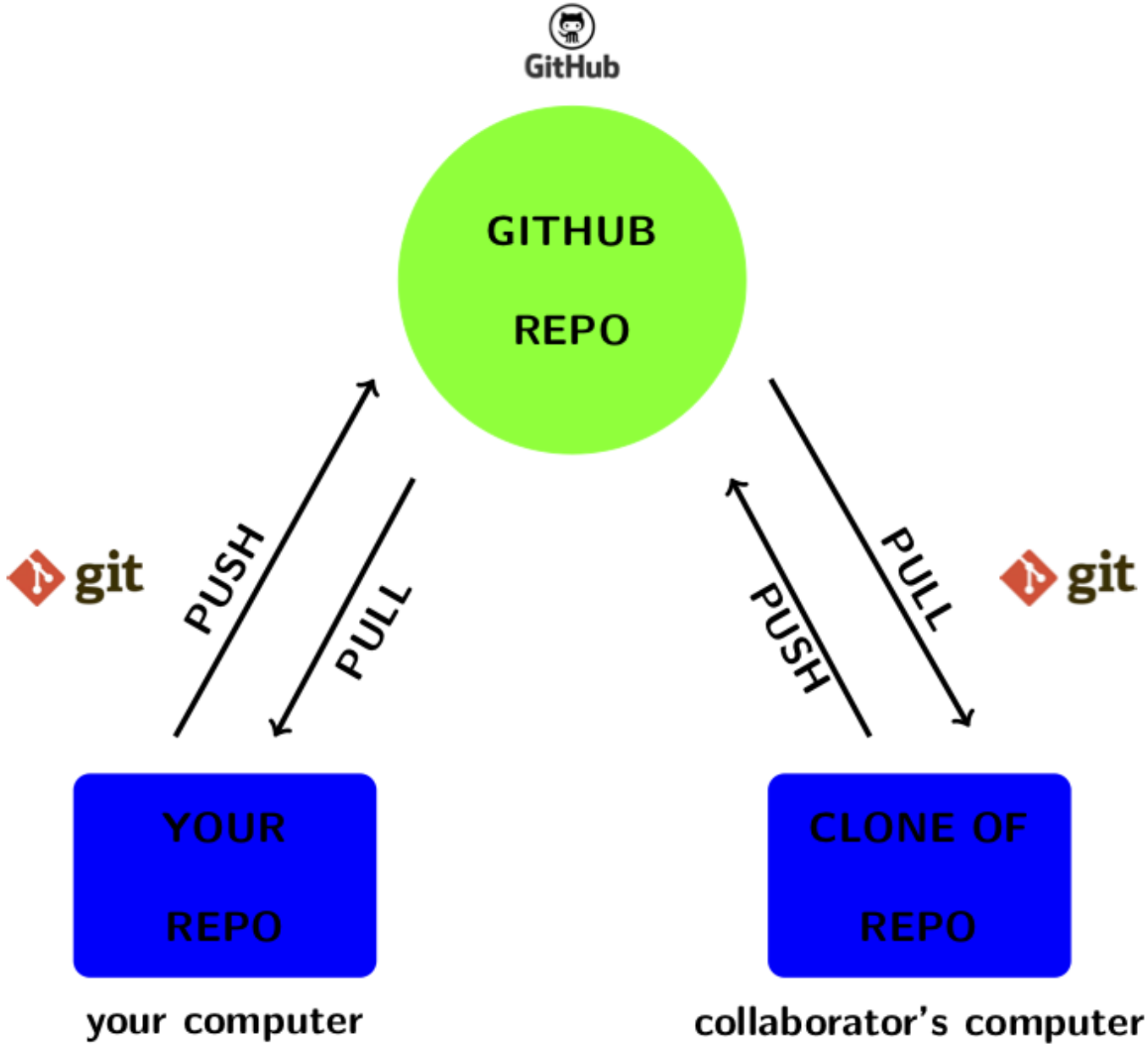
SHARING YOUR REPO



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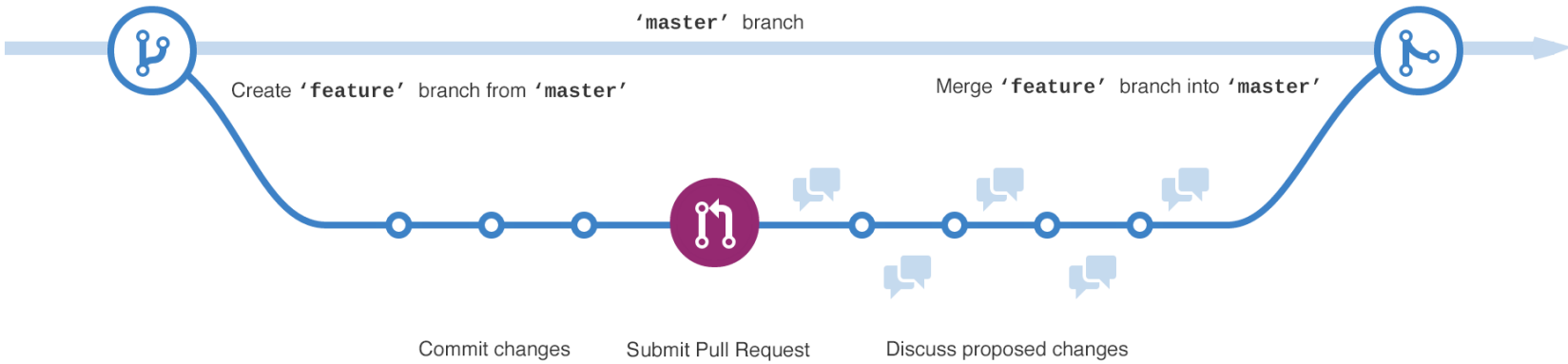
WORKING SIMULTANEOUSLY



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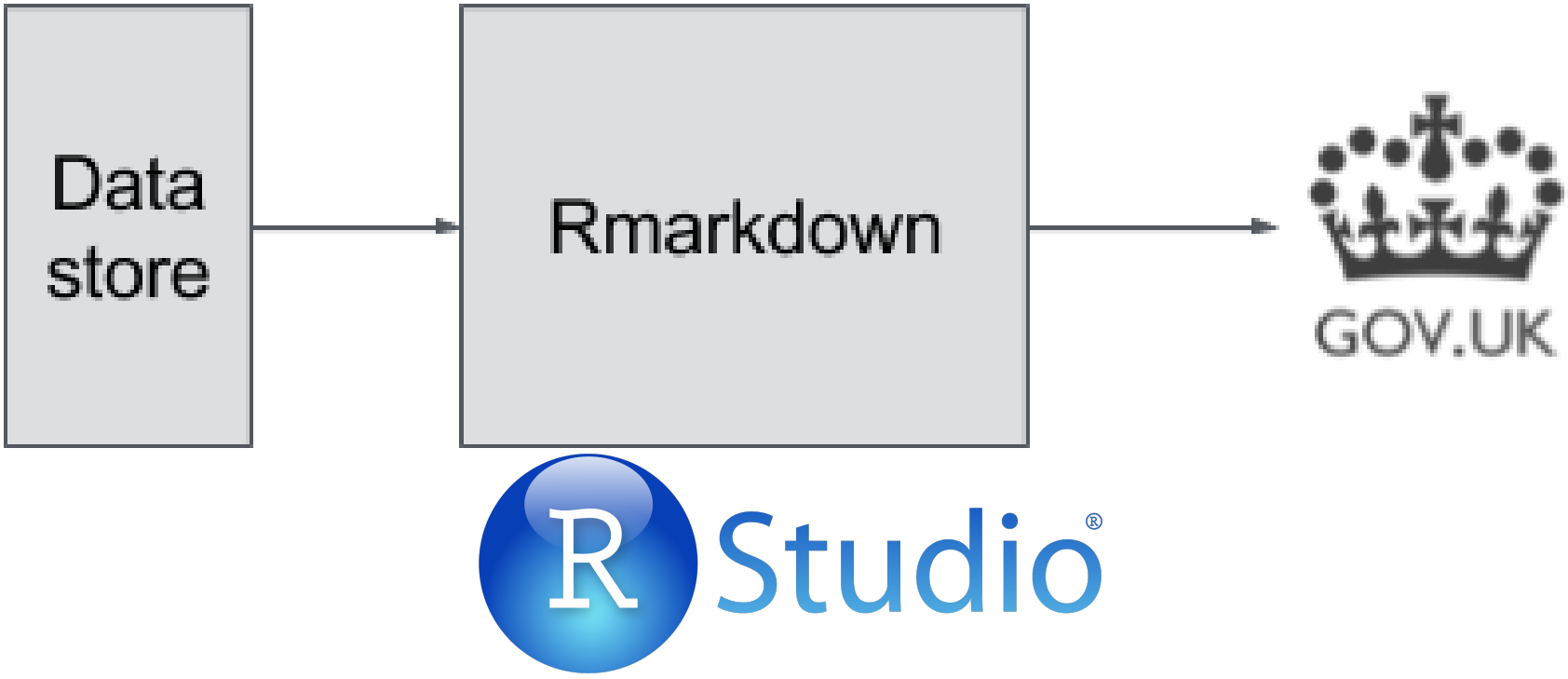
Worked example using R and RStudio



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Produce reports on HIV prevalence by given continent and year

Files in https://github.com/sonjam111/EFGS_2019

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Produce reports on HIV prevalence by given continent and year

- `hiv_report.Rmd` with text and code that generates a report for a continent and a year. Key is YAML header

```
---
params:
  current_continent: Americas
  year: 2011
  data_file: hiv_wb_new.xlsx
title: "**`r paste('Report on HIV prevalence in',
                   params$current_continent,', ', params$year)`**"
author: Sonia Mazzi - Data Science Campus
description: "An example of a reproducible report, from data importing,
        tidying, and cleaning, analysing to publishing with rmarkdown"
date: "`r format(Sys.Date(), '%d %B %Y')`"
output:
  html_document:
    theme: yeti
    highlight: haddock
    number_sections: TRUE
---
```

- When happy that the code in `hiv_report.Rmd` work, write a function to run it overriding the parameters in the YAML.

```
year <- 2010
render_report <- function(continent) {
  rmarkdown::render("hiv_report.Rmd",
                    output_file = paste0(
                      continent, "_", year, "_report_", ".html"),
                    params = list(current_continent = continent),
                    output_options = list(
                      self_contained = FALSE, lib_dir = "libs"))
}
```

- Now write code that generates all 4 reports in one execution

```
continents <- c("Asia", "Europe", "Africa", "Americas")
year <- 2011
purrr::walk(continents, render_report)
```

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