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Centralized Database Management:
Enhancing User Interaction and Accessibility with R / Shiny and AWS

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Presentation **Contents**

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About us: who we are and what do we do?

Granular coverage of CEE & Austrian markets and issuers

- **Macro, Fixed Income, Equity, ESG**

Diverse team of **~80 analysts** in Austria and 12 CEE countries

Strong regional, product and client focus

Local market expertise

Exclusive Research provider to Austrian Raiffeisen Banking Group in retail research

- **Data and models used by several departments**

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About us: one platform, countless insights

Stakeholders' expectations

- Need for **reliable**, **digital** and **sustainable** research
- Urge for local expertise in 12 CEE countries and Vienna
- Need to serve corporate & institutional clients
- Data always **ready** and up to date

What we offer

- Up to date, **ad hoc**, latest research
- Analysts contacts & local expertise on your request
- Access to research community events
- Unique database & platform to analysts & clients

Current vs future environment

Economic Indicators: Poland 2019 - 2026

Annual Data	2019	2020	2021	2022	2023	2024e	2025f	2026f
Nominal GDP (EUR bn)	532.0	526.5	576.6	652.3	747.7	847.0	918.5	990.7
Real GDP (% yoy)	4.4	-2.0	6.9	5.3	0.2	3.1	3.8	3.5
GDP per capita (EUR)	13900	13800	15200	17300	19900	22600	24500	26400
Private consumption (% yoy)	3.5	-3.6	6.2	5.2	-1.0	2.3	3.4	n.a.
Gross fixed capital formation (% yoy)	6.2	-2.3	1.2	4.9	8.4	4.3	4.4	n.a.
Gross wages (LCY, % yoy)	4.8	2.9	8.9	12.1	12.2	9.1	6.4	4.5
Unemployment (avg, %)	5.4	5.9	6.0	5.4	5.2	5.2	5.3	5.7
Budget balance (% of GDP)	-0.7	-6.9	-1.8	-3.5	-5.2	-4.7	-3.8	n.a.
Public debt (% of GDP)	45.7	57.2	53.6	49.2	49.6	50.4	50.9	n.a.
Goods exports (EUR billion)	220.3	220.5	263.6	322.1	334.2	356.0	391.0	n.a.
Goods imports (EUR billion)	224.7	213.6	271.3	346.3	328.0	355.0	390.0	n.a.
Goods trade balance (% of GDP)	-0.8	1.3	-1.3	-3.7	0.8	0.1	0.1	n.a.
Current account balance (% of GDP)	-0.2	2.4	-1.3	-2.4	1.6	0.2	0.2	n.a.
FX reserves with gold (EUR bn)	114.5	125.6	146.6	n.a.	n.a.	n.a.	n.a.	n.a.
Gross foreign debt (% of GDP)	59.5	58.1	55.9	n.a.	n.a.	n.a.	n.a.	n.a.
CPI inflation (avg, % yoy)	2.3	3.4	5.2	14.4	11.6	4.0	3.5	3.0
Core CPI inflation (avg, % yoy)	2.0	3.9	4.1	9.1	10.2	3.8	2.4	n.a.
Policy rate (% eop)	1.50	0.10	1.75	6.75	5.75	5.50	3.50	3.00
3M interbank rate (% eop)	1.72	0.21	2.54	7.02	5.88	5.50	4.40	3.15
EUR/LCY (eop)	4.26	4.61	4.60	4.69	4.34	4.35	4.25	4.25
EUR/LCY (avg)	4.30	4.44	4.56	4.70	4.54	4.36	4.30	4.25
USD/LCY (eop)	3.80	3.76	4.05	4.38	3.93	4.03	3.79	3.70
USD/LCY (avg)	3.84	3.90	3.86	4.46	4.20	4.06	3.90	3.73

Source: LSEG, Focus Economics, RBI/Raiffeisen Research

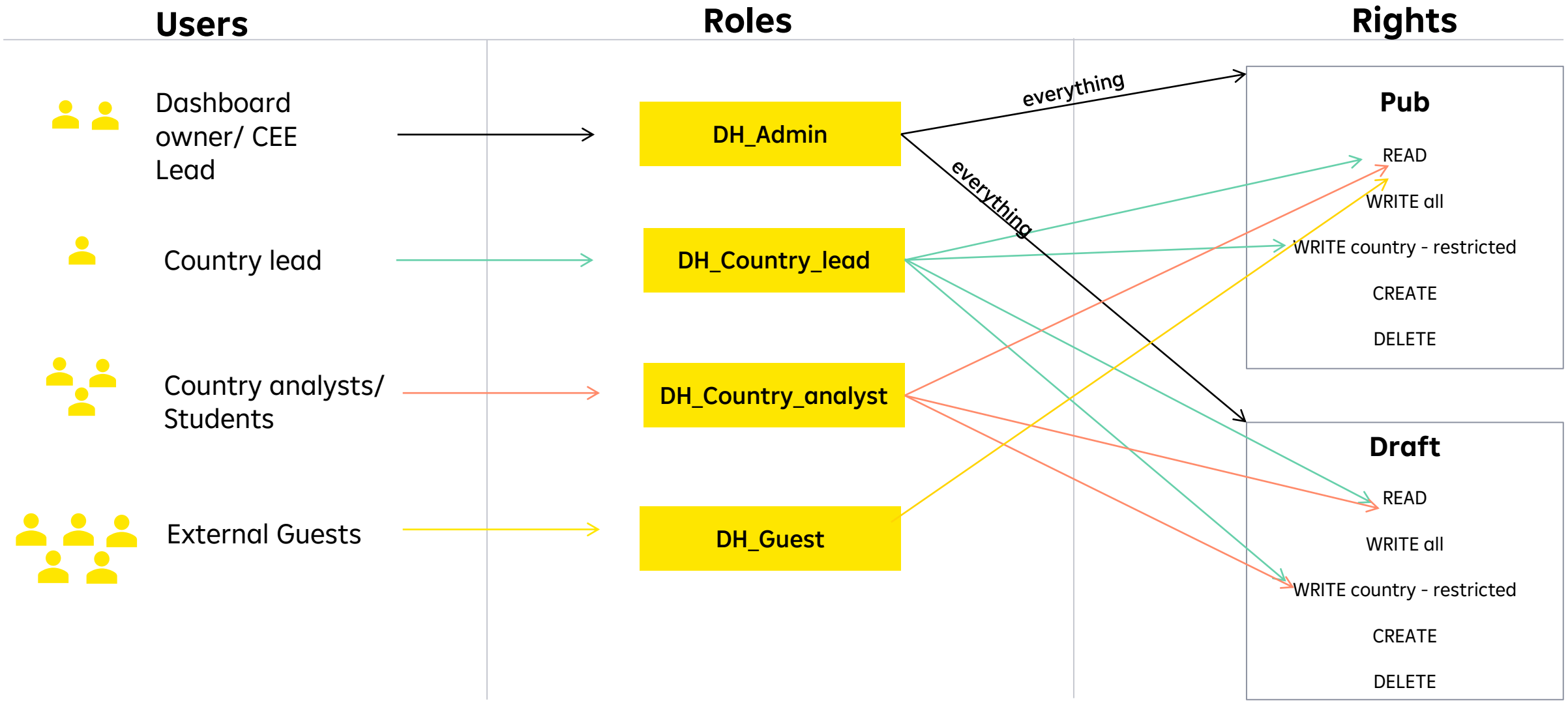
Overview | Global | **Poland** | Hungary | Czech Republic | Slovakia | Slovenia | CE | Romania

Current vs future environment

- x Many transfer sheets
- x Multiple data sources
- x Vulnerable to overwriting
- x Limited back-testing capability
- x Data downloads based on cell reading, highly error-prone

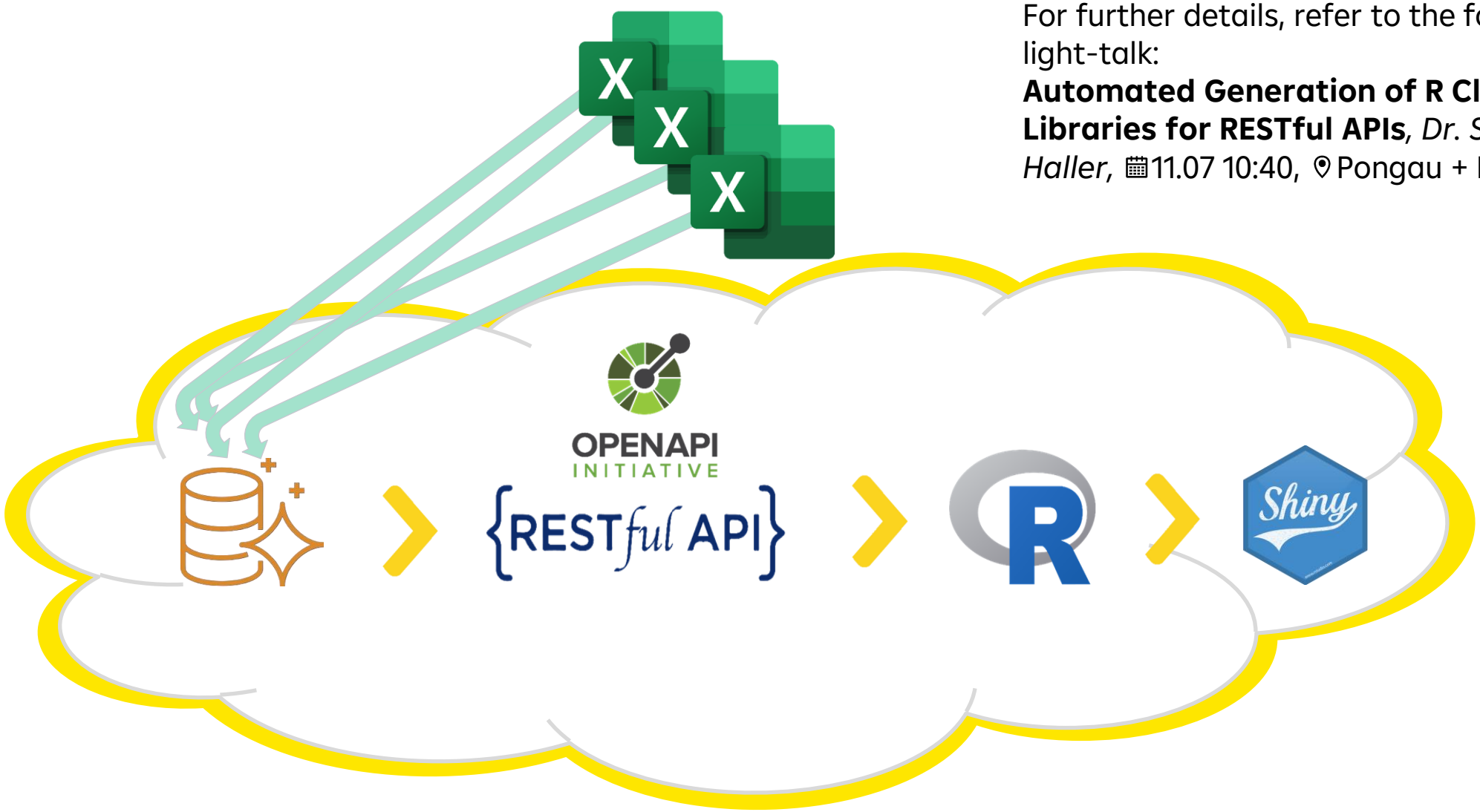
- ✓ One interface
- ✓ One database
- ✓ Only authorized users can edit
- ✓ Any revision is stored with author and revision date
- ✓ API for data download in R

Role- based access control model



Please note the risk notifications and explanations at the end of this document

A modern view for research data handling



For further details, refer to the following light-talk:
Automated Generation of R Client Libraries for RESTful APIs, *Dr. Simon Haller*, 11.07 10:40, Pongau + Flachgau

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HTTP Methods

Via our R client it is now possible to perform various HTTP methods in the database of our macro-economic timeseries:

Initialization:

```
library(rdhsdk)
client<-ApiClient$new(base_path, bearer_token)
dh<-TimeseriesApi$new(client)
```

GET:

```
table <- dh$get_data_bulk(instrument_name, datafield_name, freq, variant, start_date, end_date, version)
```

POST:

```
to_post <- dh$post_publish_bulk(instrument_name, datafield_name,freq,variant, version, target_version)
```

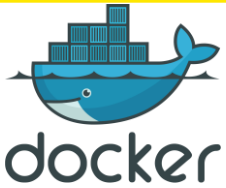
Deployment of the Shiny application

Development

- Shiny server and user interface

Dockerization

- It allows to „freeze" the R- and package versions.



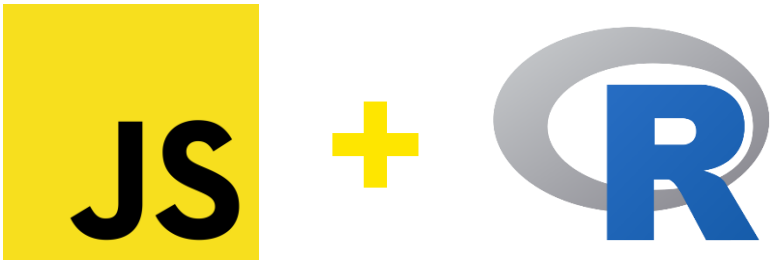
Deployment

- Authorization and authentication are handled via AWS Cognito.

Implementation in Shiny – Custom Requests

Why **rhandsontable**[1]

- Mimics Excel's logic
- Supports multiple cells copy/paste
- Allows column/row blocking
- Enables endless options for writing custom JS renderers for the desired logic.



[1] Jonathan Owen et al., 2021

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Implementation in Shiny II – sample renderer

```
renderer <- function(switchv,  row_diff = numeric(0), col_diff = numeric(0)){
paste0("
  function(instance, td, row, col, prop, value, cellProperties) {",
  "var hotInstance = instance.getData();
  var cellValue = hotInstance[row][col];",
  paste(switchv),
  "Handsontable.renderers.NumericRenderer.apply(this, arguments);
  if   (cellProperties.readOnly === true && col != 0) {
     td.style.background = '#e6e3e3';}
  for (var i = 0; i < ", length(row_diff), "; i++) {
     if (switchv){
        if (", toJSON(row_diff), "[i] === row && ", toJSON(col_diff), "[i] === col) {
           td.style.backgroundColor = '#FFFCA2'; // Apply custom style}
  }}}
")
}
```

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Pen-Test findings

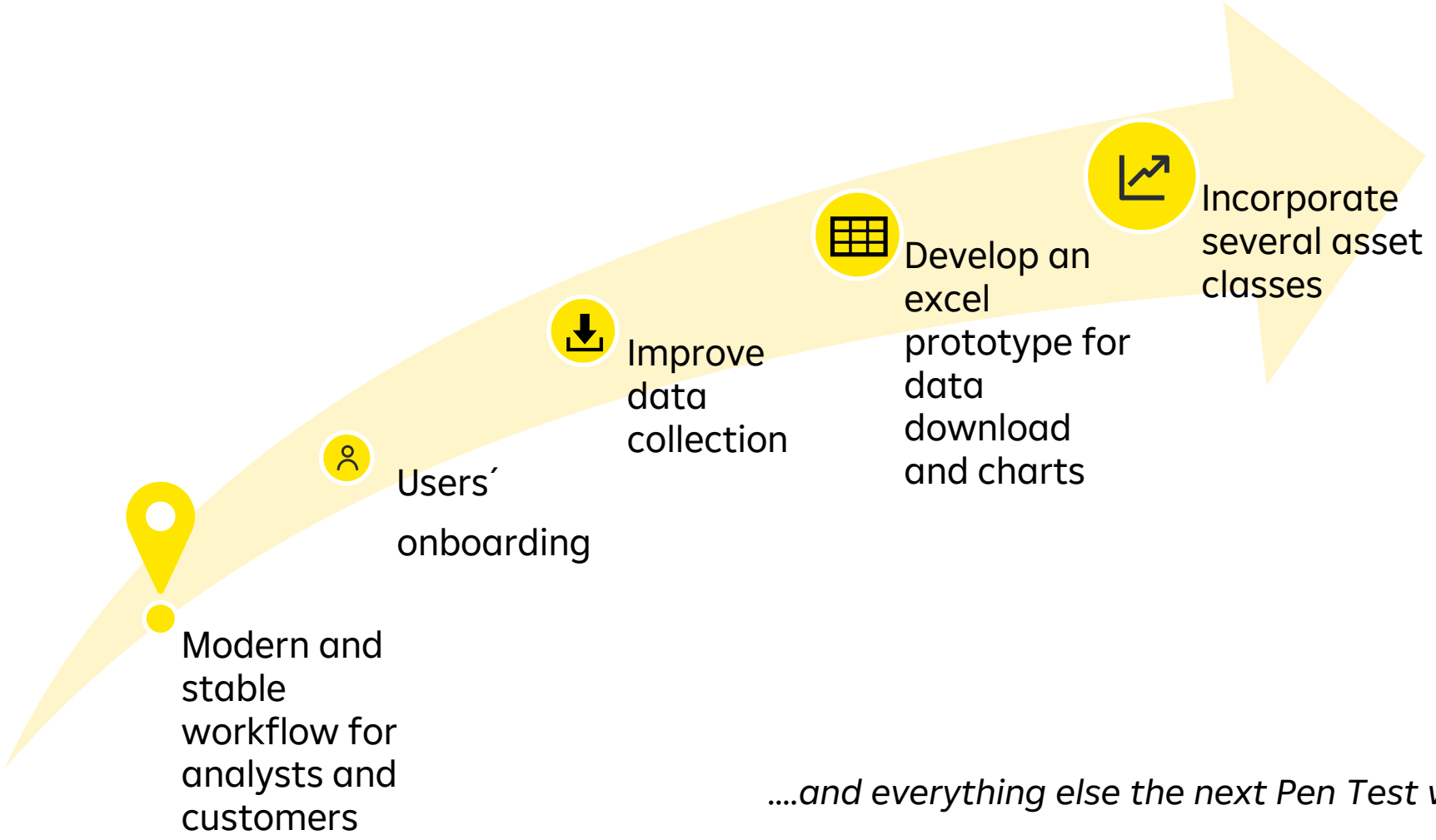
Issues

- Vulnerable Javascript finding due to outdated "Bootstrap 3.4.1" (2019) internally embedded in Shiny;
- Missing security-relevant HTTP headers

Solutions

- Redesign of the UI with the **bslib** library (Carson Sievert et al., 2024) for custom Bootstrap version;
- Adapted the default Shiny package with HTTP headers

Summary and Outlook



....and everything else the next Pen Test will bring

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Thank you!