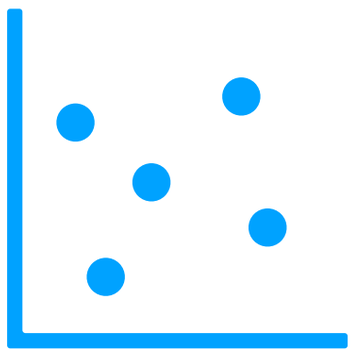
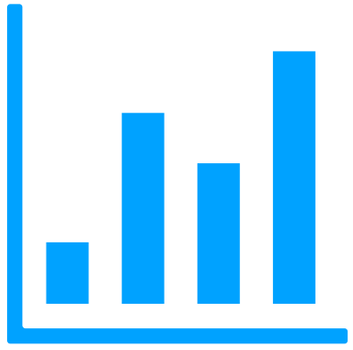
Data Visualisation

Pensions Persistency: Generalised Linear Models

Agenda



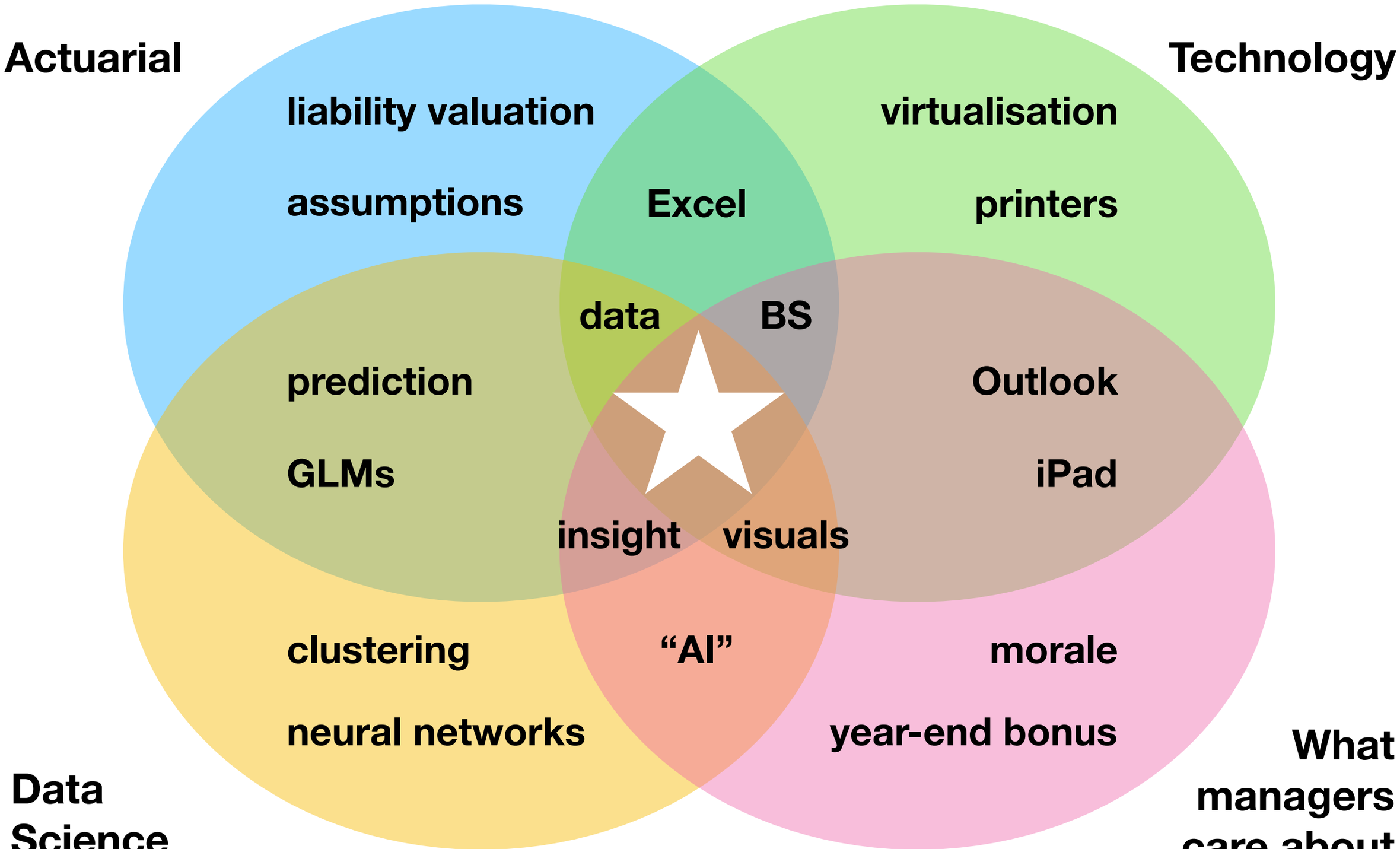
Introduce the “Advanced Modelling of Pensions Persistency” project



Describe how to put a D3 HTML widget into an R Shiny dashboard

Set a challenge for you…

Why?

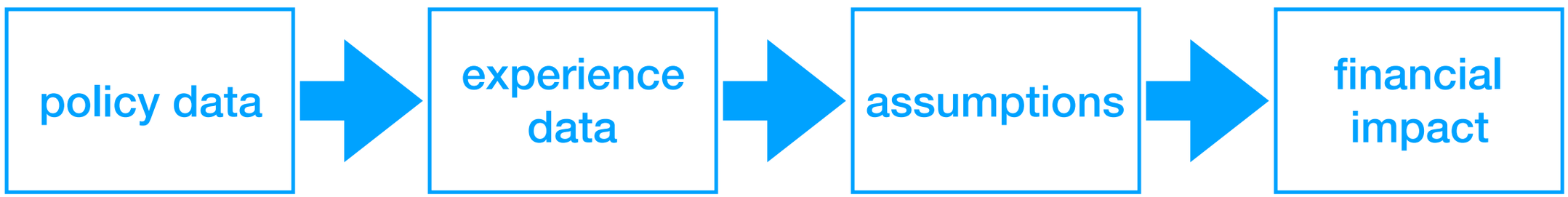

Actuarial
liability valuation
assumptions
Technology
virtualisation
printers
Excel
data
BS
prediction
GLMs
Outlook
iPad
insight
visuals
clustering
neural networks
“AI”
morale
year-end bonus
Data Science
What managers care about

What managers care about

- looks good
- correct
- intuitive
- no (or familiar) jargon
- bottom line
- quick wins
- what their boss will think

- what happens if it fails?
- new skills required
- perceived duplication
- IT security / bureaucracy
- upfront costs
- what others are doing
- “how bad will I look if it fails?”

Actuarial



- Policy number
- Birth date
- Entry date
- PUP date
- Exit date
- Exit reason
- Premium type
- Product
- …

- Age
- Duration
- Year
- Product
- …
- Exposure (years)
- Decrements (PUP or exit)

- Age
- Duration
- Product
- …
- Decrement rate (PUP or exit)

- Scenario
- Product
- BEL

We are ignoring a few complications: pensions freedoms; auto-enrolment staging; data quality; snapshot v transactions; temporal variables like fund value and premium paying status; augmenting data sets; missing postcodes; continuation schemes; processing lags; product versions and options; switches; partial withdrawals; policy segments; initial v. central exposure; valuation model limitations and approximations.

Data Science

$$log(Decrements) = \beta_0 + \beta_1 * Age + \beta_2 * Duration + log(Exposure) + \varepsilon$$

- Generalised Linear Models (GLM) are common in general insurance for modelling multiple risk factors.

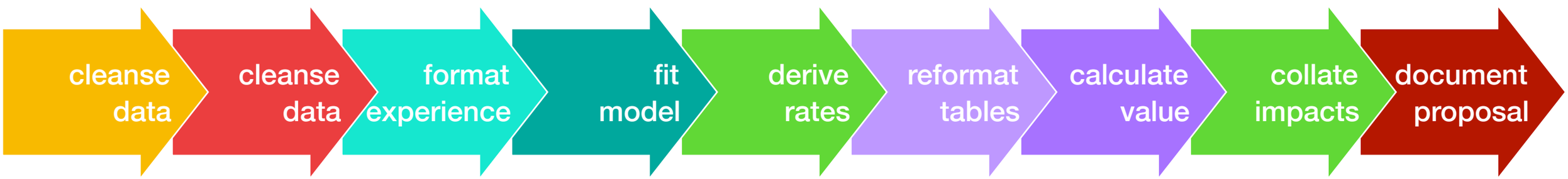
- We assume a Poisson distribution with log link and an Exposure offset

- Decrement analysis looks like a classification problem… but it is different.

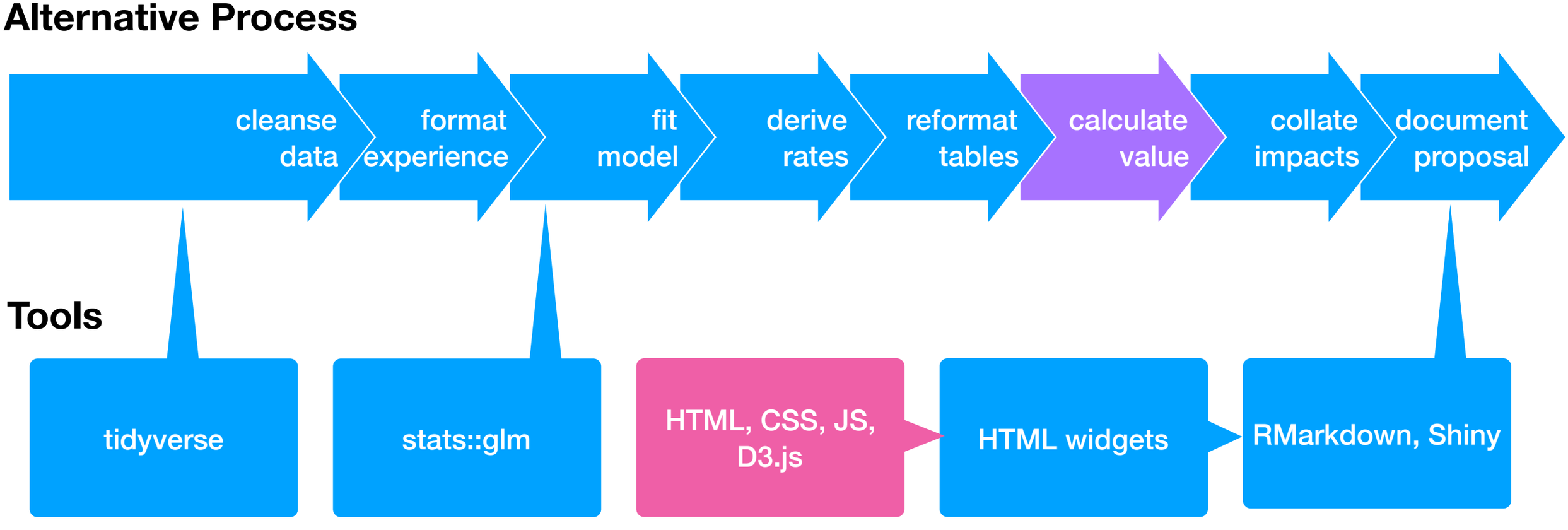
- We chose models based on Akaike Information Criterion (AIC), p-values, “common sense”, stability of relationships over time, ease of implementation.

Technology

Actual Process



Alternative Process



2 “quick” demos

testWidgetScroll

lineChartWidget

- aimed at semi-technical management
- illustrate how experience analysis and GLMs work
- help visualise a multiple dimensional problem
- help rationalise the financial impact
- describe how to choose GLM
- show off capability of the R ecosystem

exposureApp

exposureChartWidget

- aimed at this room
- illustrate how experience data is collated
- provide a template for a D3 HTML widget

What do you think works well? … and what could be better?

Anatomy of an HTML widget

Meta / project

DESCRIPTION

NAMESPACE

.gitignore

.Rbuildignore

.Rhistory

R code

XYZwidget
R function formats data / options then ‘creates’ the HTMLwidget

XYZwidgetOutput

renderXYZWidget

JS code

XYZwidget.JS
defines ‘factory’ to create object with methods: ‘resize’ and ‘renderValue’

XYZwidget.YAML

Other files

D3 V4 js

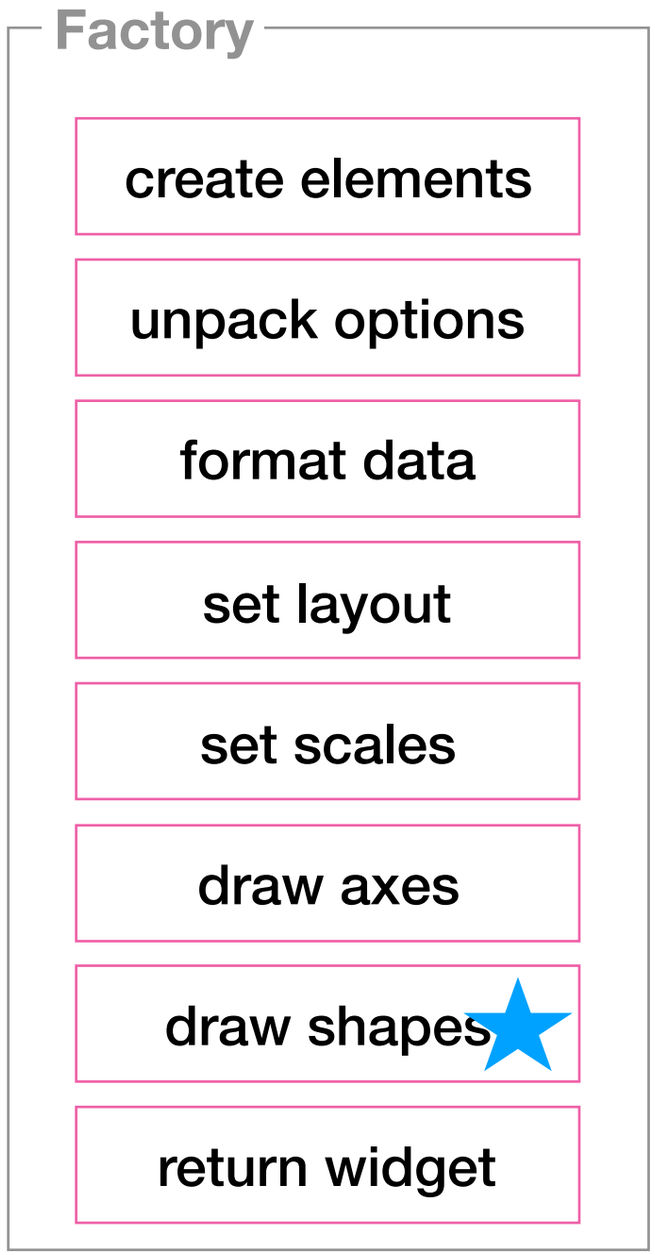
…

XYZwidget.CSS

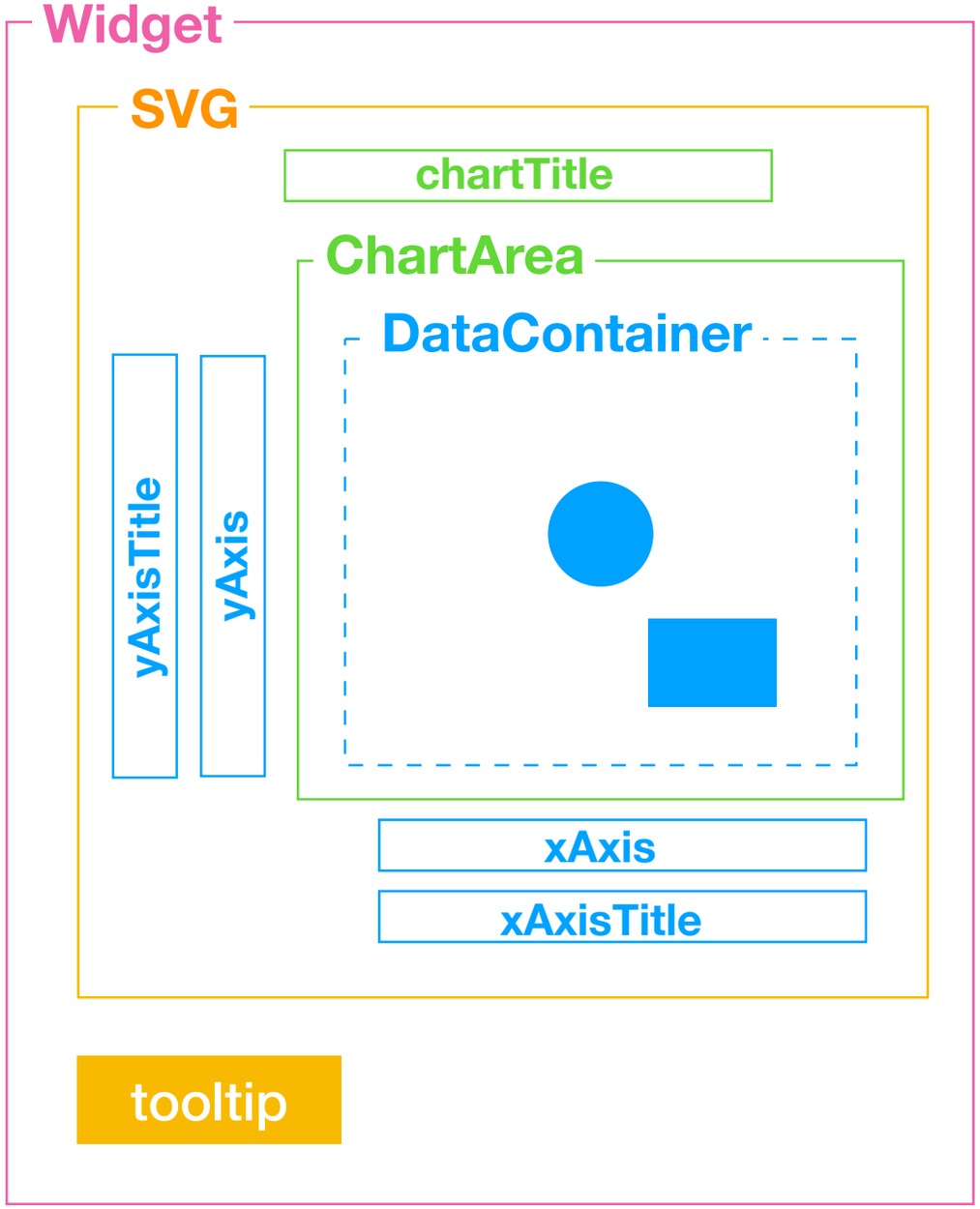
XYZwidget(dataset, options, …, width, height)

D3: Linking data to shapes

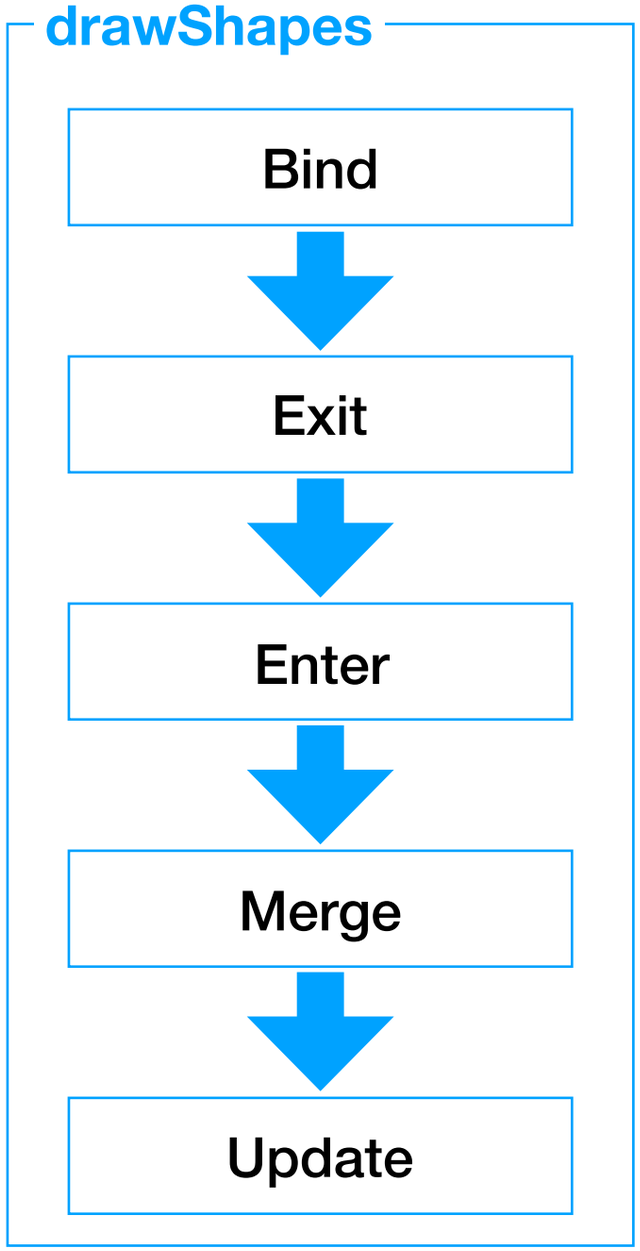
Widget JS Code



DOM Elements



D3 update cycle



Challenge

- Design a data visualisation tool.
- Ideally, focus on a subject that you are already familiar with.
- Think about how a user would interact with the data visualisation tool.
- Think about how your design addresses “what managers care about”.
- Present back to the group to explain your thoughts and sketches.

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- quick wins
- what their boss will think

- what happens if it fails?
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Resources / Inspiration

- Some great charts: https://github.com/d3/d3/wiki/Gallery
- How shiny apps work: https://shiny.rstudio.com/gallery/
- How HTML widgets work: https://www.htmlwidgets.org
- How D3 works: https://www.d3-graph-gallery.com
- Potential ideas for business /data problems to solve:
    - understand the assets in a portfolio and their sensitivity to different risks
    - understand the impact of changes in the risk profile on the diversification benefit
    - describe the split of policies between different product types
    - show how process controls are linked to the risks they aim to mitigate