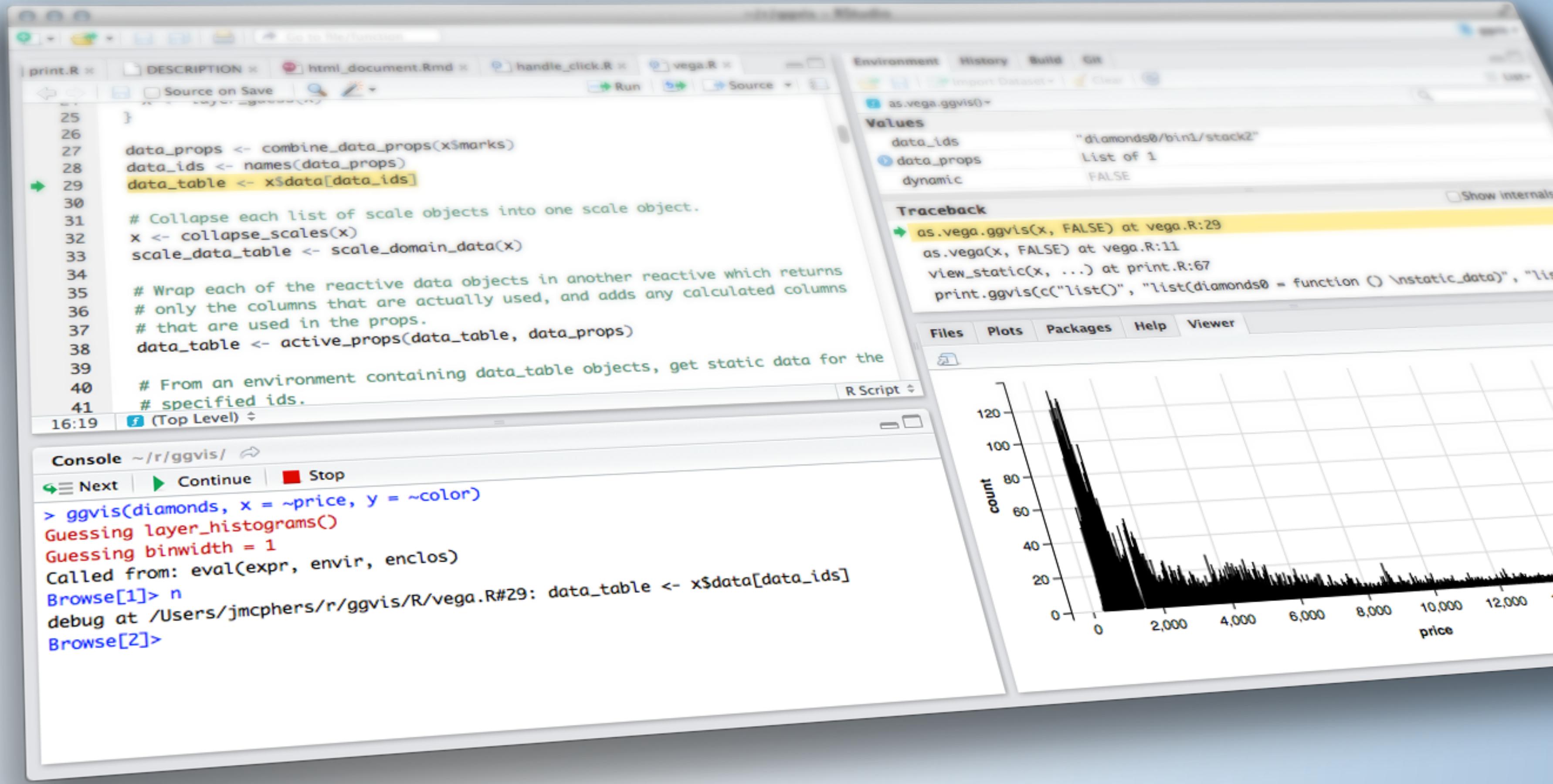


A FAST INTRODUCTION TO SHINY



Shiny from  R Studio™

BACKGROUND

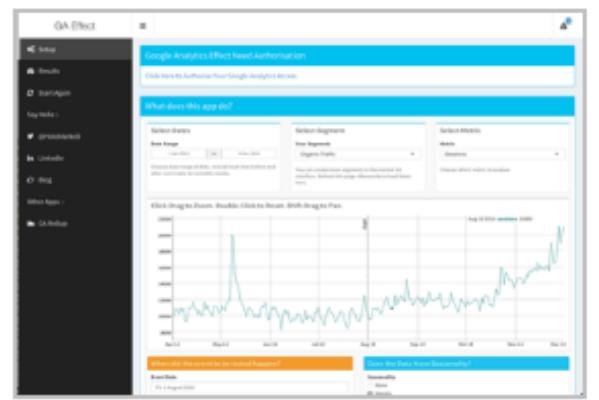
- ▶ You know what a Shiny app is, and may have even made a few of them.
- ▶ You are familiar with R as a programming language.

SHINY SHOWCASE

Shiny User Showcase

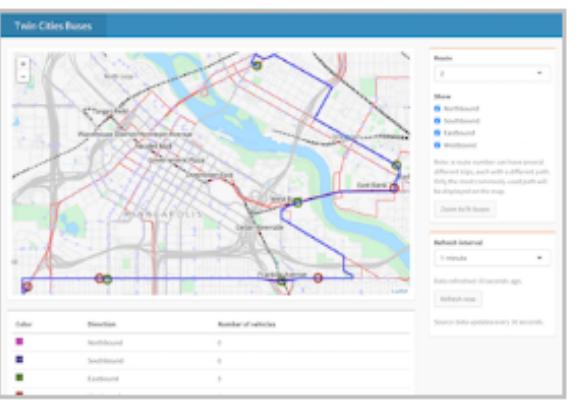
Shiny is designed for fully interactive visualization, using JavaScript libraries like d3, Leaflet, and Google Charts. Our users create fantastic examples, and some have shared them with the community. Here are some examples that we particularly like.

Shiny Apps for the Enterprise



MARKETING EFFECTS

See the effects of your marketing campaigns.



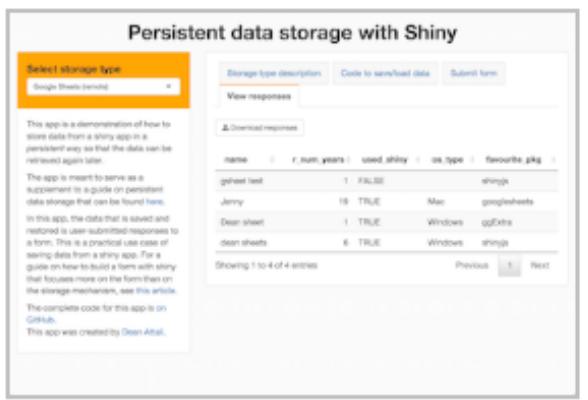
LOCATION TRACKER

Track locations over time with streaming data.



DOWNLOAD MONITOR

Streaming download rates visualized as a bubble chart.

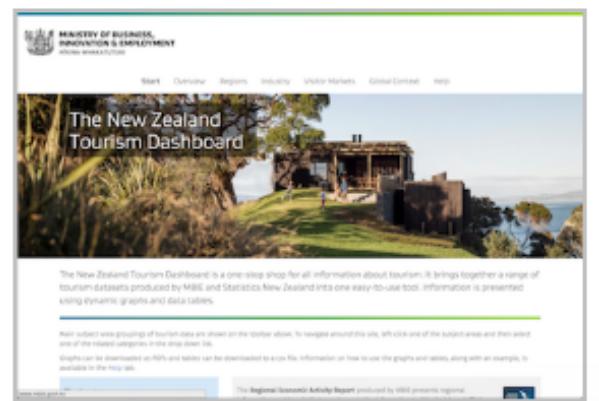


PERSISTENT STORAGE

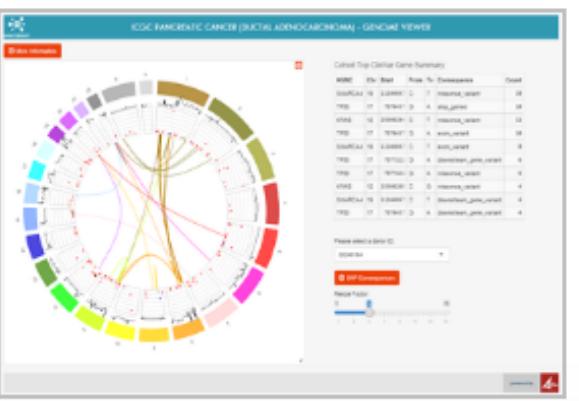
Save data from your apps to local files, servers, databases, and more.

<https://www.rstudio.com/products/shiny/shiny-user-showcase/>

Industry Specific Shiny Apps



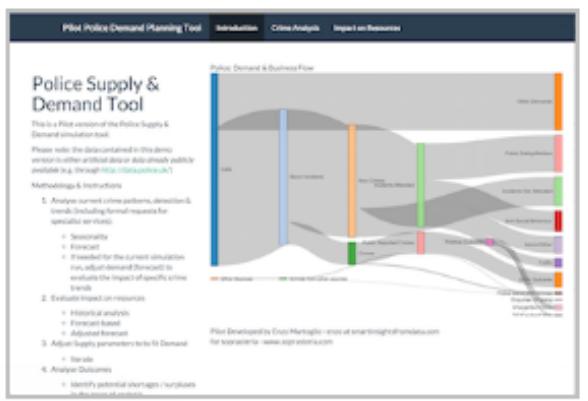
TOURISM DASHBOARD



GENOME BROWSER



ER OPTIMIZATION



SUPPLY AND DEMAND

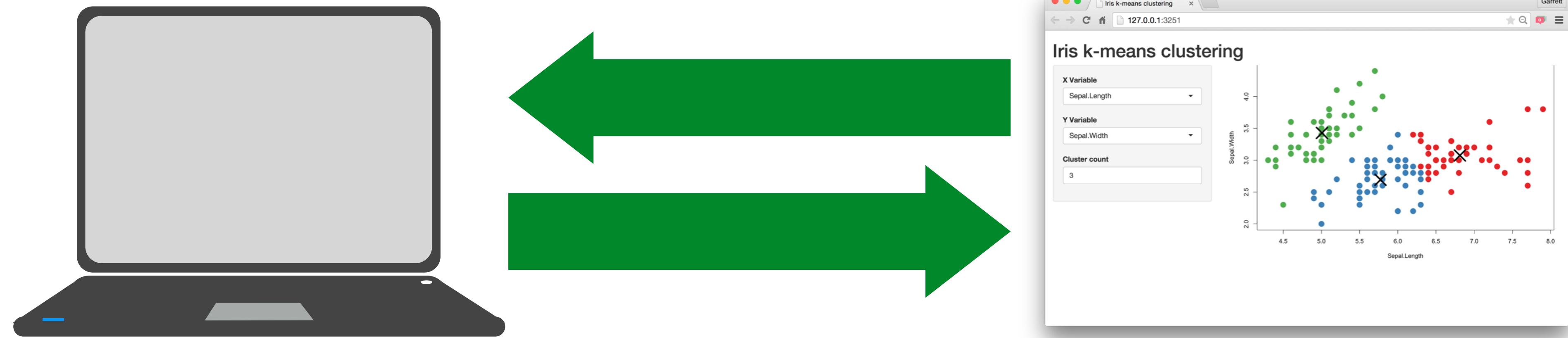
OUTLINE

- ▶ High level view
- ▶ Anatomy of a Shiny app
 - ▶ User interface
 - ▶ Server function
 - ▶ Running the app
- ▶ File Structure
- ▶ Sharing your app

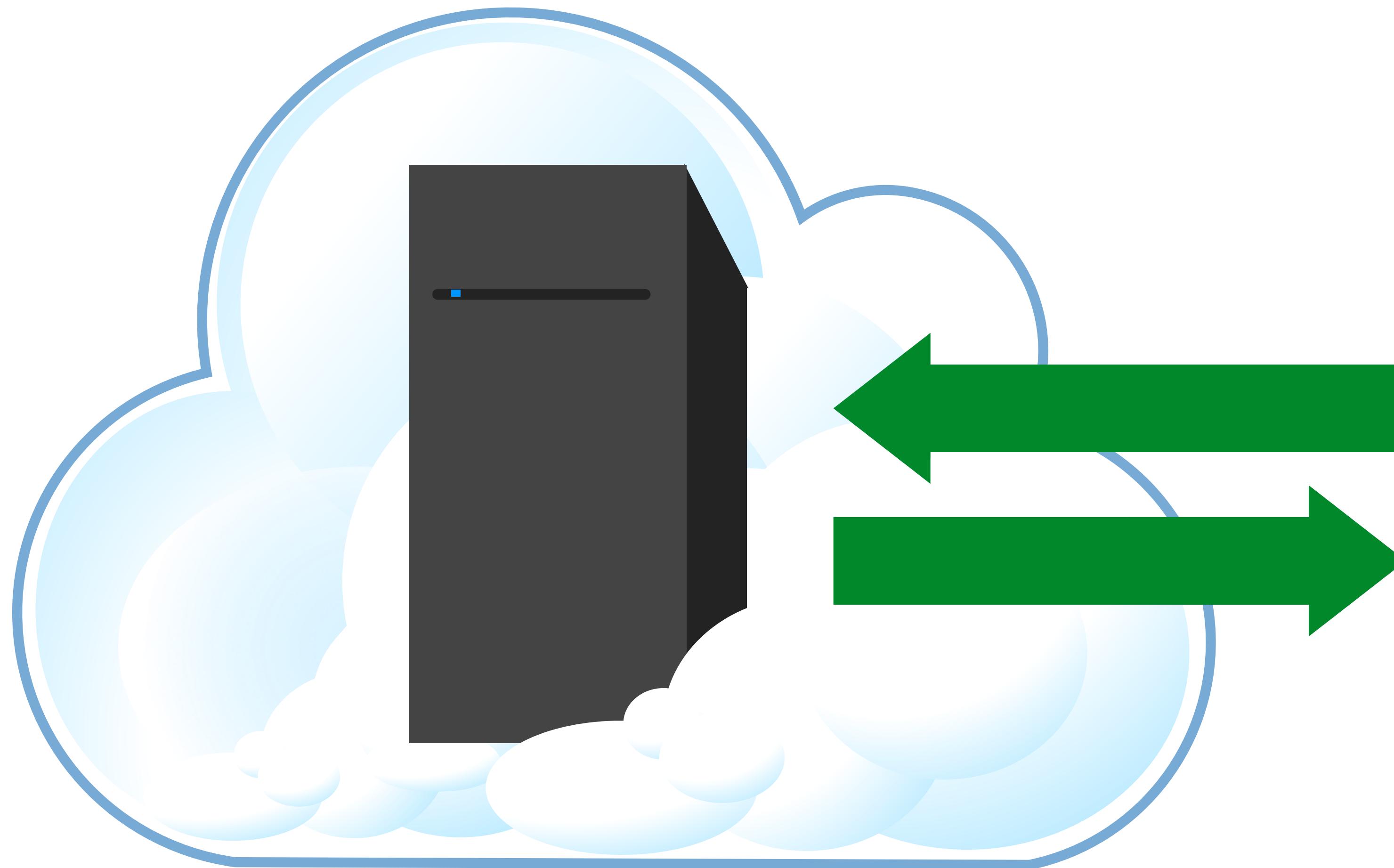
High level

view

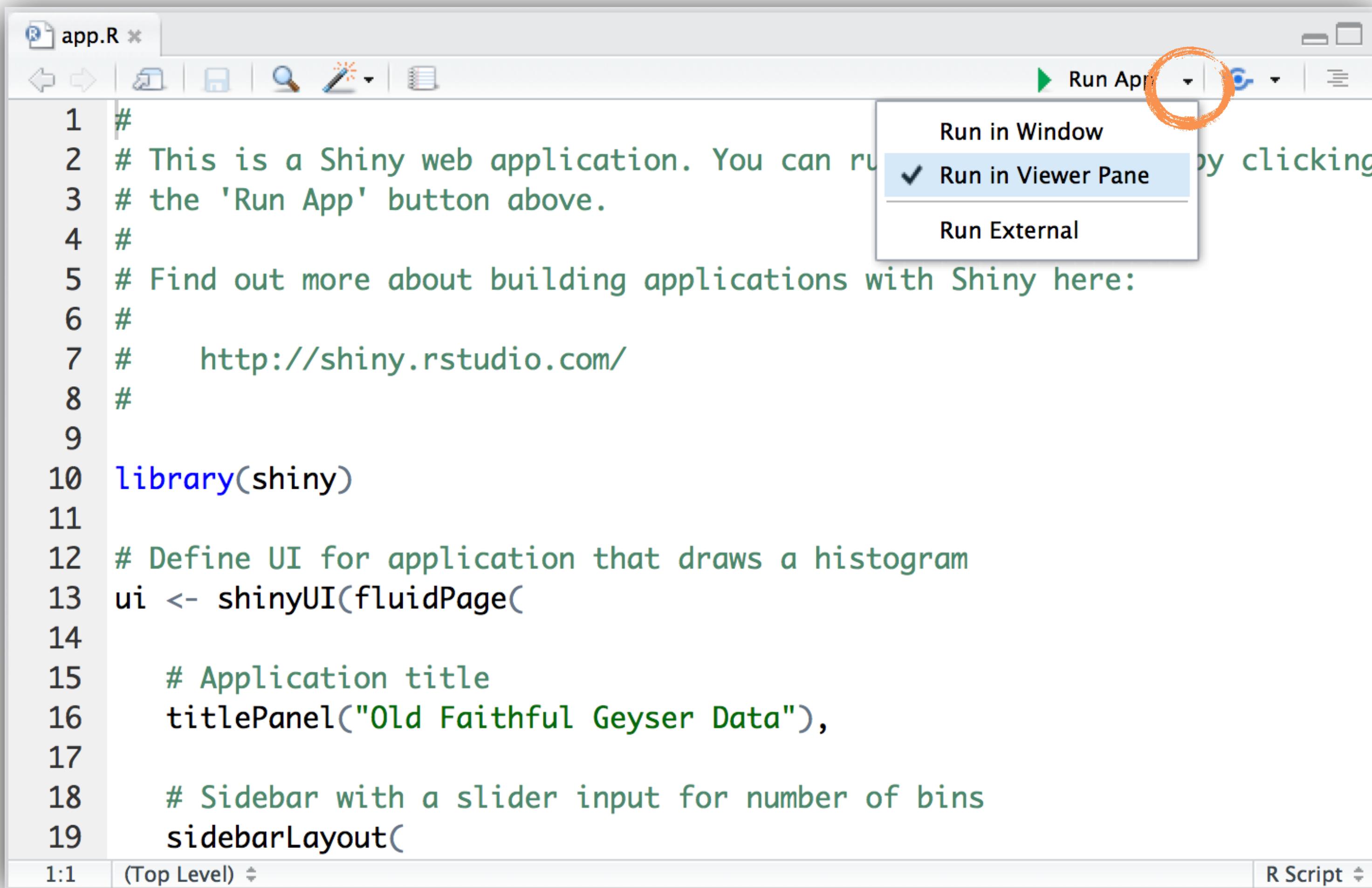
Every Shiny app is maintained by a computer running R



Every Shiny app is maintained by a computer running R



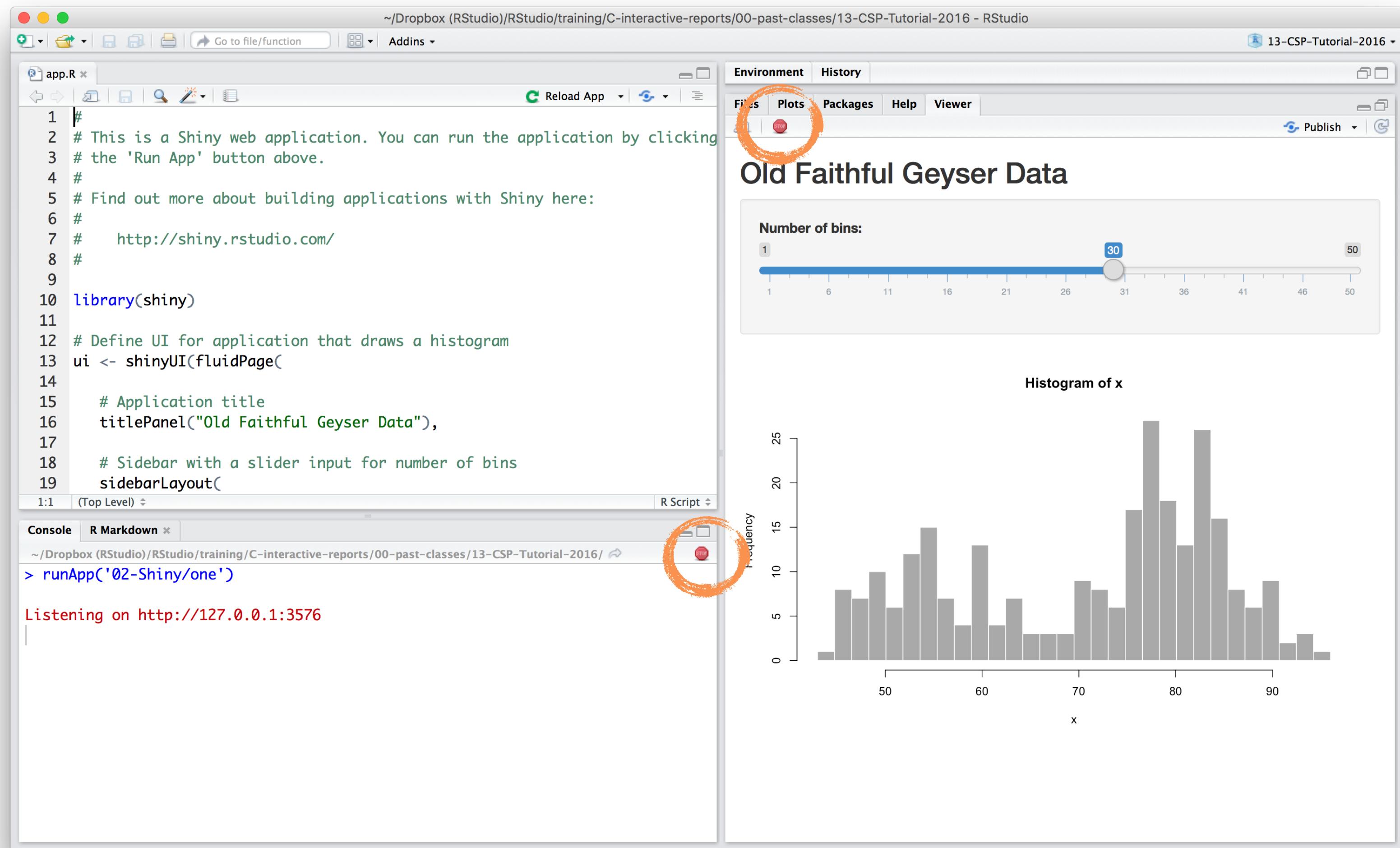
Change display



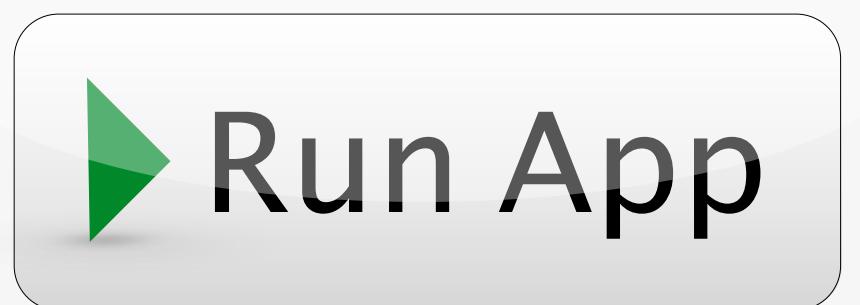
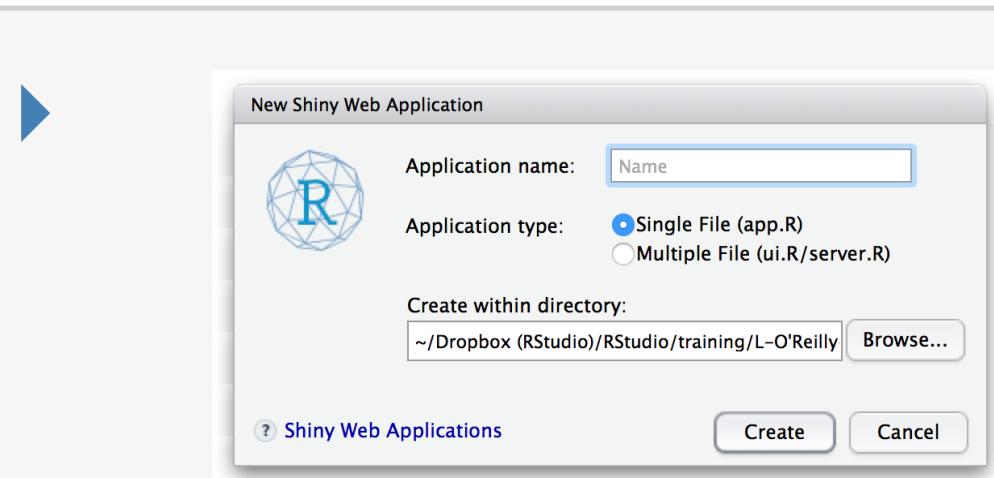
The screenshot shows the RStudio interface with the 'app.R' script open. The 'Run App' button in the toolbar has a red circle drawn around it. A context menu is open from this button, listing three options: 'Run in Window', 'Run in Viewer Pane' (which is checked), and 'Run External'. The code in the script is a basic Shiny application example.

```
1 #>
2 # This is a Shiny web application. You can run
3 # the 'Run App' button above.
4 #
5 # Find out more about building applications with Shiny here:
6 #
7 #   http://shiny.rstudio.com/
8 #
9
10 library(shiny)
11
12 # Define UI for application that draws a histogram
13 ui <- shinyUI(fluidPage(
14
15   # Application title
16   titlePanel("Old Faithful Geyser Data"),
17
18   # Sidebar with a slider input for number of bins
19   sidebarLayout(
```

Close an app



EXERCISE



Open a new Shiny app with
File ▶ New File ▶ Shiny Web App...

Launch the app by opening app.R and
clicking **Run App**

Close app by clicking the stop sign icon

Select view mode in the drop down
menu next to Run App

3m 00s

Anatomy of a shiny app

WHAT'S IN AN APP?

```
library(shiny)  
ui <- fluidPage()
```

User interface

controls the layout and appearance of app

```
server <- function(input, output) {}
```

Server function

contains instructions needed to build app

```
shinyApp(ui = ui, server = server)
```

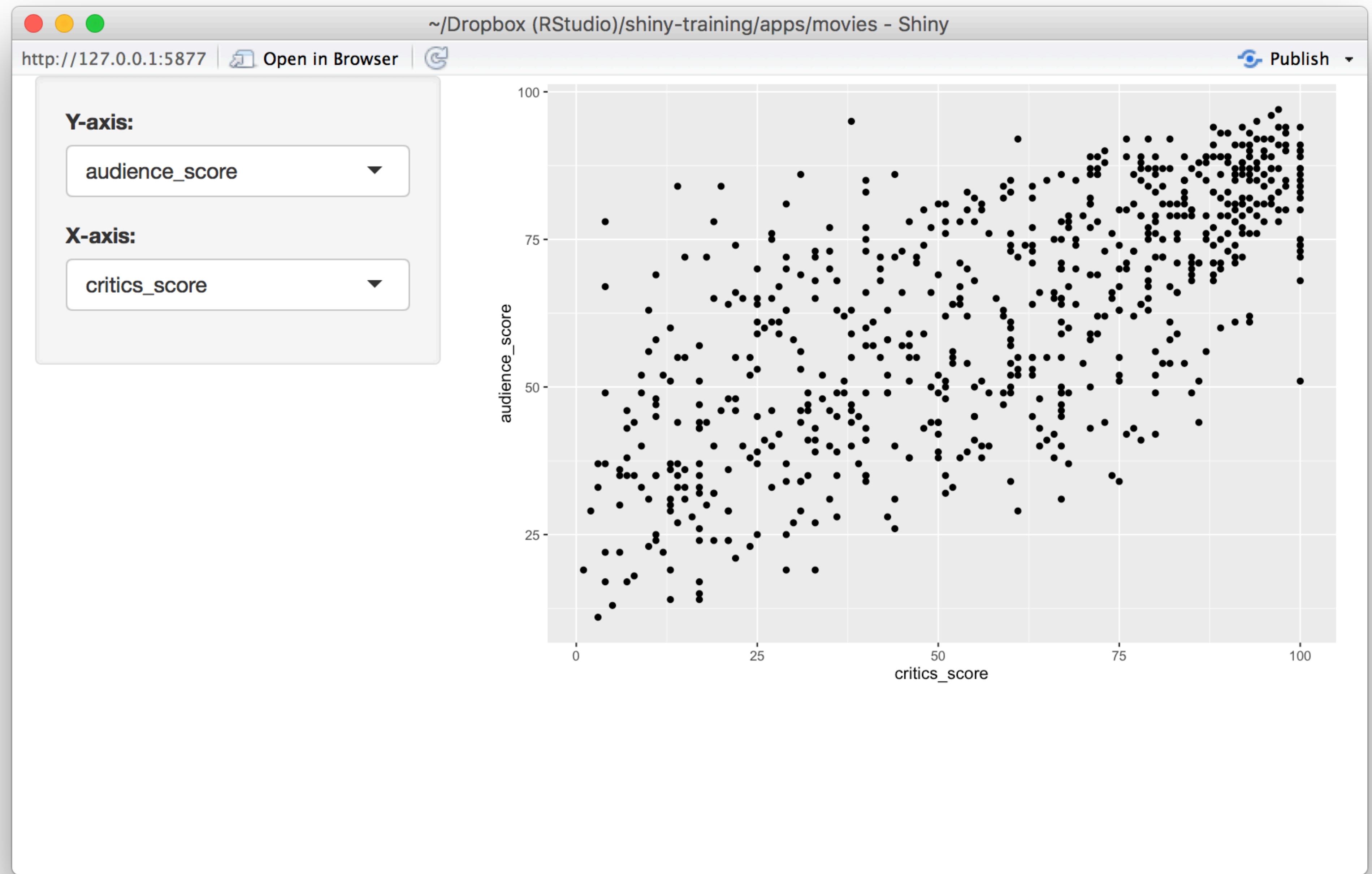


Let's build a simple movie browser app!



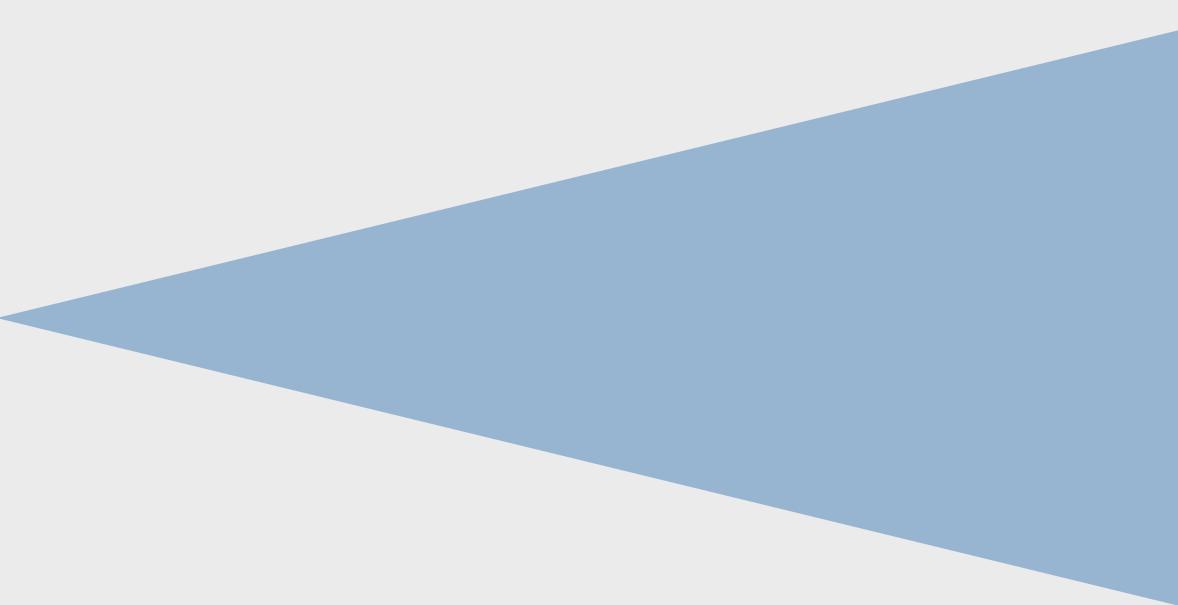
movies.Rdata

Data from IMDB and Rotten Tomatoes on random sample of 651 movies released in the US between 1970 and 2014



APP TEMPLATE

```
library(shiny)  
library(ggplot2)  
load("movies.Rdata")  
ui <- fluidPage()
```



Dataset used for this app

```
server <- function(input, output) {}  
  
shinyApp(ui = ui, server = server)
```

User interface

```
# Define UI for application that plots features of movies
ui <- fluidPage(

  # Sidebar layout with a input and output definitions
  sidebarLayout(
    # Inputs: Select variables to plot
    sidebarPanel(
      # Select variable for y-axis
      selectInput(inputId = "y", label = "Y-axis:",
                  choices = c("imdb_rating", "imdb_num_votes", "critics_score", "audience_score", "runtime"),
                  selected = "audience_score"),
      # Select variable for x-axis
      selectInput(inputId = "x", label = "X-axis:",
                  choices = c("imdb_rating", "imdb_num_votes", "critics_score", "audience_score", "runtime"),
                  selected = "critics_score")
    ),
    # Output: Show scatterplot
    mainPanel(
      plotOutput(outputId = "scatterplot")
    )
  )
)
```

```
# Define UI for application that plots features of movies
ui <- fluidPage( Create fluid page layout

  # Sidebar layout with a input and output definitions
  sidebarLayout(
    # Inputs: Select variables to plot
    sidebarPanel(
      # Select variable for y-axis
      selectInput(inputId = "y", label = "Y-axis:",
                  choices = c("imdb_rating", "imdb_num_votes", "critics_score", "audience_score", "runtime"),
                  selected = "audience_score"),
      # Select variable for x-axis
      selectInput(inputId = "x", label = "X-axis:",
                  choices = c("imdb_rating", "imdb_num_votes", "critics_score", "audience_score", "runtime"),
                  selected = "critics_score")
    ),
    # Output: Show scatterplot
    mainPanel(
      plotOutput(outputId = "scatterplot")
    )
  )
)
```

```
# Define UI for application that plots features of movies
ui <- fluidPage(  
  
  # Sidebar layout with a input and output definitions
  sidebarLayout(  
    # Inputs: Select variables to plot
    sidebarPanel(  
      # Select variable for y-axis
      selectInput(inputId = "y", label = "Y-axis:",
                  choices = c("imdb_rating", "imdb_num_votes", "critics_score", "audience_score", "runtime"),
                  selected = "audience_score"),  

      # Select variable for x-axis
      selectInput(inputId = "x", label = "X-axis:",
                  choices = c("imdb_rating", "imdb_num_votes", "critics_score", "audience_score", "runtime"),
                  selected = "critics_score")  
    ),  
  
    # Output: Show scatterplot
    mainPanel(  
      plotOutput(outputId = "scatterplot")  
    )  
  )
```

Create a layout with a sidebar and main area

```
# Define UI for application that plots features of movies
ui <- fluidPage(
```

```
  # Sidebar layout with a input and output definitions
  sidebarLayout(
```

```
    # Inputs: Select variables to plot
    sidebarPanel(
```

```
      # Select variable for y-axis
      selectInput(inputId = "y", label = "Y-axis:",
                  choices = c("imdb_rating", "imdb_num_votes", "critics_score", "audience_score", "runtime"),
                  selected = "audience_score"),
```

```
      # Select variable for x-axis
      selectInput(inputId = "x", label = "X-axis:",
                  choices = c("imdb_rating", "imdb_num_votes", "critics_score", "audience_score", "runtime"),
                  selected = "critics_score")
```

```
    ),
```

```
    # Output: Show scatterplot
    mainPanel(
```

```
      plotOutput(outputId = "scatterplot")
```

```
    )
```

```
)
```

Create a sidebar panel containing **input** controls that can in turn be passed to **sidebarLayout**

```
# Define UI for application that plots features of movies
ui <- fluidPage(
```



```
  # Sidebar layout with a input and output definitions
  sidebarLayout(
```



```
    # Inputs: Select variables to plot
    sidebarPanel(
```



```
      # Select variable for y-axis
      selectInput(inputId = "y", label = "Y-axis:",
                  choices = c("imdb_rating", "imdb_num_votes", "critics_score",
                             "audience_score"),
                  selected = "audience_score"),
```



```
      # Select variable for x-axis
      selectInput(inputId = "x", label = "X-axis:",
                  choices = c("imdb_rating", "imdb_num_votes", "critics_score",
                             "audience_score", "runtime"),
                  selected = "critics_score")
```



```
    ),
```



```
    # Output: Show scatterplot
    mainPanel(
```



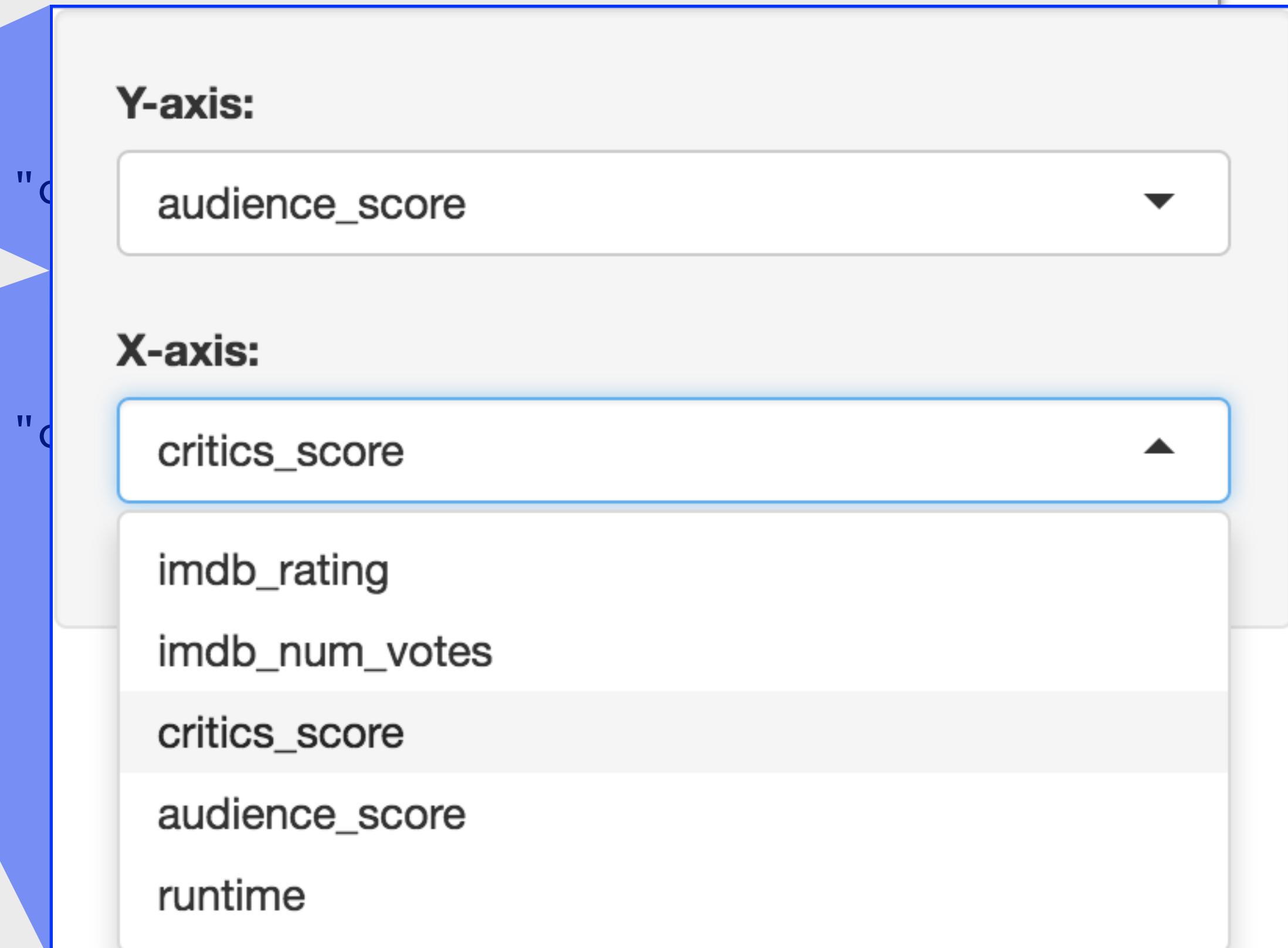
```
      plotOutput(outputId = "scatterplot")
```



```
    )
```



```
  )
```



```
# Define UI for application that plots features of movies
ui <- fluidPage(
```

```
  # Sidebar layout with a input and output definitions
  sidebarLayout(
```

```
    # Inputs: Select variables to plot
    sidebarPanel(
```

```
      # Select variable for y-axis
      selectInput(inputId = "y", label = "Y-axis:",
                  choices = c("imdb_rating", "imdb_num_votes", "critics_score", "audience_score", "runtime"),
                  selected = "audience_score"),
```

```
      # Select variable for x-axis
      selectInput(inputId = "x", label = "X-axis:",
                  choices = c("imdb_rating", "imdb_num_votes", "critics_score", "audience_score", "runtime"),
                  selected = "critics_score")
```

```
    ),
```

```
    # Output: Show scatterplot
    mainPanel(
```

```
      plotOutput(outputId = "scatterplot")
```

```
    )
```

```
)
```

Create a main panel containing **output** elements that get created in the server function can in turn be passed to **sidebarLayout**

Server function

```
# Define server function required to create the scatterplot
server <- function(input, output) {

  # Create the scatterplot object the plotOutput function is expecting
  output$scatterplot <- renderPlot({
    ggplot(data = movies, aes_string(x = input$x, y = input$y)) +
      geom_point()
  })
}
```

```
# Define server function required to create the s  
server <- function(input, output) {  
  
  # Create the scatterplot object the plotOutput function is expecting  
  output$scatterplot <- renderPlot({  
    ggplot(data = movies, aes_string(x = input$x, y = input$y)) +  
    geom_point()  
  })  
}  
}
```

Contains instructions
needed to build app

```
# Define server function required to create the scatterplot
server <- function(input, output) {

  # Create the scatterplot object the plotOutput
  output$scatterplot <- renderPlot({
    ggplot(data = movies, aes_string(x = input$x,
      geom_point()
    })
  })
}
```

Renders a **reactive** plot that is suitable for assigning to an output slot

```
# Define server function required to create the scatterplot
server <- function(input, output) {

  # Create the scatterplot object the plotOutput function is expecting
  output$scatterplot <- renderPlot({
    ggplot(data = movies, aes_string(x = input$x, y = input$y)) +
      geom_point()
  })
}
```

Good ol' ggplot2 code,
with **inputs** from UI

Running the app

```
# Run the application  
shinyApp(ui = ui, server = server)
```

DEMO



Putting it all together...

`movies_01.R`



EXERCISE

- ▶ Add new select menu to color the points by
 - ▶ `inputId = "z"`
 - ▶ `label = "Color by:"`
 - ▶ `choices = c("title_type", "genre", "mpaa_rating", "critics_rating", "audience_rating")`
 - ▶ `selected = "mpaa_rating"`
- ▶ Use this variable in the aesthetics of the `ggplot` function as the color argument to color the points by
- ▶ Run the app in the Viewer Pane
- ▶ Compare your code / output with the person sitting next to / nearby you

5m 00s



SOLUTION

Solution to the previous exercise

`movies_02.R`

INPUTS

Interactive Web Apps with shiny Cheat Sheet
learn more at shiny.rstudio.com

R Studio

Basics

A shiny app is a web page (`UI`) connected to a server running a live R session (`Server`).
Users can manipulate the UI, which will cause the server to update the UI displays (by running R code).
A template

```
library(shiny)
ui <- fluidPage(
  numericInput(inputId = "n",
              label = "Sample size",
              value = 25,
              min = 1,
              max = 100)
  server <- function(input, output) {
    output$hist <- renderPlot({
      hist(rnorm(input$n))
    })
  }
  shinyApp(ui = ui, server = server)
```

Begin writing a new app with this template. Preview the app by running the code at the command line.

Outputs - render() and output() functions work together to add R output to the UI

```
library(shiny)
ui <- fluidPage(
  numericInput(inputId = "n",
              label = "Sample size",
              value = 25,
              min = 1,
              max = 100)
  server <- function(input, output) {
    output$hist <- renderPlot({
      hist(rnorm(input$n))
    })
  }
  shinyApp(ui = ui, server = server)
```

Save each app as a directory that contains an `app.R` file (or a `server.R` file and a `ui.R` file) plus optional extra files.

Share your app

To host it on shinyapps.io, a cloud based service from RStudio

- Create a free or professional account at <http://shinyapps.io>
- Click the Publish icon in the RStudio IDE (F12 or run `rsmash`)
- Build or purchase your own Shiny Server at www.rstudio.com/products/shiny-server/

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Action

actionButton(inputId, label, icon, ...)

Link

actionLink(inputId, label, icon, ...)

checkboxGroupInput(inputId, label, choices, selected, inline)

checkboxInput(inputId, label, value)

dateInput(inputId, label, value, min, max, format, startview, weekstart, language)

dateRangeInput(inputId, label, start, end, min, max, format, startview, weekstart, language, separator)

fileInput(inputId, label, multiple, accept)

numericInput(inputId, label, value, min, max, step)

passwordInput(inputId, label, value)

radioButtons(inputId, label, choices, selected, inline)

selectInput(inputId, label, choices, selected, multiple, selectize, width, size) (also selectizeInput())

sliderInput(inputId, label, min, max, value, step, round, format, locale, ticks, animate, width, sep, pre, post)

submitButton(text, icon)
(Prevents reactions across entire app)

textInput(inputId, label, value)

numericInput(inputId, label, value, min, max, step)

passwordInput(inputId, label, value)

radioButtons(inputId, label, choices, selected, inline)

selectInput(inputId, label, choices, selected, multiple, selectize, width, size) (also selectizeInput())

sliderInput(inputId, label, min, max, value, step, round, format, locale, ticks, animate, width, sep, pre, post)

submitButton(text, icon)
(Prevents reactions across entire app)

textInput(inputId, label, value)



EXERCISE

- ▶ Add new input variable to control the alpha level of the points
 - ▶ This should be a **sliderInput**
 - ▶ See shiny.rstudio.com/reference/shiny/latest/ for help
 - ▶ Values should range from 0 to 1
 - ▶ Set a default value that looks good
 - ▶ Use this variable in the geom of the **ggplot** function as the alpha argument
 - ▶ Run the app in a new window
 - ▶ Compare your code / output with the person sitting next to / nearby you

5m 00s

A large, light gray checkmark icon inside a circle, positioned in the top-left corner.

SOLUTION

Solution to the previous exercise

`movies_03.R`

OUTPUTS

Interactive Web Apps with shiny Cheat Sheet
learn more at shiny.rstudio.com

R Studio

Basics

A Shiny app is a web page (UI) connected to a computer running a live R session (Server).
Users can manipulate the UI, which will cause the server to update the UI displays (by running R code).

App template
Begin writing a new app with this template. Preview the app by running the code at the R command line.

```
library(shiny)
ui <- fluidPage(
  numericInput("n", "Number of observations", value = 25,
  plotOutput("hist"))
)
server <- function(input, output) {
  output$hist <- renderPlot({
    hist(rnorm(input$n))
  })
}
shinyApp(ui = ui, server = server)
```

• **ui** - nest R functions that assemble an HTML user interface for a function.
• **server** - a function that defines how to build and return the R objects displayed in the UI.
• **shinyApp** - combines **ui** and **server** into a functioning app. Wrap with `runApp()` if calling from a separate script or inside a function.

Share your app
The easiest way to share your app is to host it on shinyapps.io, a cloud based service from RStudio.

1. Create a free or professional account at <http://shinyapps.io>
2. Click the **Publish** icon in the RStudio IDE (≥ 0.99) or run: `rconnect::deployApp(<path to directory>)`

Build or purchase your own Shiny Server at www.rstudio.com/products/shiny-server/

Shiny is a trademark of RStudio, Inc. • CC BY RStudio • info@rstudio.com • 844-448-1212 • rstudio.com • More cheat sheets at <http://rstudio.com/resources/cheatsheets> • Learn more at shiny.rstudio.com/tutorial • shiny 0.12.0 • Updated: 01/16

Building an App - Complete the template by adding arguments to `fluidPage()` and a body to the server function.

Inputs - collect values from the user
Access the current value of an input object with `$<inputId>`. Input values are reactive.

Actions
actionButton(inputId, label, icon, ...)
actionLink(inputId, label, icon, ...)

Links
choice 1, choice 2, choice 3
checkboxGroupInput(inputId, label, choices, selected, inline)

Check me
checkboxInput(inputId, label, value)

Date inputs
dateRangeInput(inputId, label, start, end, min, max, format, startview, weekstart, language, separator)

File inputs
fileInput(inputId, label, multiple, accept)

Numeric inputs
numericInput(inputId, label, value, min, max, step)

Password inputs
passwordInput(inputId, label, value)

Radio buttons
radioButtons(inputId, label, choices, selected, inline)

Select inputs
selectInput(inputId, label, choices, selected, multiple, selectizeInput, width, size) (also `selectizeInput`)

Table outputs
tableOutput(outputId)

Text outputs
textOutput(outputId, container, inline)

UI outputs
uiOutput(outputId, inline, container, ...)

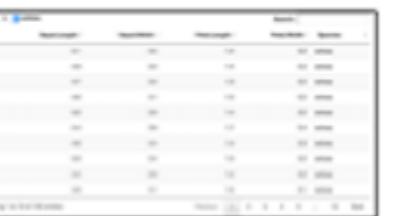
HTML outputs
htmlOutput(outputId, inline, container, ...)

Form controls
choose a number, write a title, histogram of random normal values

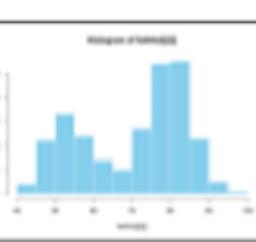
DT::renderDataTable(expr, options, callback, escape, env, quoted)

works with

dataTableOutput(outputId, icon, ...)



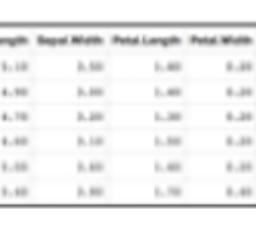
renderImage(expr, env, quoted, deleteFile)



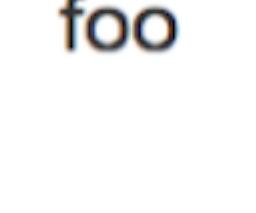
renderPlot(expr, width, height, res, ..., env, quoted, func)



renderPrint(expr, env, quoted, func, width)



renderTable(expr, ..., env, quoted, func)



renderText(expr, env, quoted, func)



renderUI(expr, env, quoted, func)

imageOutput(outputId, width, height, click, dblclick, hover, hoverDelay, hoverDelayType, brush, clickId, hoverId, inline)

plotOutput(outputId, width, height, click, dblclick, hover, hoverDelay, hoverDelayType, brush, clickId, hoverId, inline)

verbatimTextOutput(outputId)

tableOutput(outputId)

textOutput(outputId, container, inline)

uiOutput(outputId, inline, container, ...)

& htmlOutput(outputId, inline, container, ...)



EXERCISE

- ▶ Add a checkbox input to decide whether the data plotted should be shown in a data table
 - ▶ This should be a **checkboxInput** (see shiny.rstudio.com/reference/shiny/latest/ for help)
- ▶ Create a new output item using **DT::renderDataTable**, an **if** statement to check if the box is checked, and **DT::datatable**
 - ▶ Show first seven columns of movies data, show 10 rows at a time, and hide row names, e.g.
 - ▶ `data = movies[, 1:7]`
 - ▶ `options = list(pageLength = 10)`
 - ▶ `rownames = FALSE`
 - ▶ Add a **dataTableOutput** to the main panel
 - ▶ Run the app in a new Window, check and uncheck the box to test functionality
 - ▶ Compare your code / output with the person sitting next to / nearby you

5m 00s

A large, light gray checkmark icon inside a circle, positioned in the top-left corner.

SOLUTION

Solution to the previous exercise

`movies_04.R`



EXERCISE

Optional: If you finish the previous exercise early

- ▶ Add a title to your app with **titlePanel**, which goes before the **sidebarLayout**
- ▶ Prettify the variable names shown as input choices. *Hint:*
 - ▶ `choices = c("IMDB rating" = "imdb_rating", ...)`
- ▶ Prettify the axis and legend labels of your plot. *Hint:* You might use
 - ▶ **str_replace_all** from the `stringr` package
 - ▶ **toTitleCase** from the `tools` package

5m 00s



SOLUTION

Solution to the previous exercise

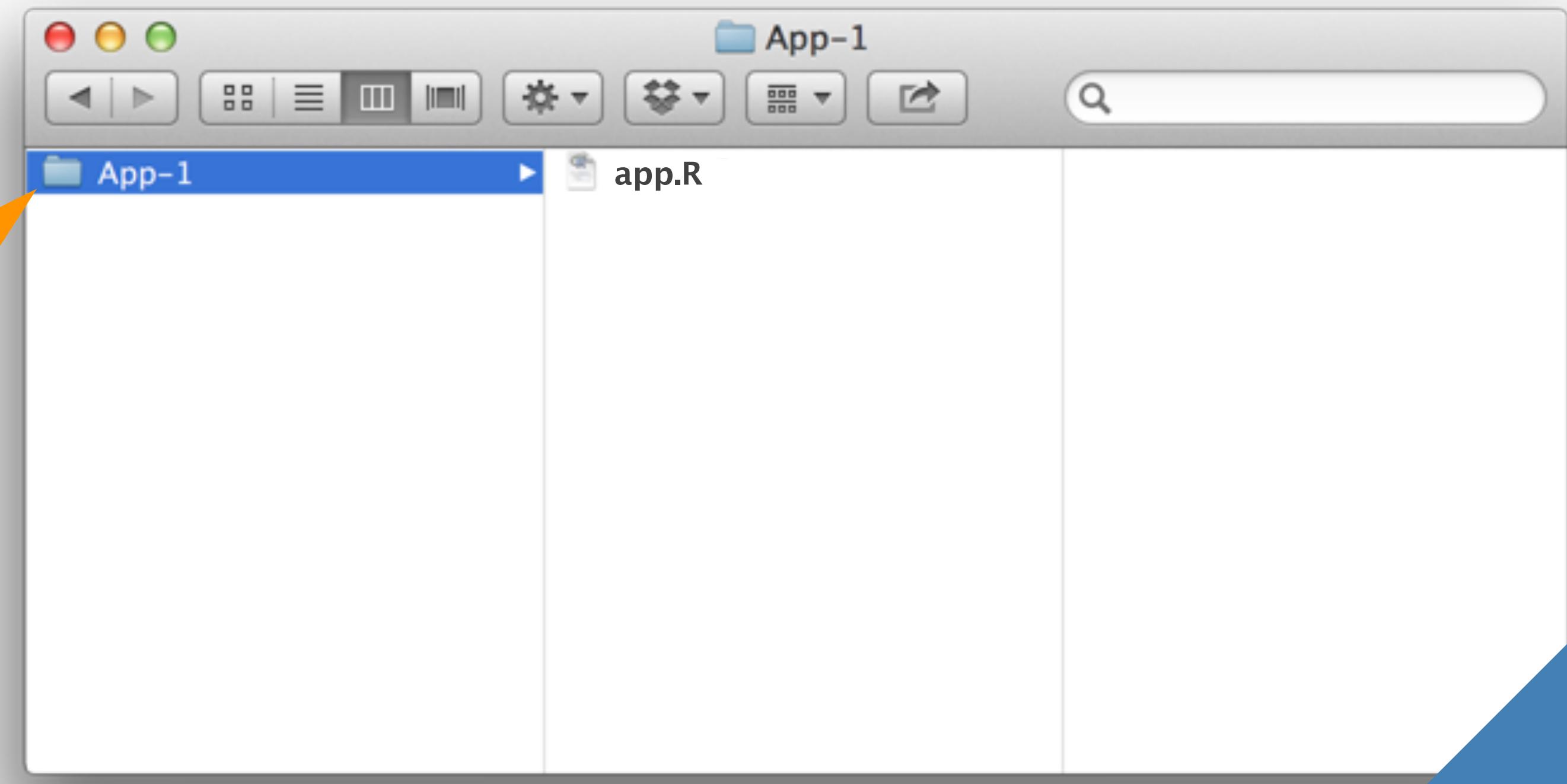
`movies_05.R`

File structure

SAVING YOUR SINGLE FILE APP

One directory with every file the app needs:

- ▶ `app.R` (your script which ends with a call to `shinyApp()`)
- ▶ datasets, images, css, helper scripts, etc.



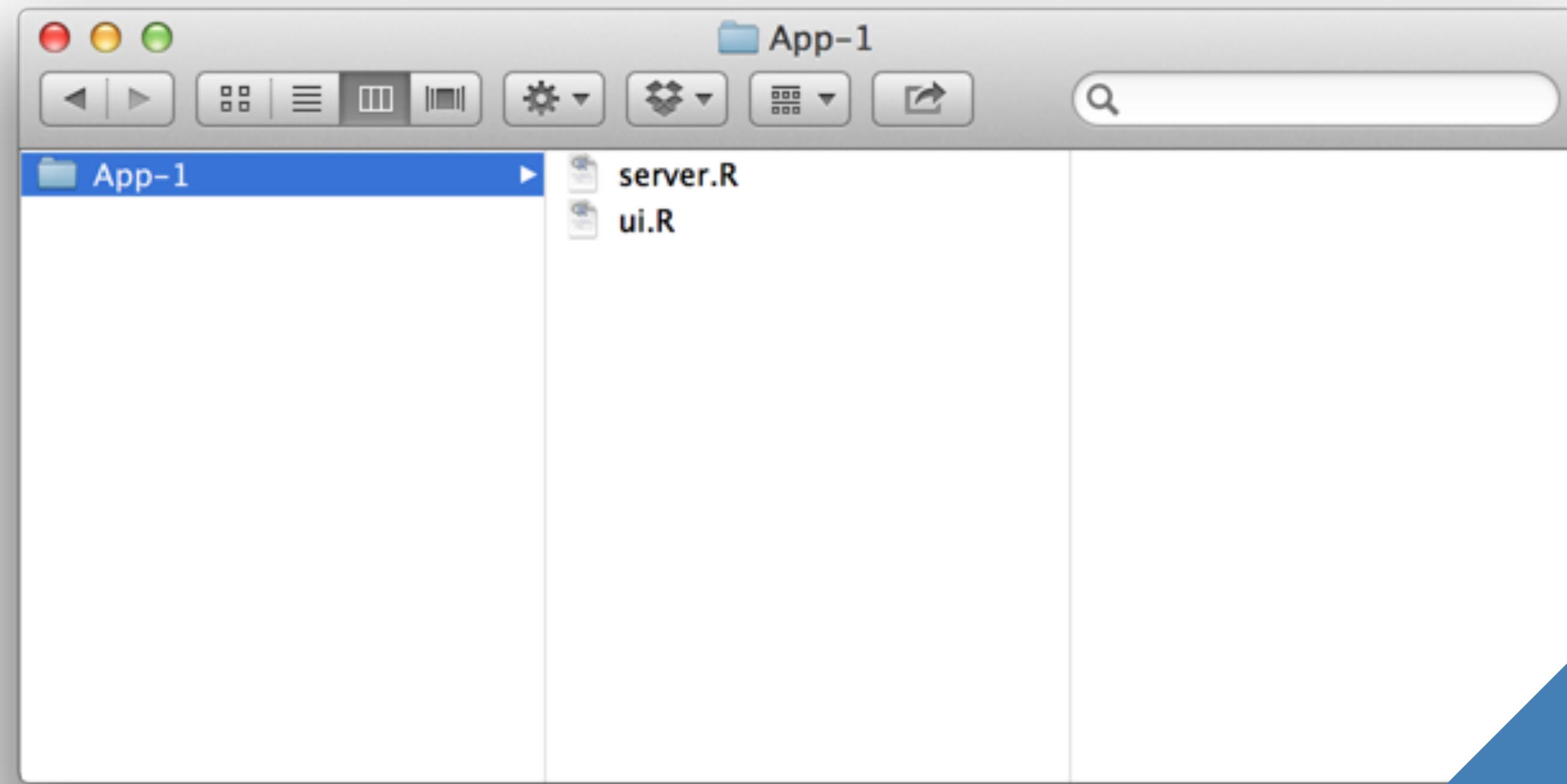
We will focus
on the single
file format
throughout
the workshop

You must use this
exact name (`app.R`)

SAVING YOUR MULTIPLE FILE APP

One directory with every file the app needs:

- ▶ **ui.R** and **server.R**
- ▶ datasets, images, css, helper scripts, etc.



You must use these
exact names

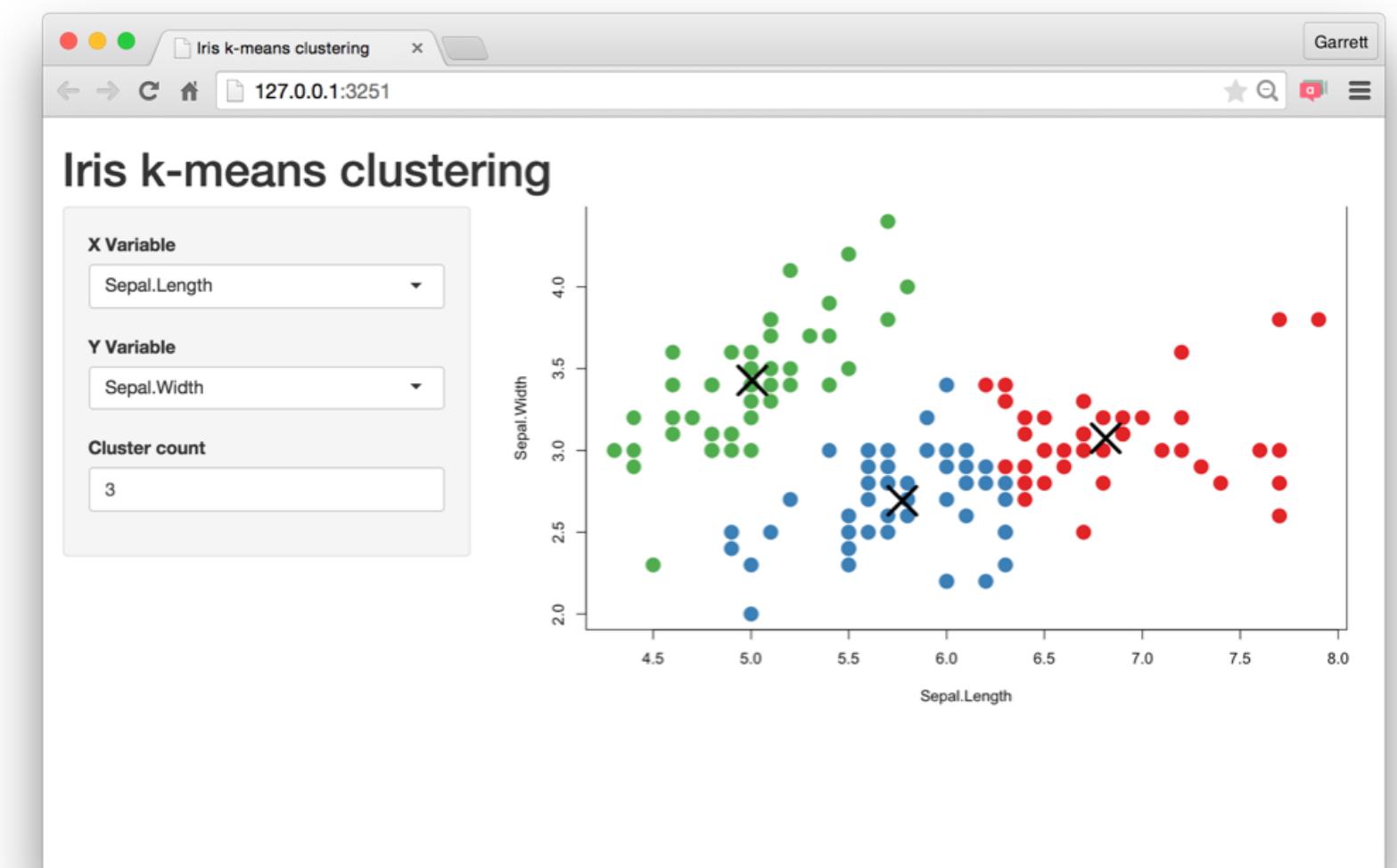
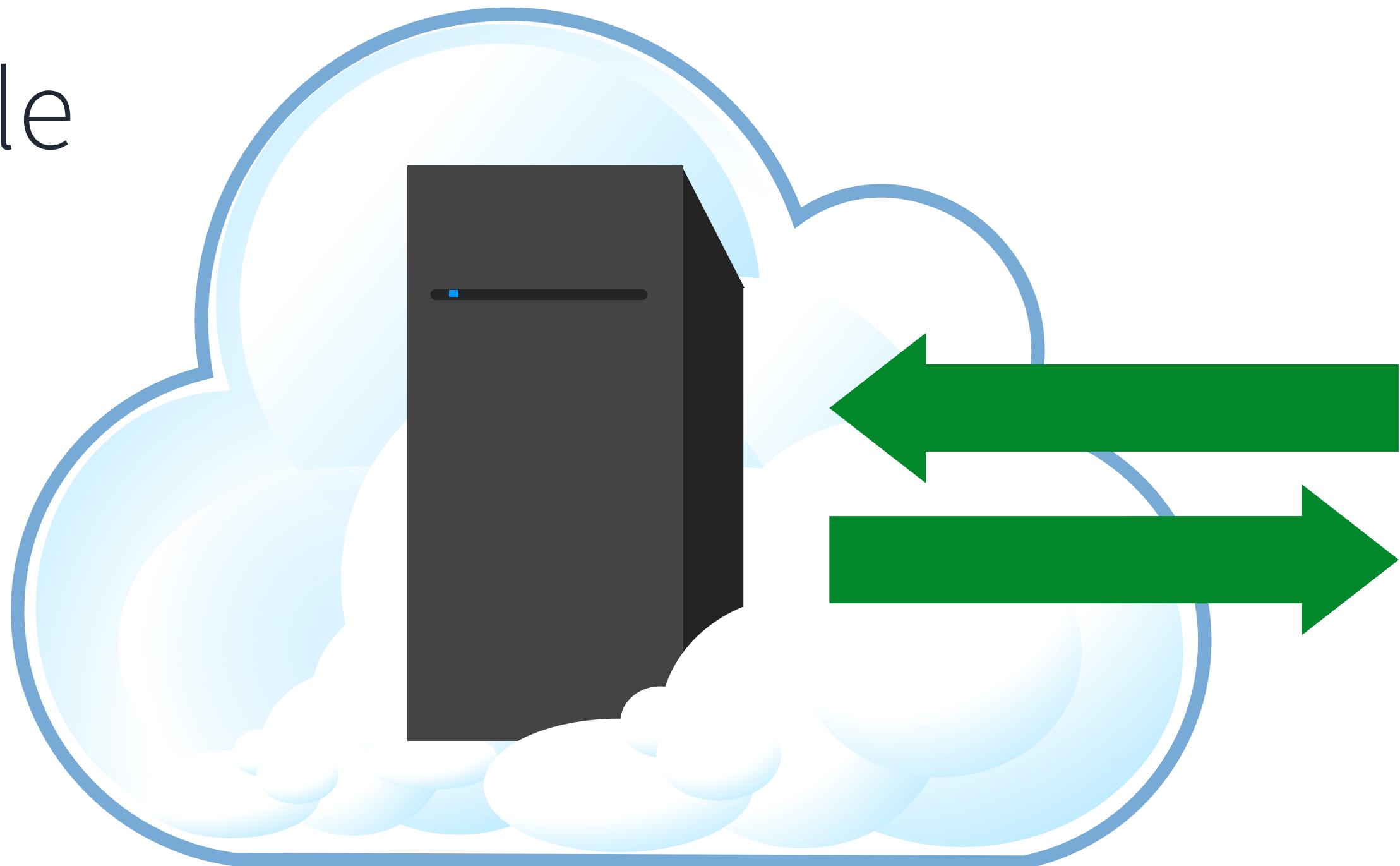
Sharing
your app

shinyapps.io



A server maintained by RStudio

- ▶ easy to use
- ▶ secure
- ▶ scalable



HASSLE-FREE CLOUD HOSTING FOR SHINY

shinyapps.io by RStudio

Home

Features

Pricing

Support

Log In

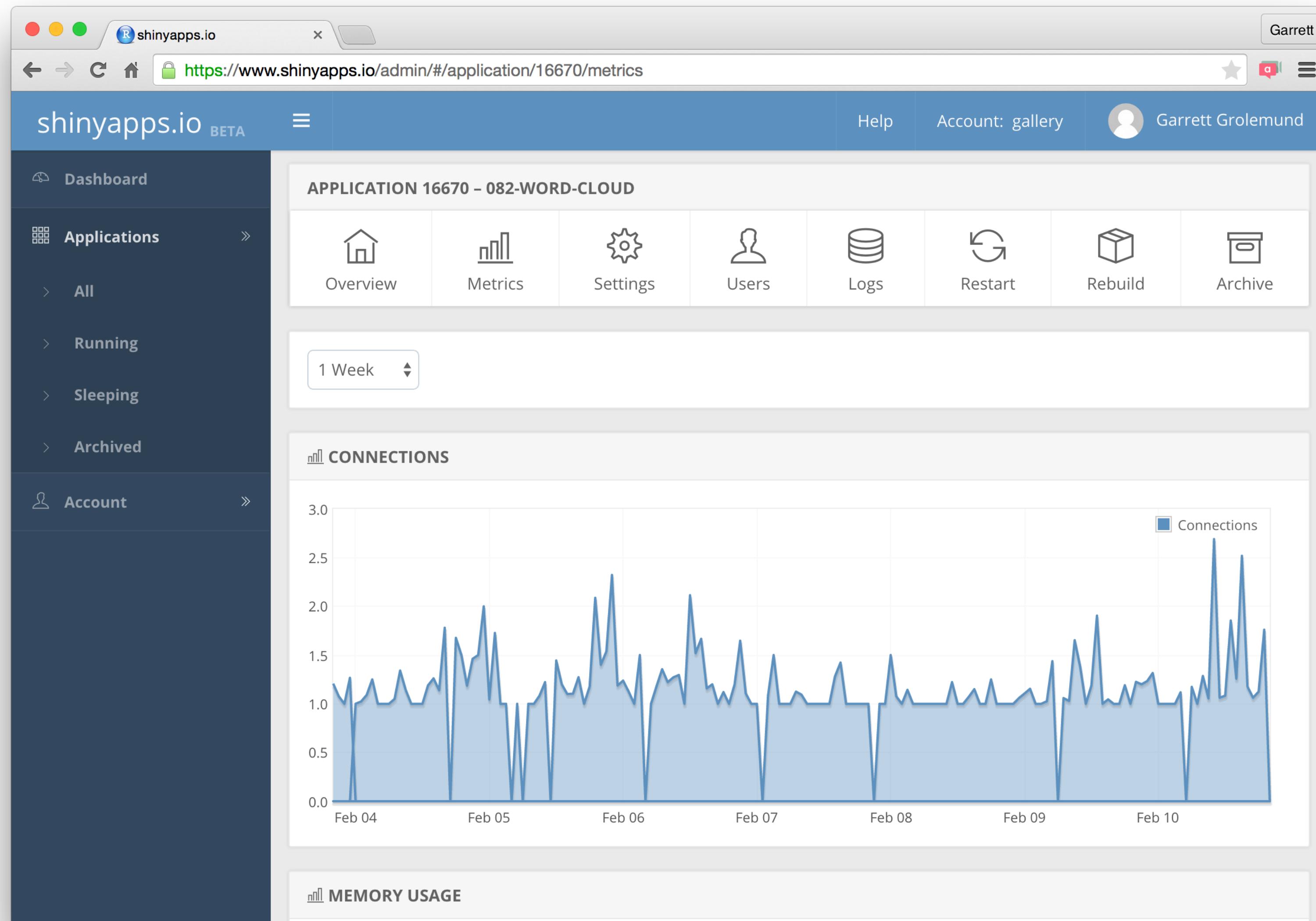
Share your Shiny Applications Online

Deploy your Shiny applications on the Web in minutes

Sign Up



WITH BUILT-IN METRICS



MEMBERSHIP PRICING

FREE

\$ 0 /month

New to Shiny? Deploy your applications for FREE.

5 Applications

25 Active Hours

Community Support

RStudio Branding

STARTER

\$ 9 /month

(or \$100/year)

More applications. More active hours!

25 Applications

100 Active Hours

Premium Support

BASIC

\$ 39 /month

(or \$440/year)

Take your users to the next level!

Unlimited Applications

500 Active Hours

Performance Boost

Premium Support

STANDARD

\$ 99 /month

(or \$1,100/year)

Password protection? Authenticate your users!

Unlimited Applications

2,000 Active Hours

Authentication

Performance Boost

Premium Support

PROFESSIONAL

\$ 299 /month

(or \$3,300/year)

Professional has it all! Personalize your domains.

Unlimited Applications

10,000 Active Hours

Authentication

Account Sharing

Performance Boost

Custom Domains

Premium Support

Build your own server



SHINY SERVER

rstudio.com/products/shiny/shiny-server/



- ✓ Deploy Shiny apps to the internet
- ✓ Run on-premises
 - move computation closer to the data
- ✓ Host multiple apps on one server
- ✓ Deploy inside the firewall
- ✓ xcopy deployment



SHINY SERVER PRO

rstudio.com/products/shiny/shiny-server/



✓ **Secure access**

LDAP, GoogleAuth, SSL, and more

✓ **Performance**

fine tune at app and server level

✓ **Management**

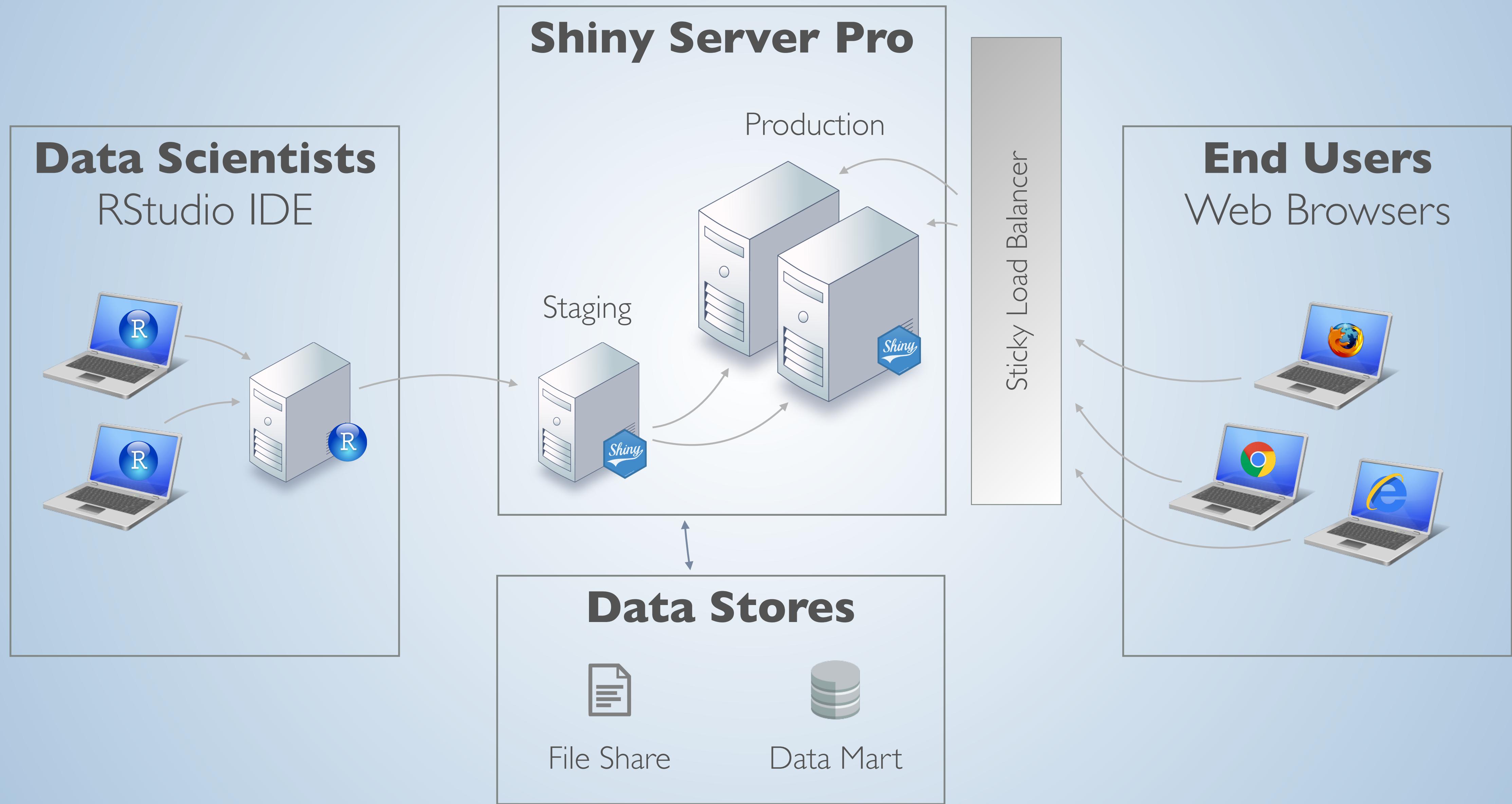
monitor and control resource use

✓ **Support**

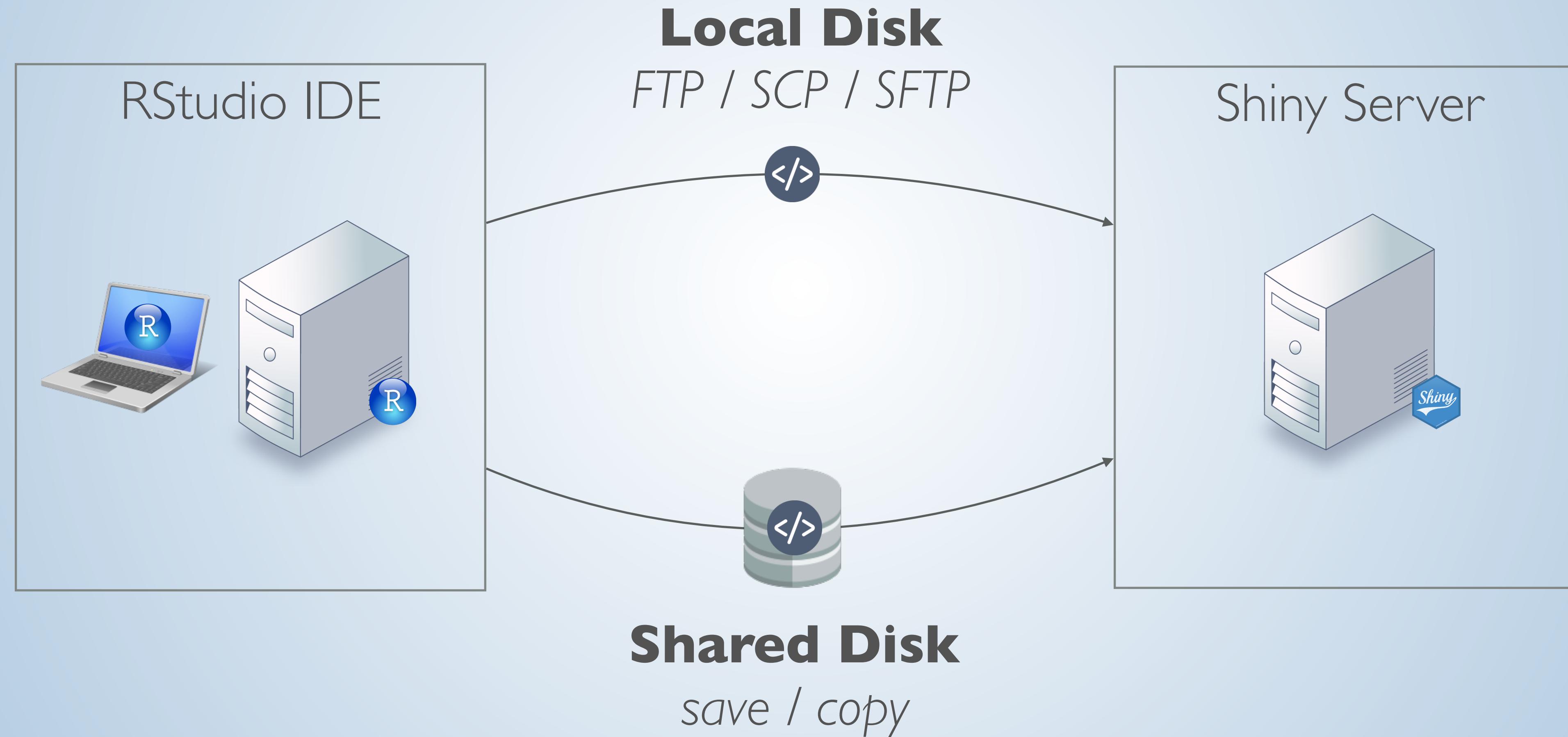
direct priority support

45 day
evaluation
free trial

What does a typical setup with SSP look like?

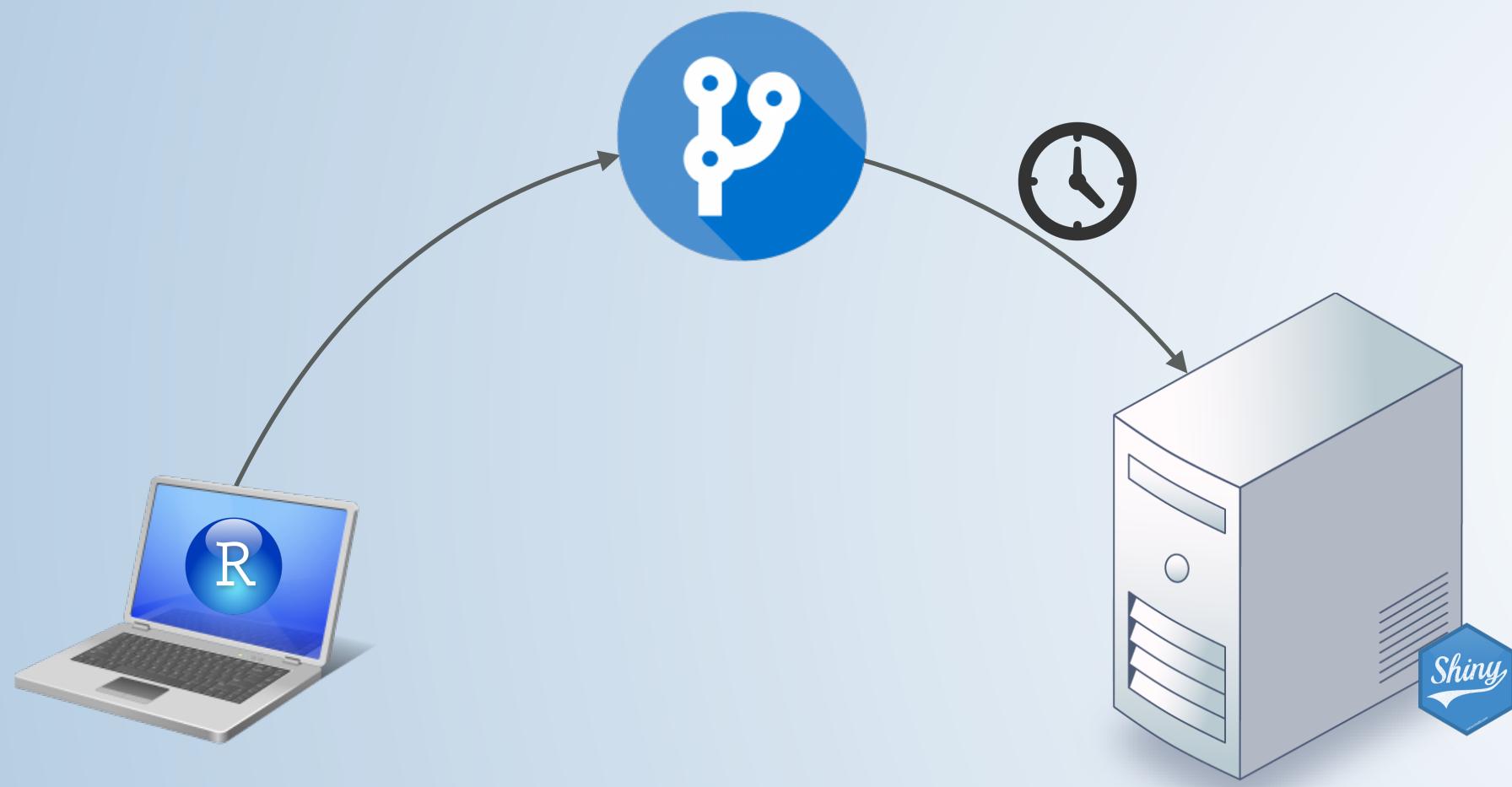


How do I deploy apps?



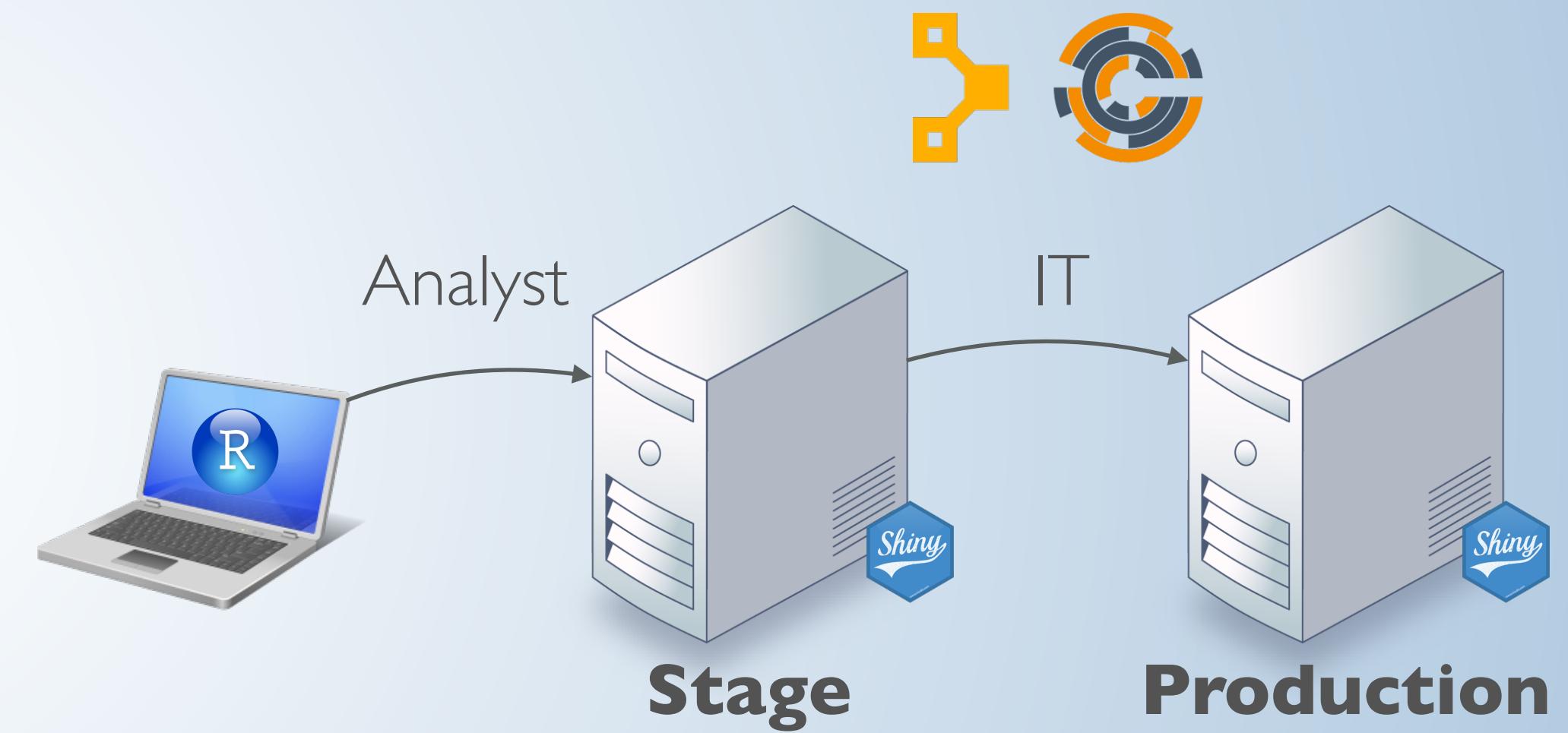
How do I deploy apps in production?

Version Control



Push to version control and automate clones via a scheduler

Handoff



Analyst stage app
IT deploys to production

More information

- ▶ Sharing your apps tutorial: [https://shiny.rstudio.com/
tutorial/lesson7/](https://shiny.rstudio.com/tutorial/lesson7/)
- ▶ Administering Shiny Server Pro webinar: [https://
www.rstudio.com/resources/webinars/administering-
shiny-server-pro/](https://www.rstudio.com/resources/webinars/administering-shiny-server-pro/)



EXERCISE

- ▶ Create a folder called movies in the ShinyApps folder
- ▶ Move any one of the movies app R scripts you worked on into this folder, and rename it as app.R
- ▶ Also move the movies.Rdata file into this folder
- ▶ Run the app
- ▶ Then go to [http://harpers-ferry.rstudio.com:3838/\[username\]/movies](http://harpers-ferry.rstudio.com:3838/[username]/movies) to view and interact with the deployed app

3m 00s

RSTUDIO CONNECT

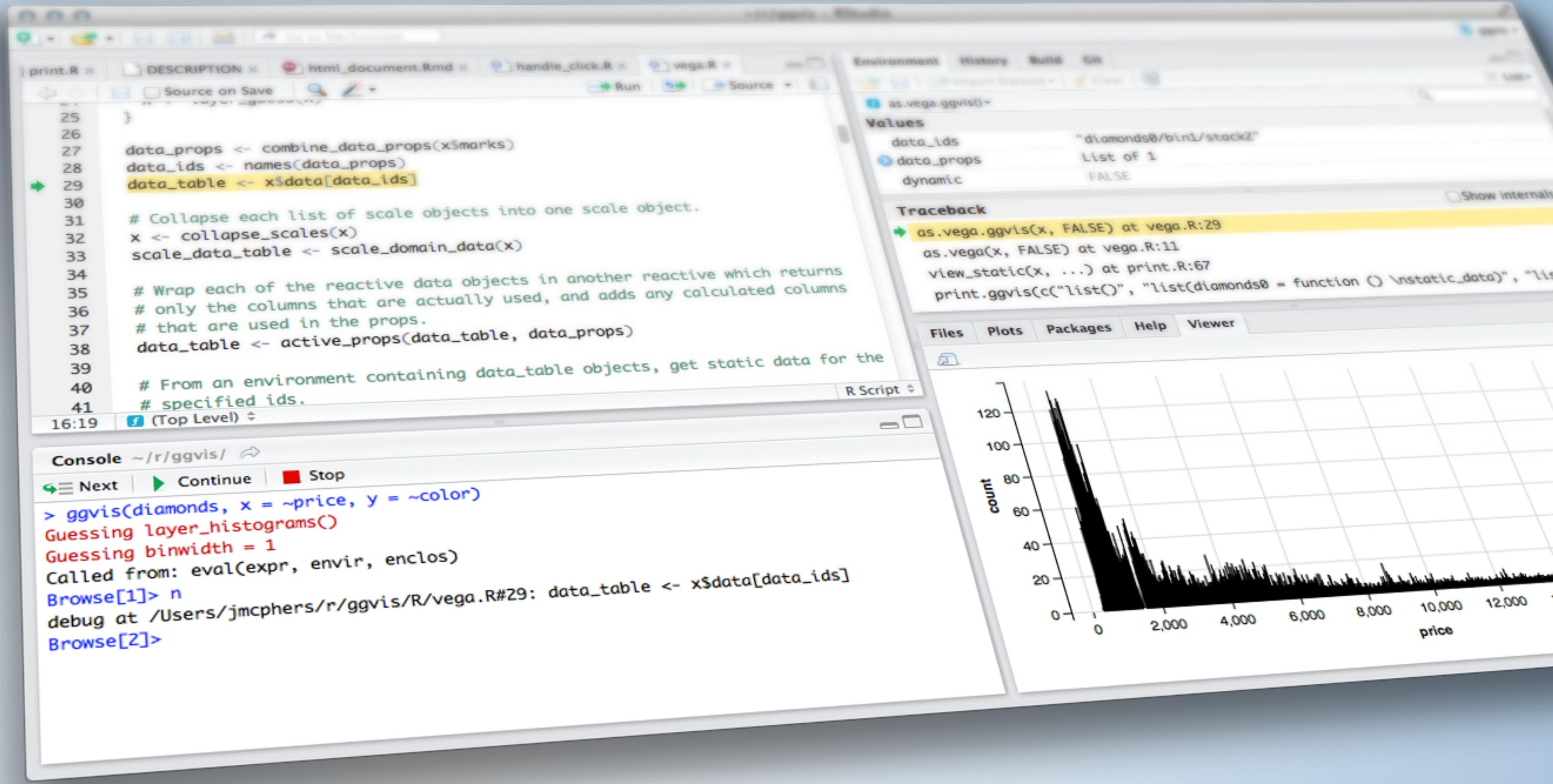
rstudio.com/products/connect/



- ✓ **Push-button publish from RStudio**
Shiny apps, R Markdown docs, and more
- ✓ **Self-managed content**
content authors decide permissions
- ✓ **Scheduled reports**
automatically run and email Rmd
- ✓ **Support**
direct priority support



A FAST INTRODUCTION TO SHINY



Shiny from  R Studio™