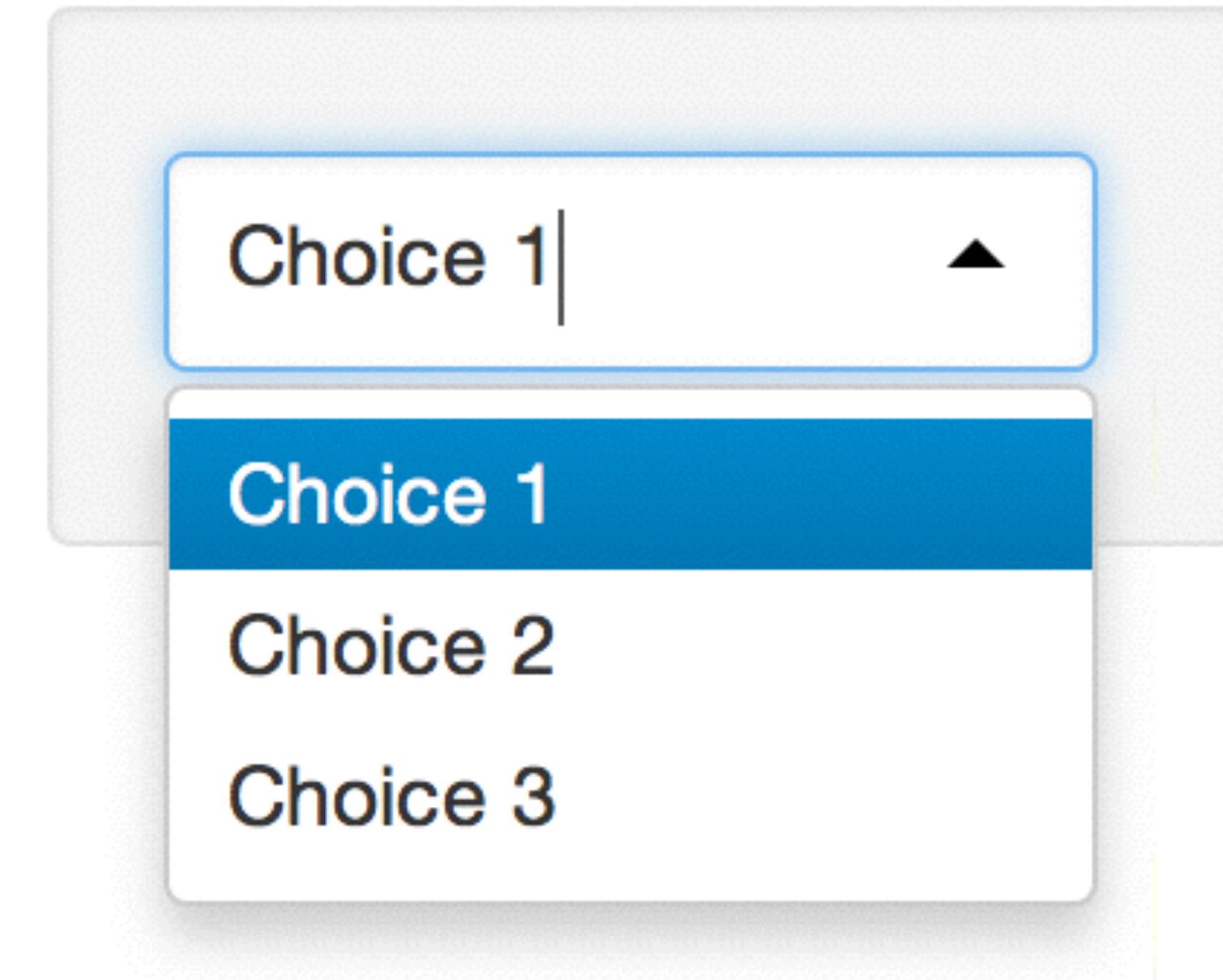


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# How to start with Shiny, Part 1

How to build a Shiny App



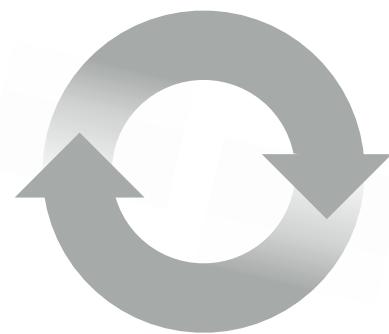
## Garrett Grolemund

Data Scientist and Master Instructor  
May 2015  
Email: [garrett@rstudio.com](mailto:garrett@rstudio.com)

Code and slides at:

[bit.ly/shiny-quickstart-1](http://bit.ly/shiny-quickstart-1)

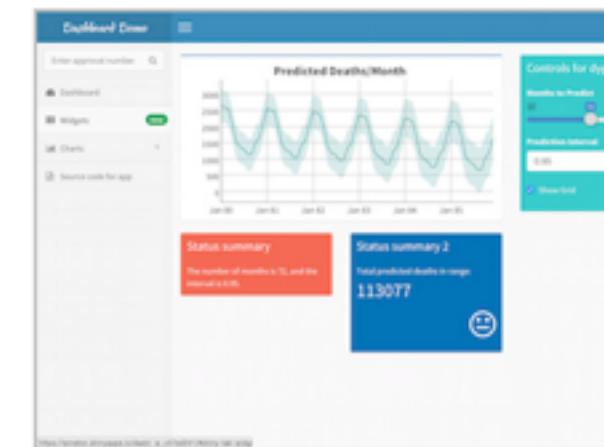
# How to start with Shiny



1. How to build a Shiny app (Today)
2. How to customize reactions (May 27)
3. How to customize appearance (June 3)

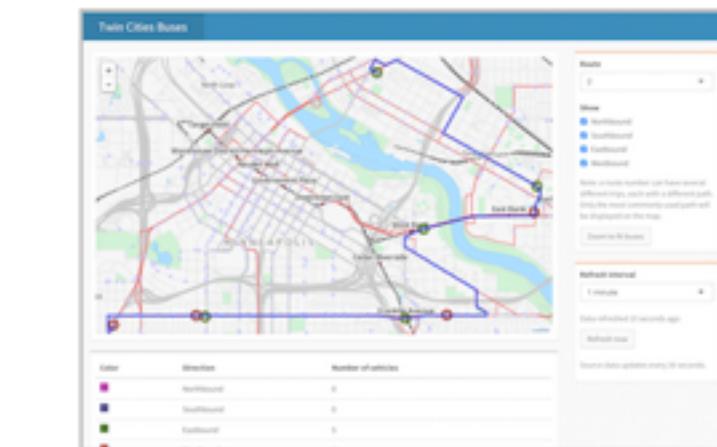


## Shiny Apps for the Enterprise



[Shiny Dashboard Demo](#)

A dashboard built with Shiny.



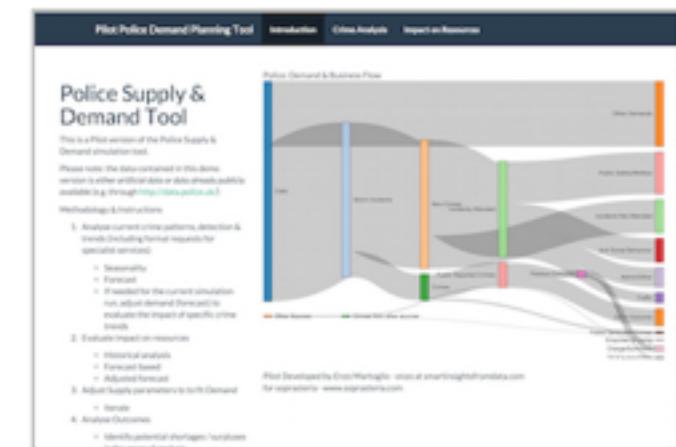
[Location tracker](#)

Track locations over time with streaming data.



[Download monitor](#)

Streaming download rates visualized as a bubble chart.



[Supply and Demand](#)

Forecast demand to plan resource allocation.

# Shiny Showcase

[www.rstudio.com/products/shiny/shiny-user-showcase/](http://www.rstudio.com/products/shiny/shiny-user-showcase/)

## Industry Specific Shiny Apps



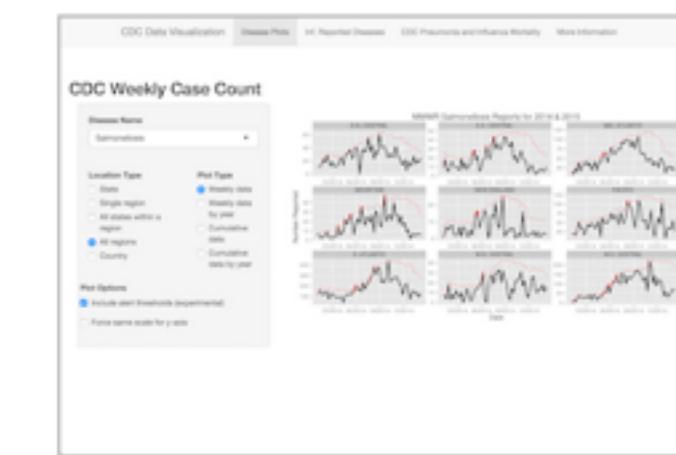
[Economic Dashboard](#)

Economic forecasting with macroeconomic indicators.



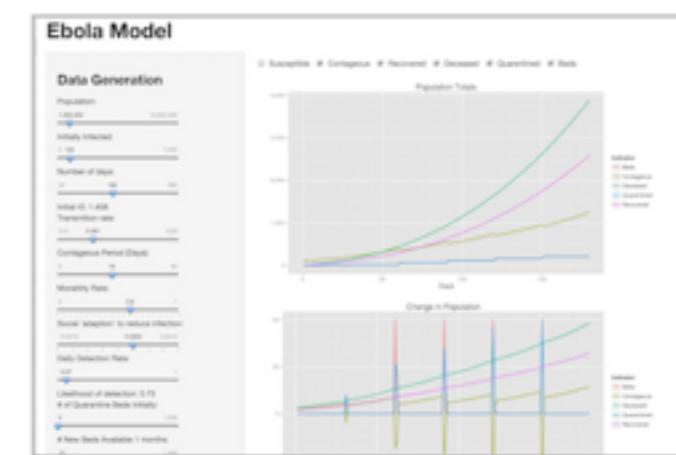
[ER Optimization](#)

An app that models patient flow.



[CDC Disease Monitor](#)

Alert thresholds and automatic weekly updates.



[Ebola Model](#)

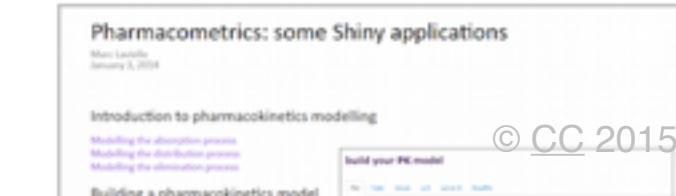
An epidemiological simulation.



[Pharmacometrics](#)



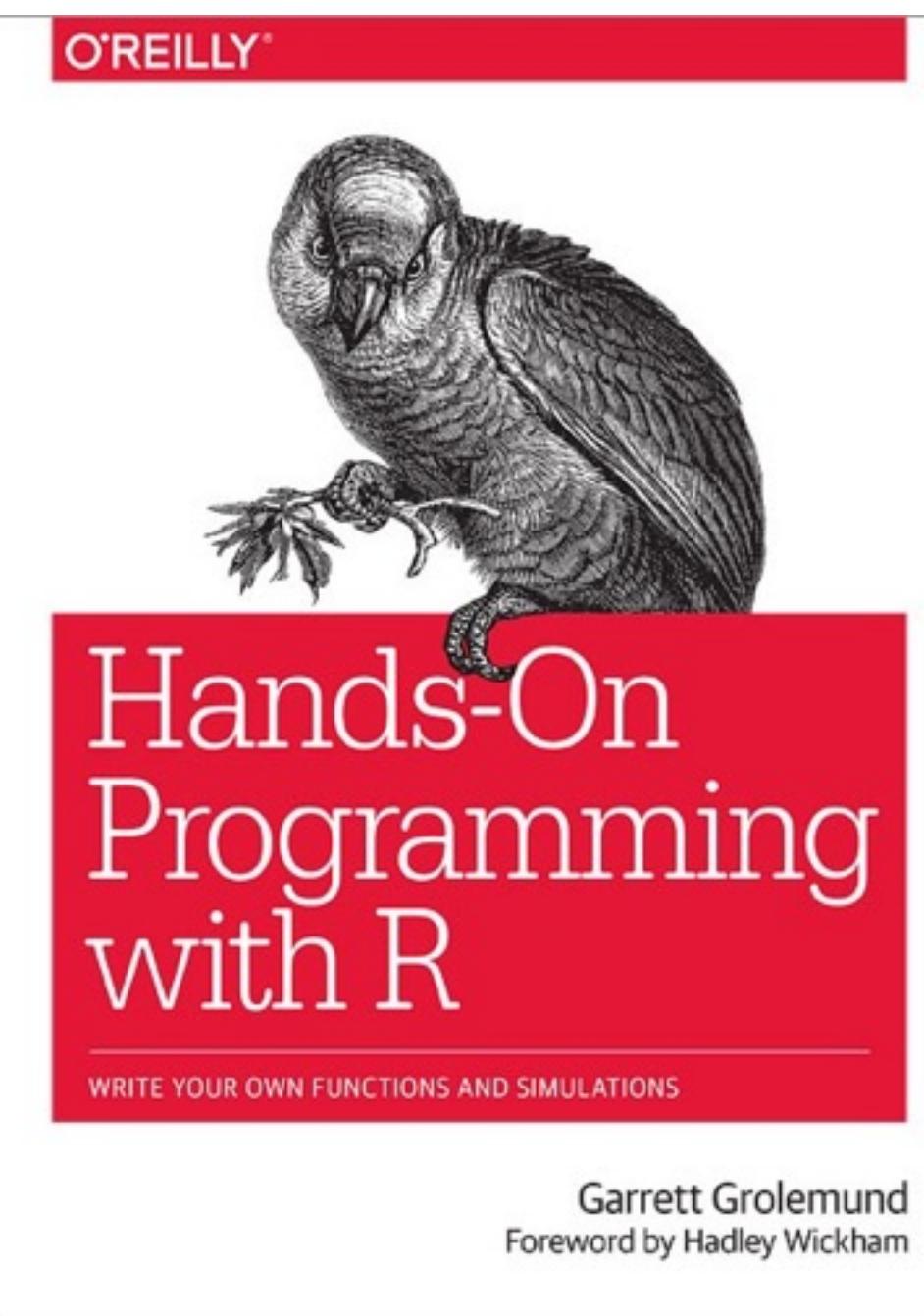
[Pharmacokinetics](#)



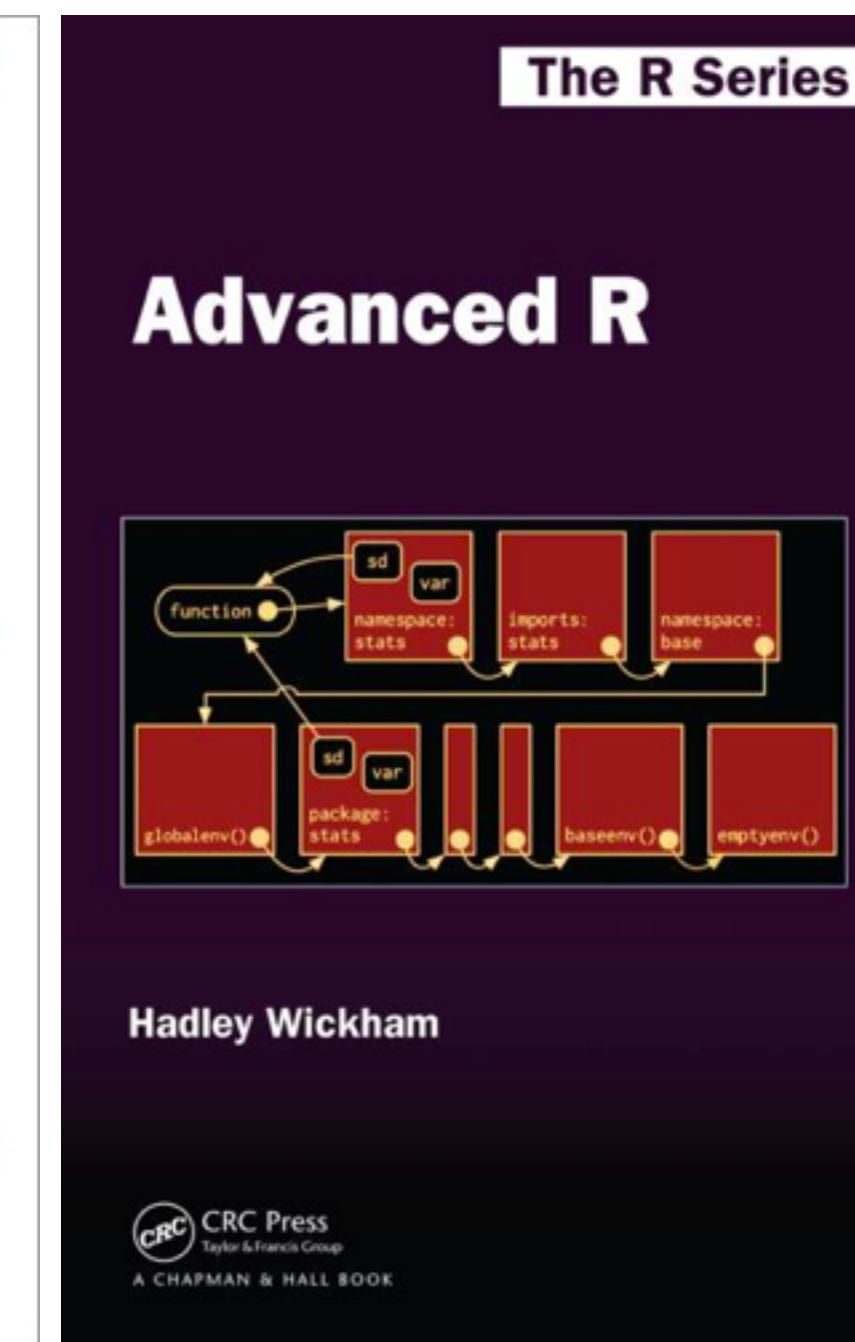
[USGS](#)

# Learn R

# Books



[shop.oreilly.com/product/  
0636920028574.do](http://shop.oreilly.com/product/0636920028574.do)

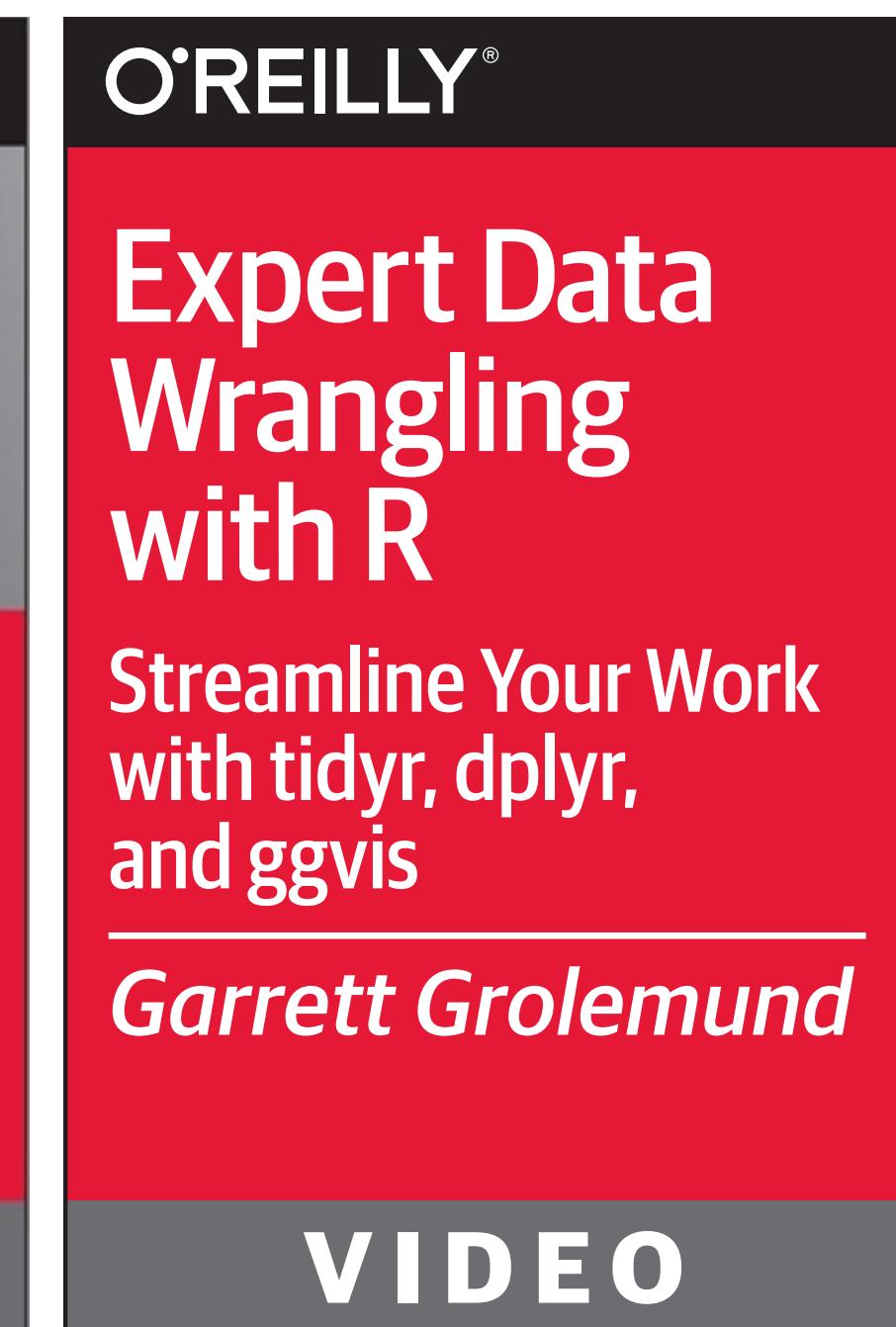


[adv-r.had.co.nz/](http://adv-r.had.co.nz/)



[shop.oreilly.com/product/  
0636920034834.do](http://shop.oreilly.com/product/0636920034834.do)

# Videos



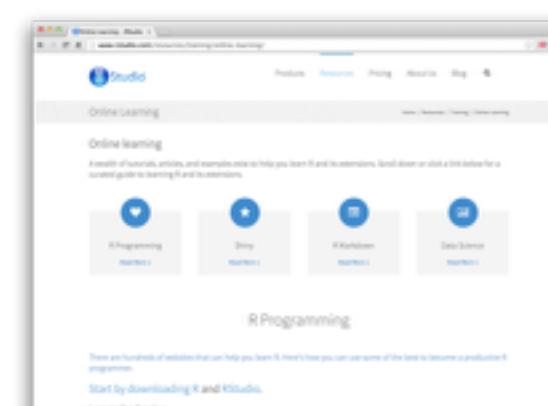
[shop.oreilly.com/product/  
0636920035992.do](http://shop.oreilly.com/product/0636920035992.do)

# Interactive tutorials



# DataCamp

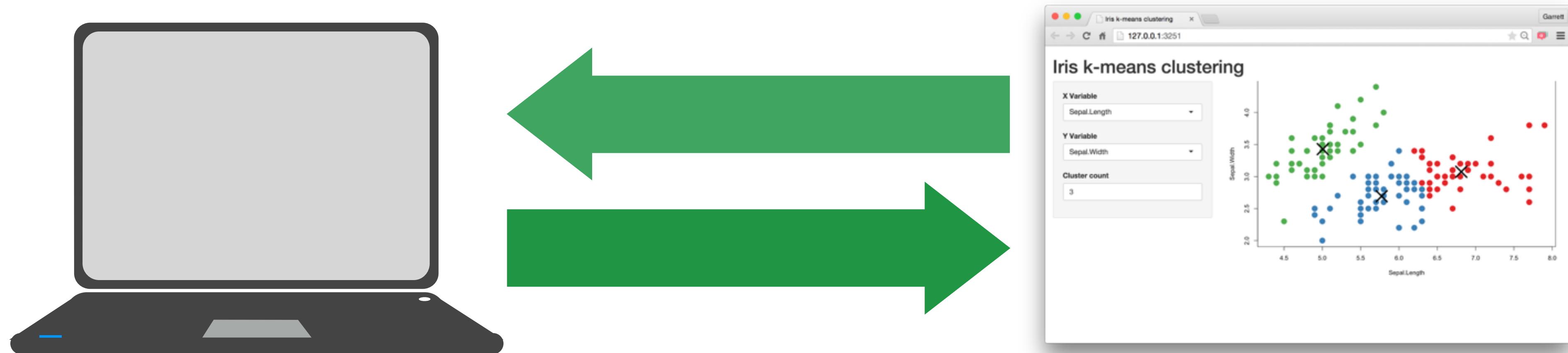
[www.datacamp.com](http://www.datacamp.com)



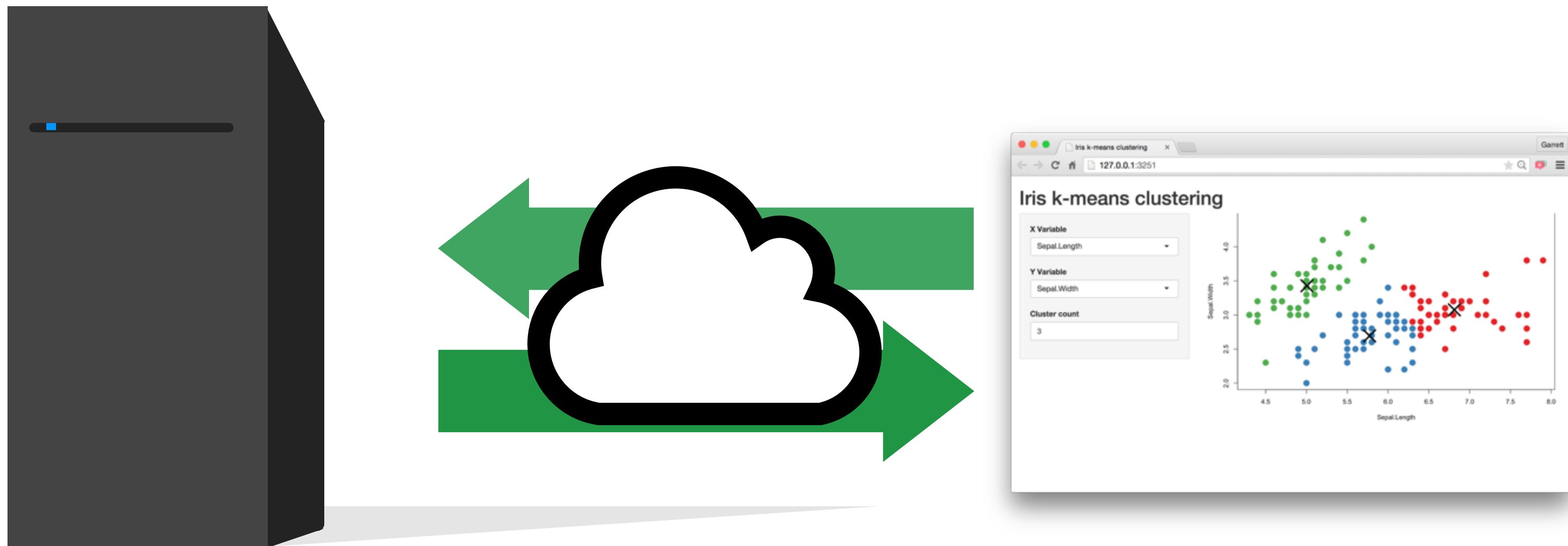
More at  
[www.rstudio.com/resources/training/online-learning/](http://www.rstudio.com/resources/training/online-learning/)

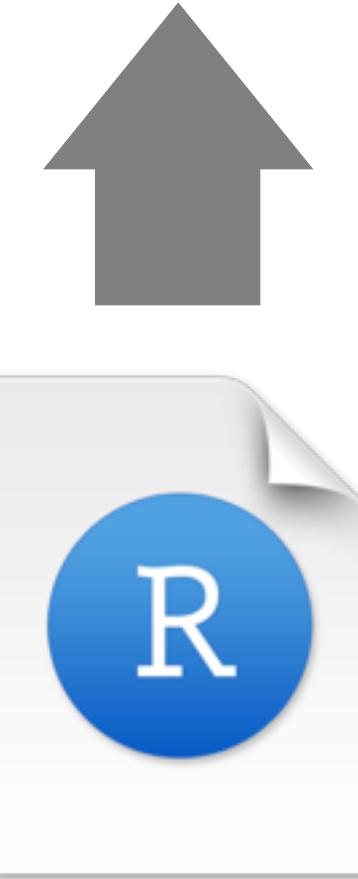
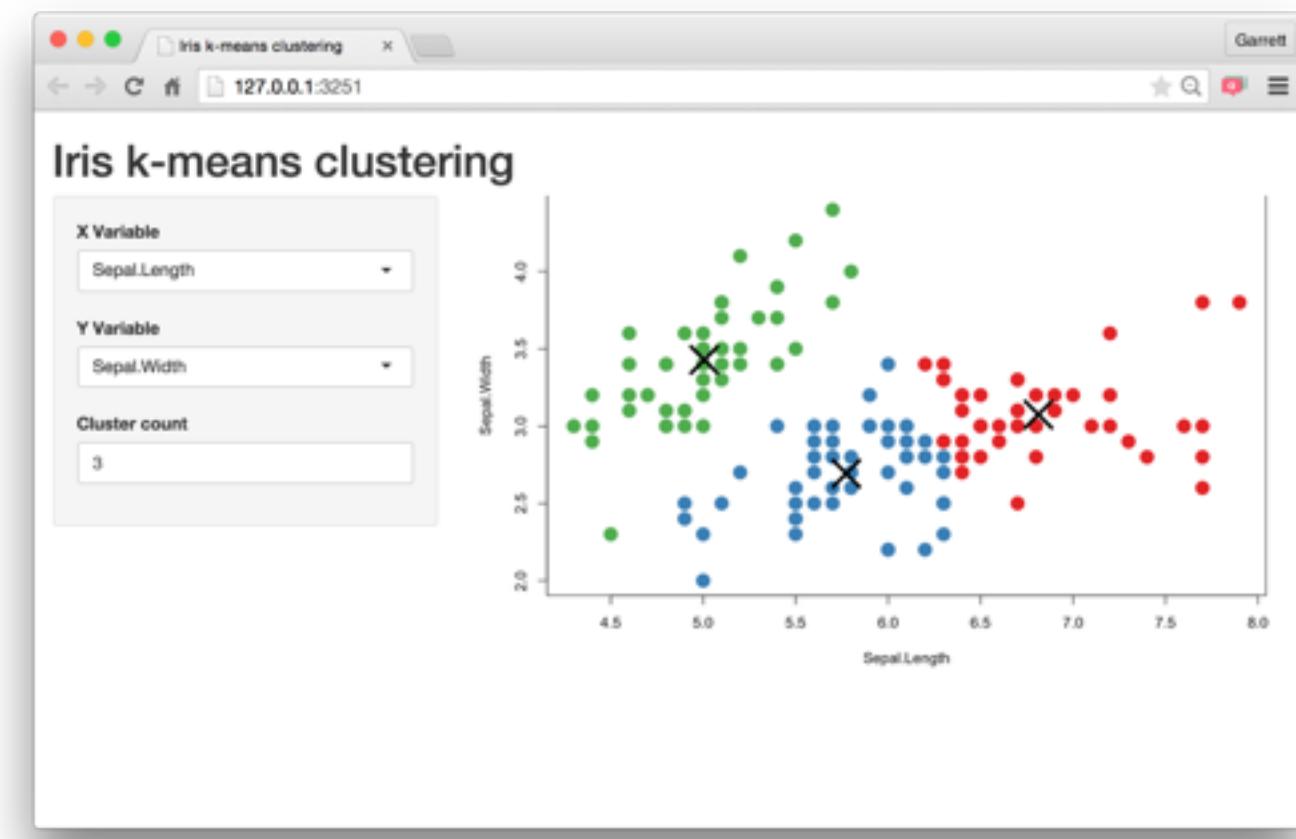
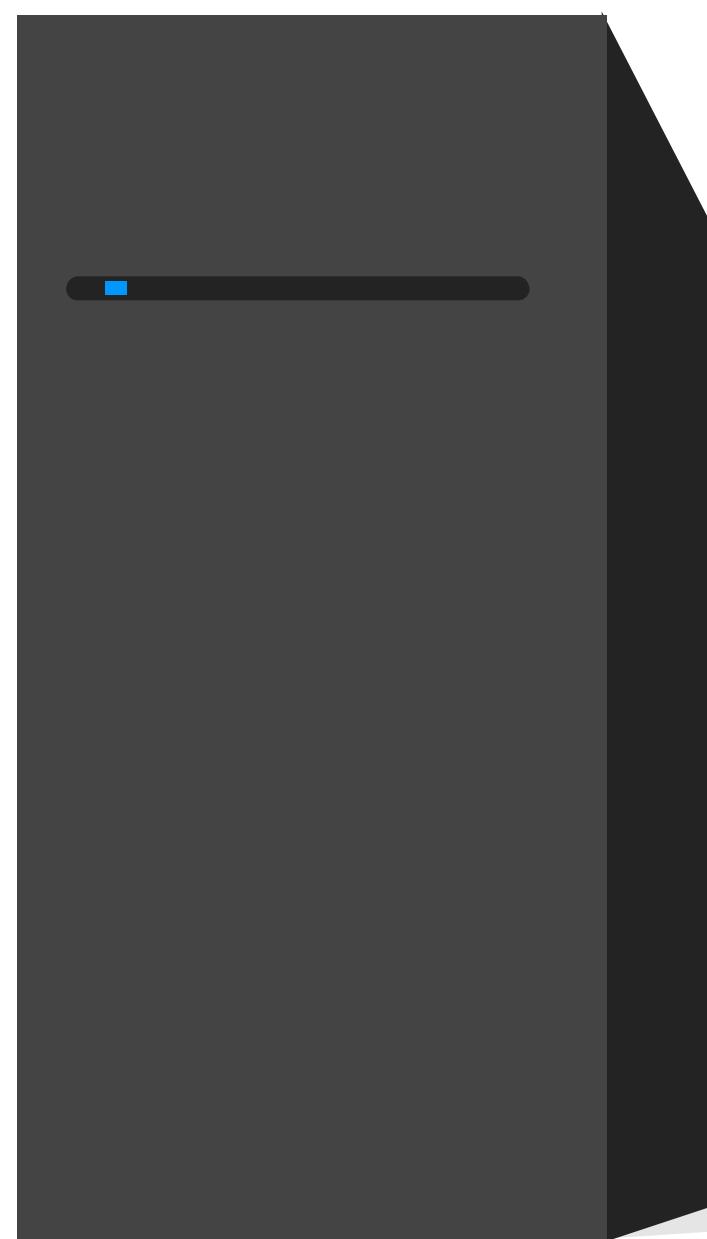
**Understand the  
architecture**

Every Shiny app is maintained by a computer running R



Every Shiny app is maintained by a computer running R





Server Instructions



User Interface (UI)

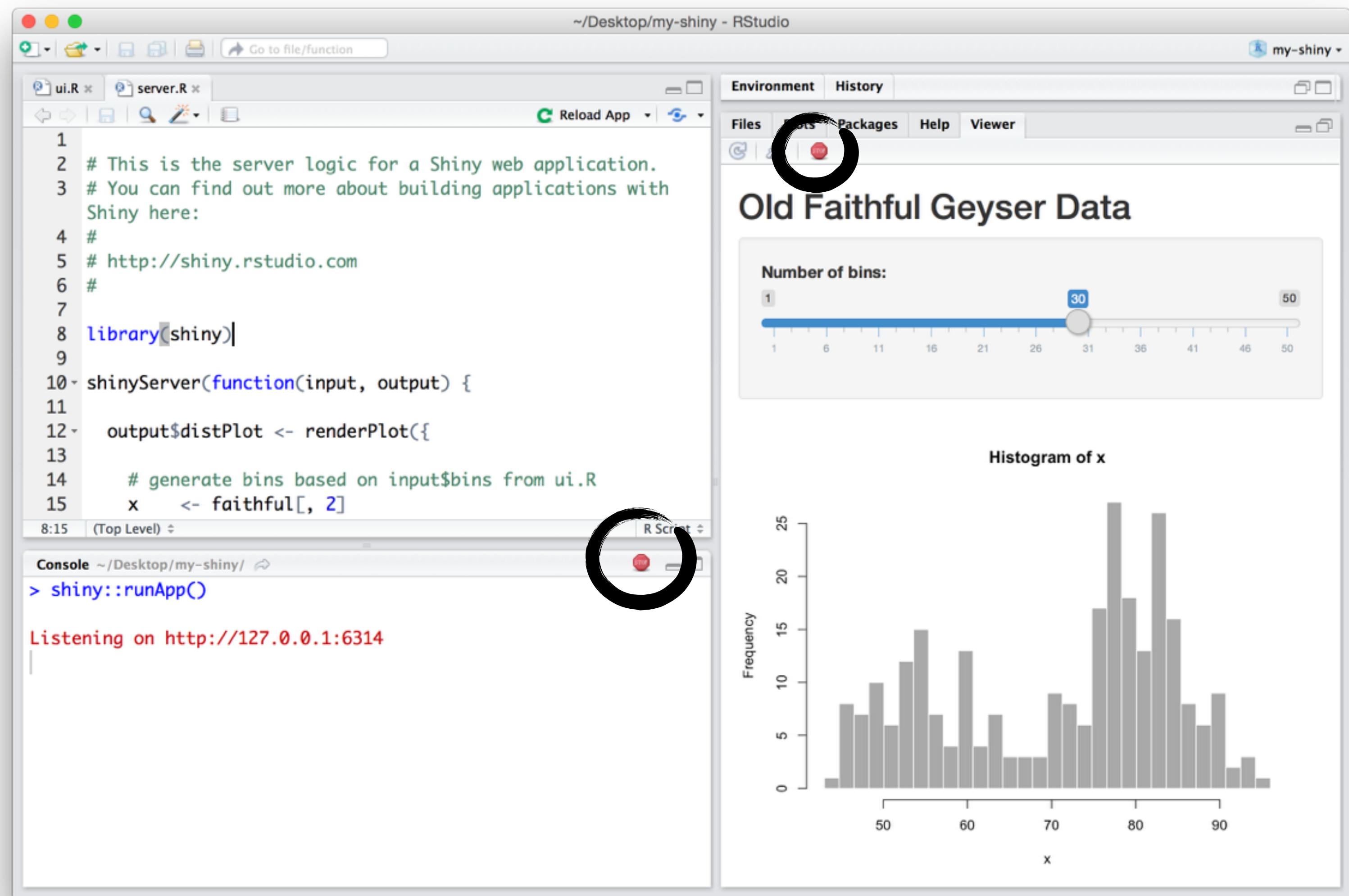
**Use the  
template**

# App template

## The shortest viable shiny app

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

# Close an app

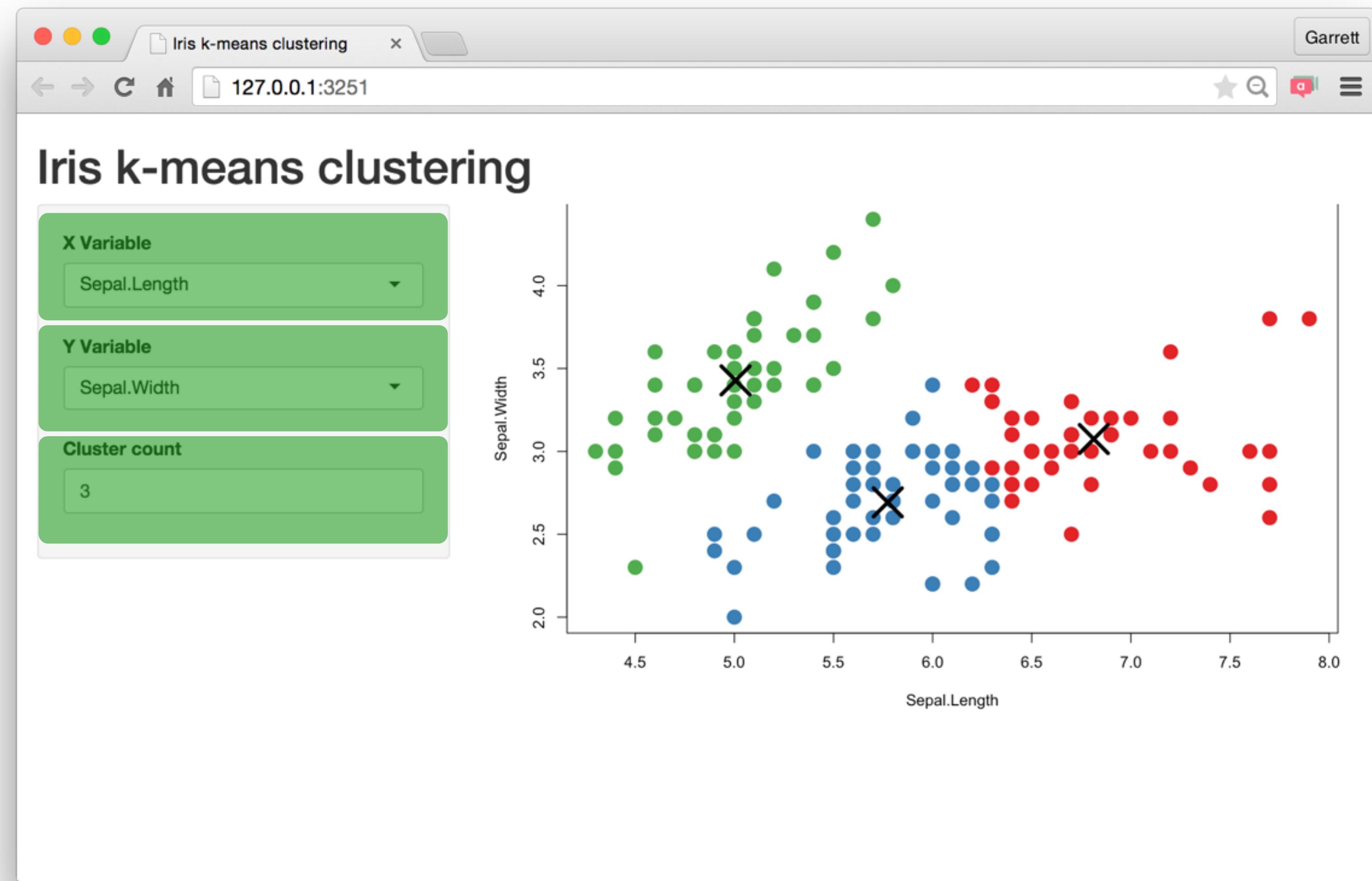


# Add elements to your app as arguments to `fluidPage()`

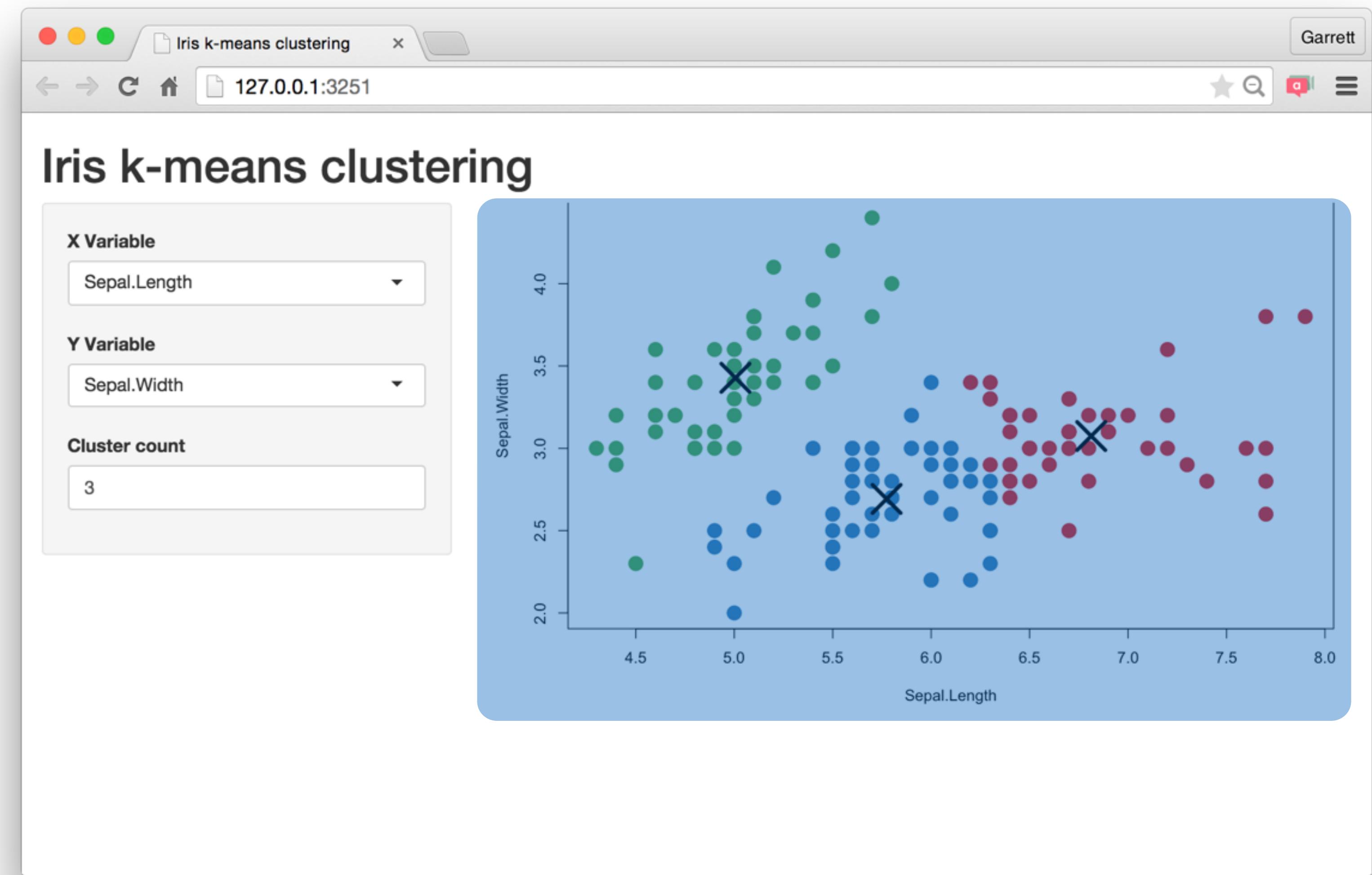
```
library(shiny)  
  
ui <- fluidPage("Hello World")  
  
server <- function(input, output) {}  
  
shinyApp(ui = ui, server = server)
```

**Build your app around  
Inputs and  
Outputs**

# Build your app around **inputs** and **outputs**



# Build your app around **inputs** and **outputs**



Add elements to your app as arguments to  
`fluidPage()`

```
ui <- fluidPage(  
  # *Input() functions,  
  # *Output() functions  
)
```

# Inputs

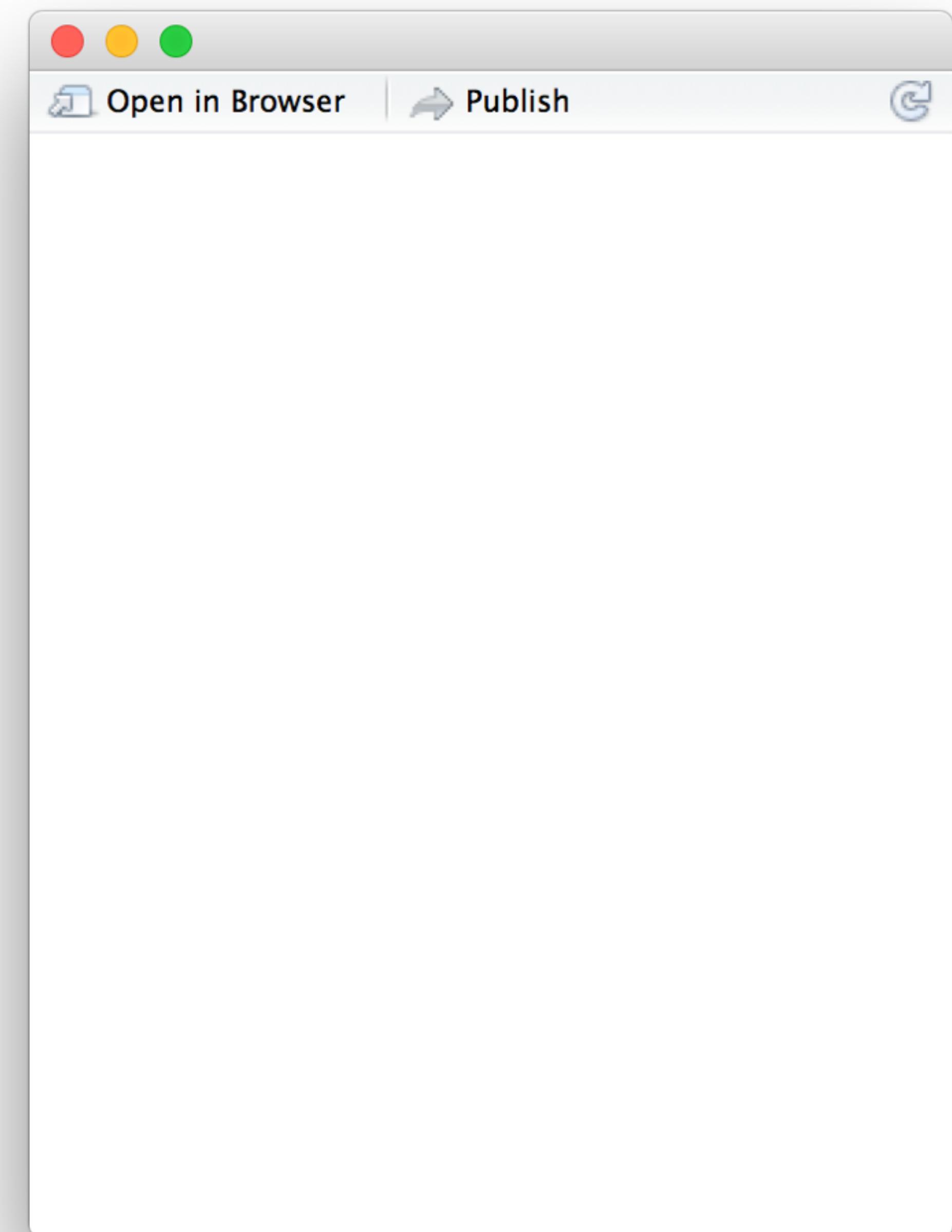
# Create an input with an **\*Input()** function.

```
sliderInput(inputId = "num",
  label = "Choose a number",
  value = 25, min = 1, max = 100)
```

```
<div class="form-group shiny-input-container">
  <label class="control-label" for="num">Choose a number</label>
  <input class="js-range-slider" id="num" data-min="1" data-max="100"
    data-from="25" data-step="1" data-grid="true" data-grid-num="9.9"
    data-grid-snap="false" data-prettyify-separator="," data-keyboard="true"
    data-keyboard-step="1.010101010101"/>
</div>
```

# Create an input with an input function.

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

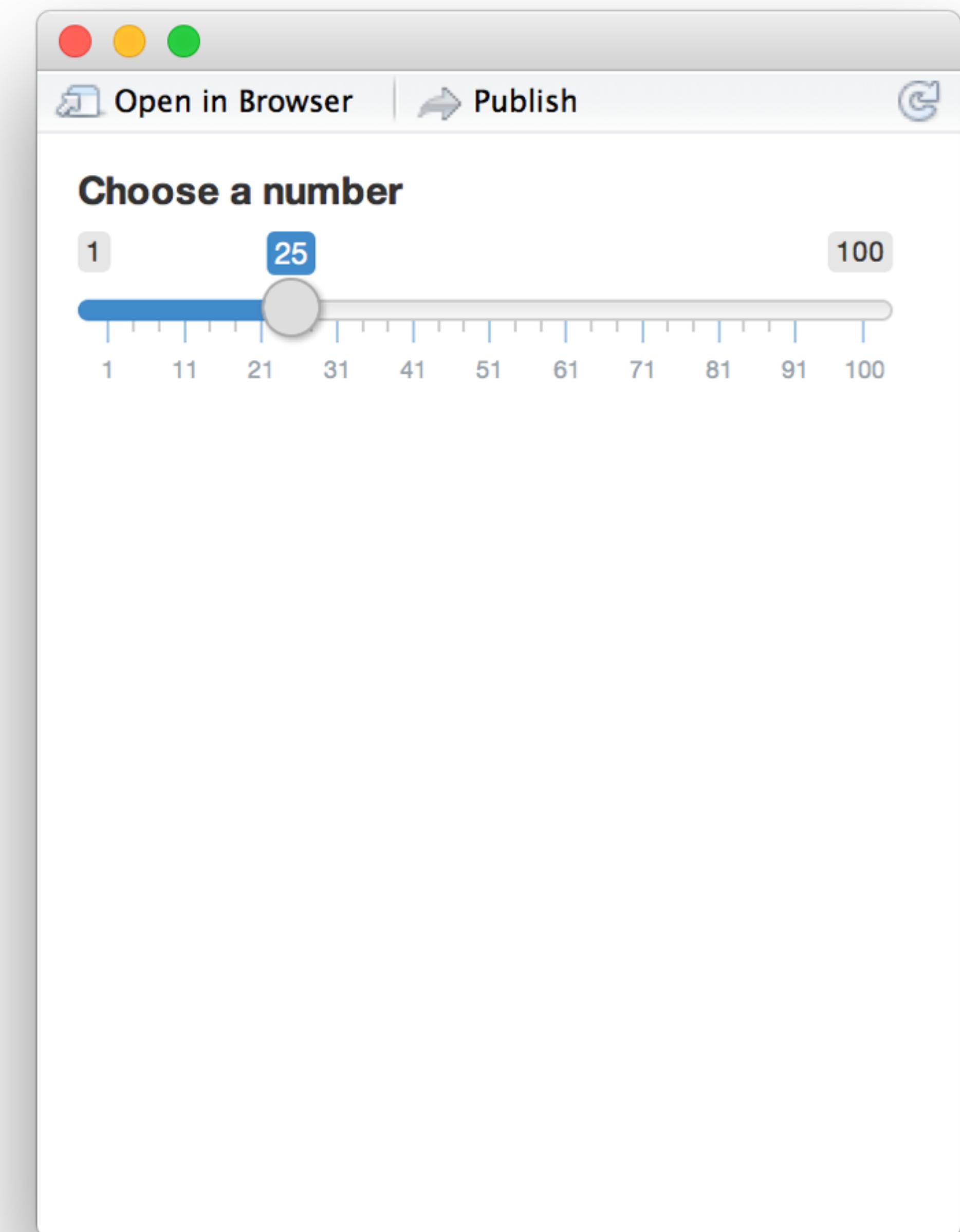


# Create an input with an input function.

```
library(shiny)
ui <- fluidPage(
  sliderInput(inputId = "num",
  label = "Choose a number",
  value = 25, min = 1, max = 100)
)
```

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

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



## Buttons

Action

Submit

actionButton()  
submitButton()

## Date range

2014-01-24 to 2014-01-24

dateRangeInput()

## Radio buttons

- Choice 1
- Choice 2
- Choice 3

radioButtons()

## Single checkbox

Choice A

checkboxInput()

## File input

No file chosen

fileInput()

## Select box

Choice 1

selectInput()

## Checkbox group

Choice 1

Choice 2

Choice 3

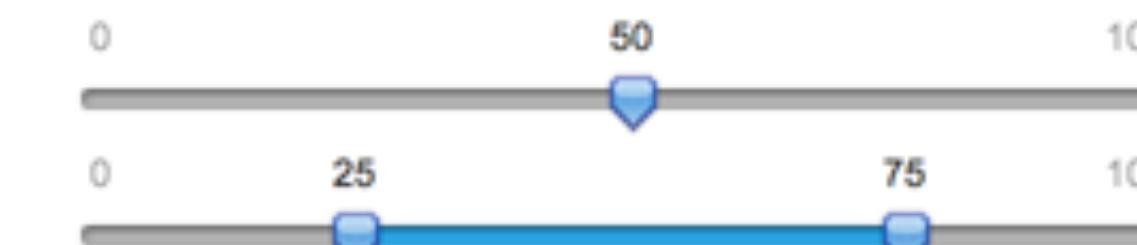
checkboxGroupInput() dateInput()

## Numeric input

1

numericInput()

## Sliders



sliderInput()

## Date input

2014-01-01

.....

passwordInput()

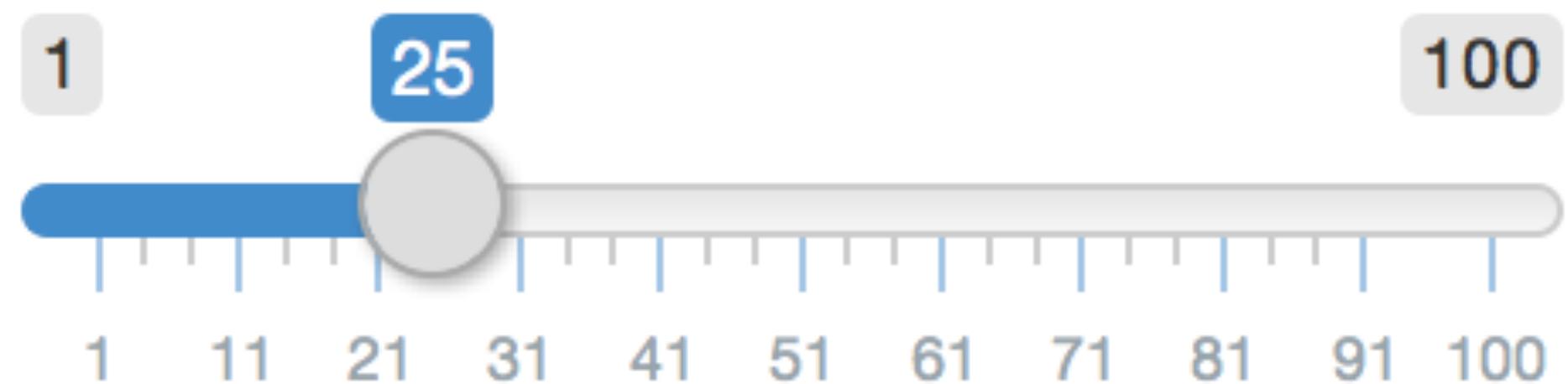
## Text input

Enter text...

textInput()

# Syntax

**Choose a number**



```
sliderInput(inputId = "num", label = "Choose a number", ...)
```

input name  
(for internal use)

Notice:  
Id not ID

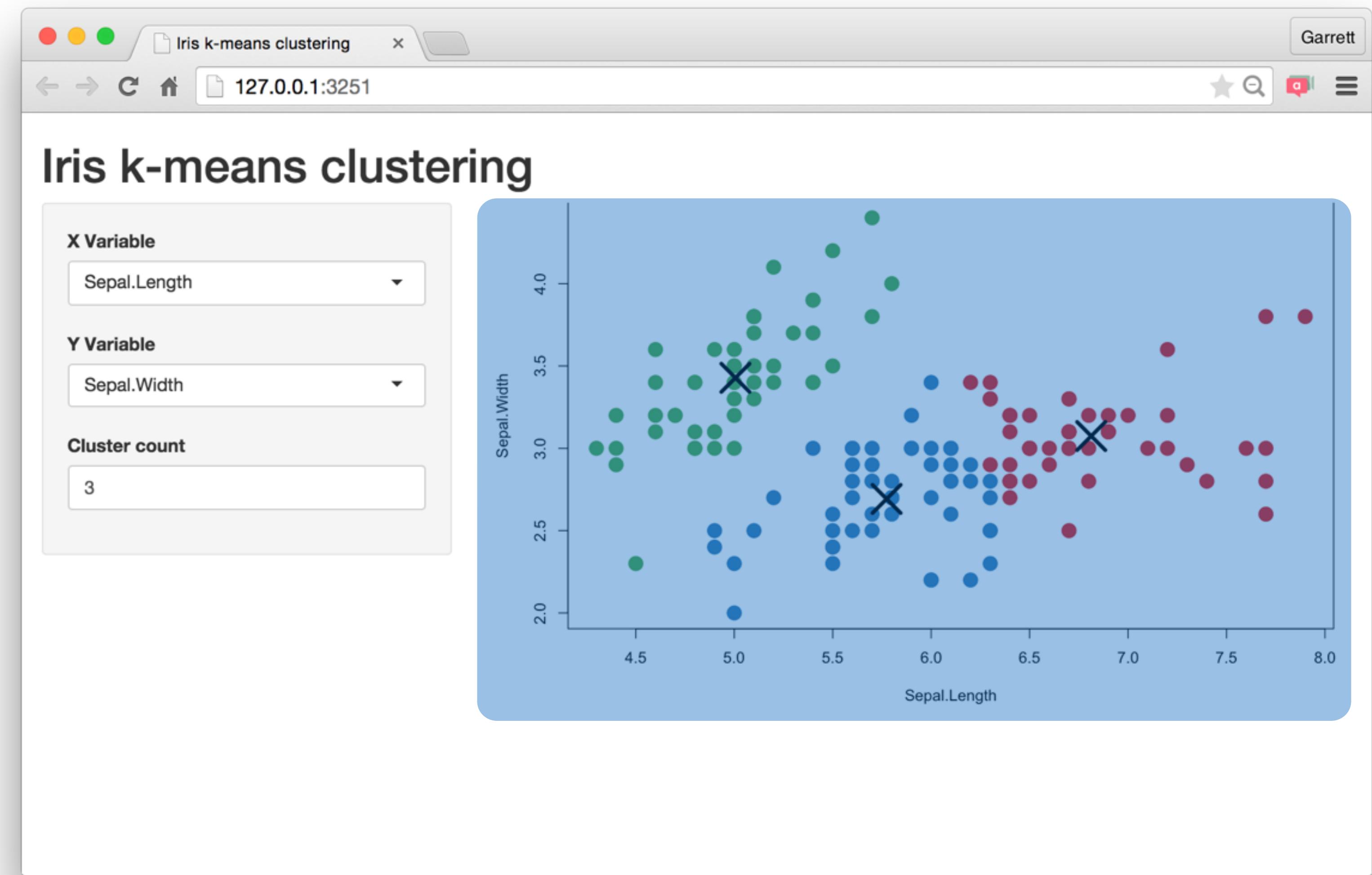
label to  
display

input specific  
arguments

?sliderInput

# Outputs

# Build your app around **inputs** and **outputs**



Function	Inserts
dataTableOutput()	an interactive table
htmlOutput()	raw HTML
imageOutput()	image
plotOutput()	plot
tableOutput()	table
textOutput()	text
uiOutput()	a Shiny UI element
verbatimTextOutput()	text

# \*Output()

To display output, add it to `fluidPage()` with an  
`*Output()` function

```
plotOutput("hist")
```

the type of output  
to display

name to give to the  
output object

```
library(shiny)

ui <- fluidPage(
  sliderInput(inputId = "num",
    label = "Choose a number",
    value = 25, min = 1, max = 100),
  plotOutput("hist")
)

server <- function(input, output) {}

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

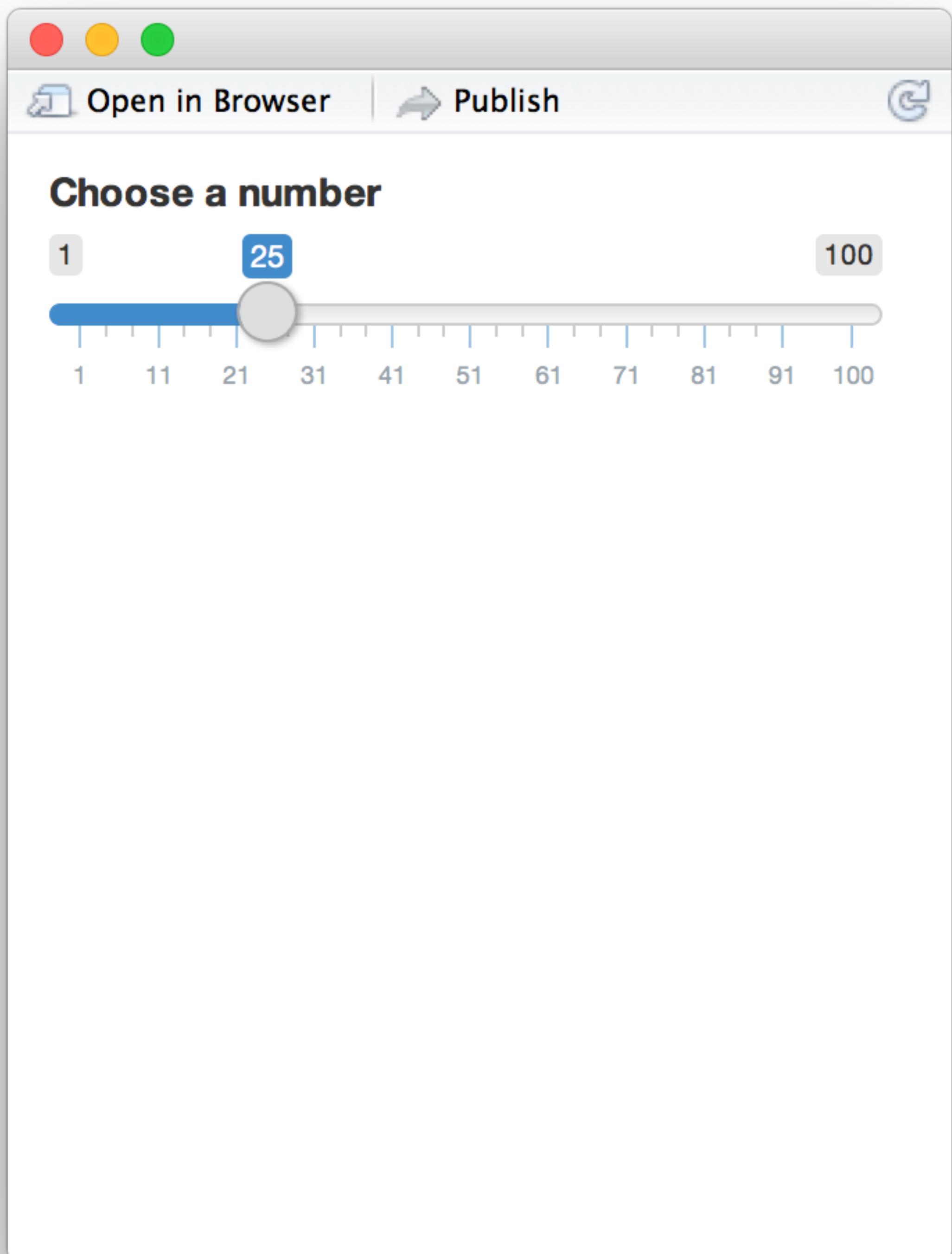
Comma between  
arguments

```
library(shiny)

ui <- fluidPage(
  sliderInput(inputId = "num",
    label = "Choose a number",
    value = 25, min = 1, max = 100),
  plotOutput("hist")
)

server <- function(input, output) {}

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

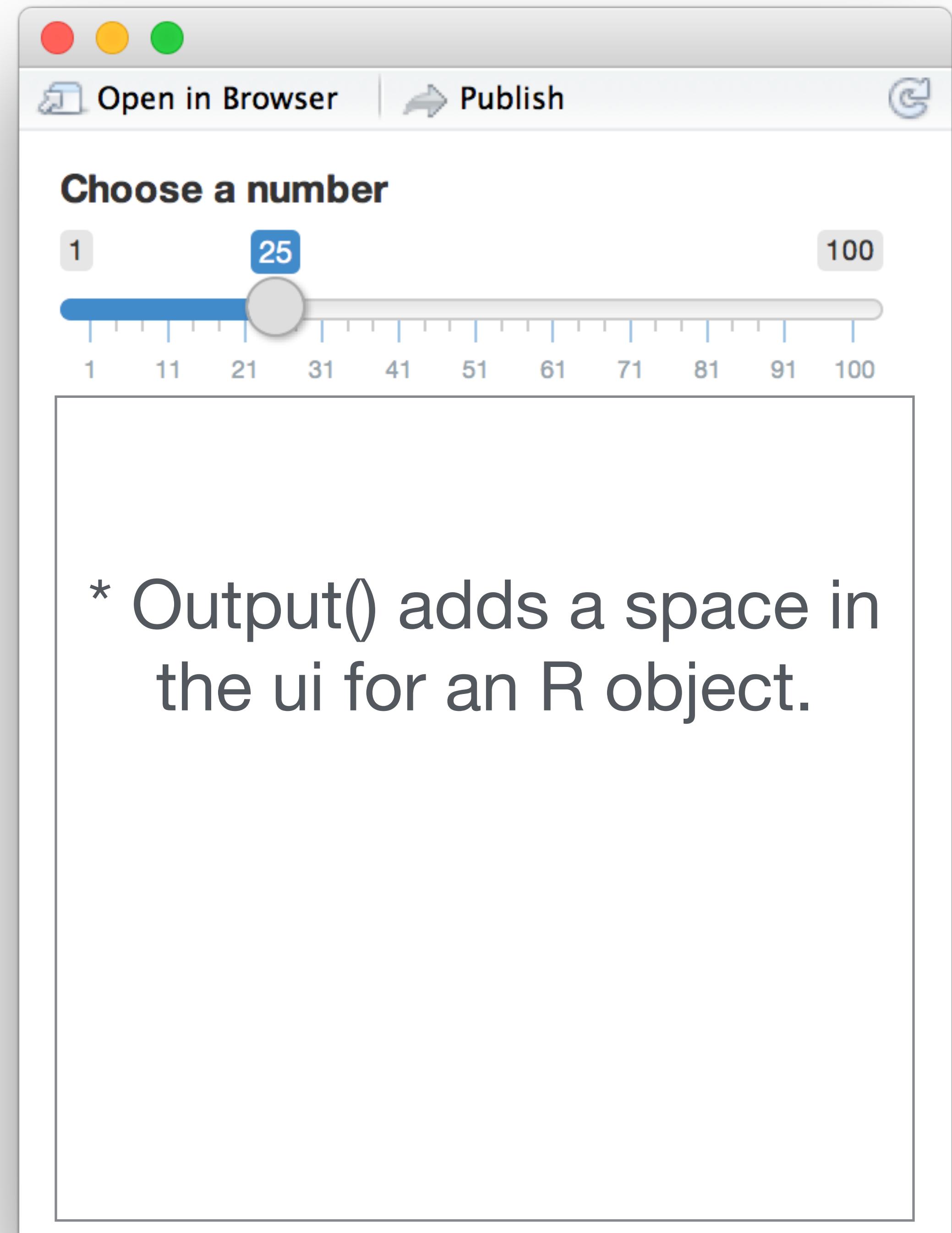


```
library(shiny)

ui <- fluidPage(
  sliderInput(inputId = "num",
    label = "Choose a number",
    value = 25, min = 1, max = 100),
  plotOutput("hist")
)

server <- function(input, output) {}

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

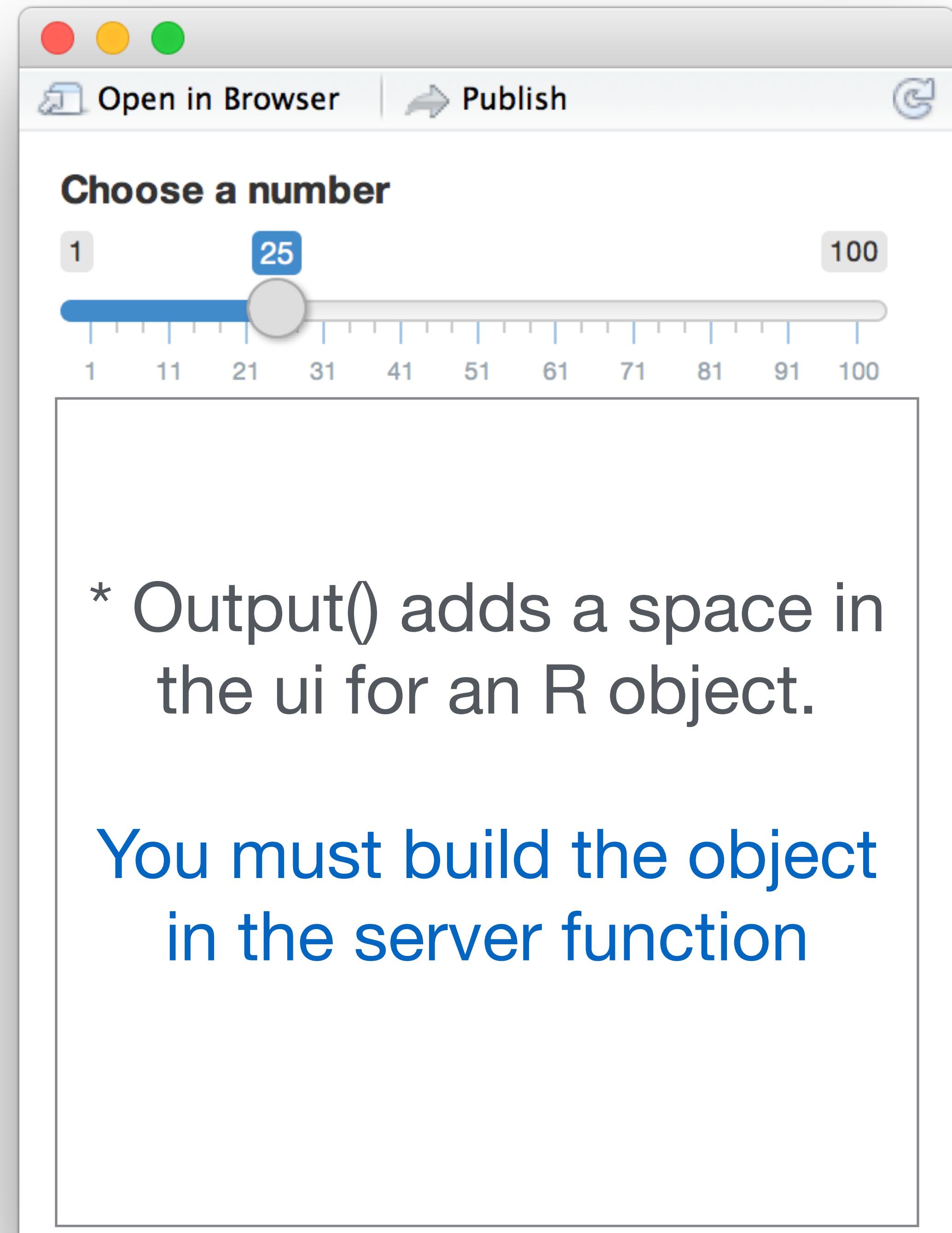


```
library(shiny)

ui <- fluidPage(
  sliderInput(inputId = "num",
    label = "Choose a number",
    value = 25, min = 1, max = 100),
  plotOutput("hist")
)

server <- function(input, output) {}

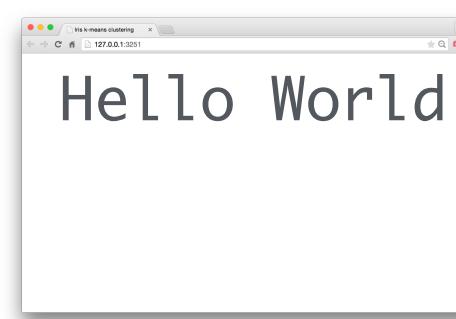
shinyApp(ui = ui, server = server)
```



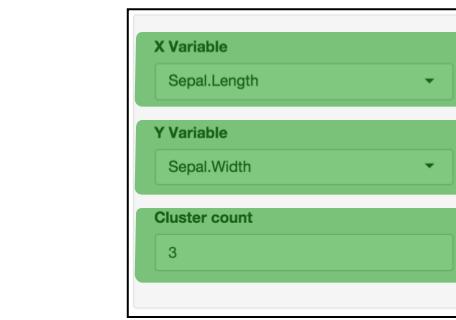
# Recap

Begin each app with the template

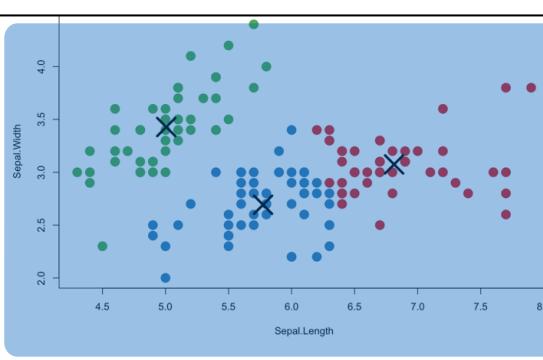
```
library(shiny)
ui <- fluidPage()
server <- function(input, output) {}
shinyApp(ui = ui, server = server)
```



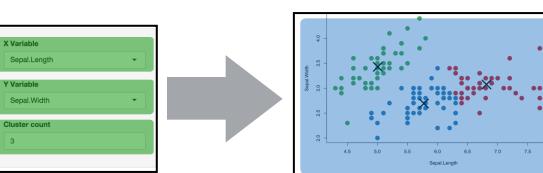
Add elements as arguments to **fluidPage()**



Create reactive inputs with an **\*Input()** function



Display reactive results with an **\*Output()** function



Assemble outputs from inputs in the server function

Tell the  
**server**  
how to assemble  
inputs into outputs

# Use **3 rules** to write the server function

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

## 1

# Save objects to display to output\$

```
server <- function(input, output) {  
  output$hist <- # code  
}
```

1

# Save objects to display to output\$

output\$hist



plotOutput("hist")

## 2

# Build objects to display with **render\***()

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

Use the **render\***() function that creates the type of output you wish to make.

function	creates
renderDataTable()	An interactive table <small>(from a data frame, matrix, or other table-like structure)</small>
renderImage()	An image (saved as a link to a source file)
renderPlot()	A plot
renderPrint()	A code block of printed output
renderTable()	A table <small>(from a data frame, matrix, or other table-like structure)</small>
renderText()	A character string
renderUI()	a Shiny UI element

# render\*()

Builds reactive output to display in UI

```
renderPlot({ hist(rnorm(100)) })
```

type of object to build

code block that builds the object

## 2

## Build objects to display with **render\***()

```
server <- function(input, output) {  
  output$hist <- renderPlot({  
    hist(rnorm(100))  
  })  
}
```

## 2

# Build objects to display with **render\***()

```
server <- function(input, output) {  
  output$hist <- renderPlot({  
    title <- "100 random normal values"  
    hist(rnorm(100), main = title)  
  })  
}
```

## 3

# Access **input** values with **input\$**

```
server <- function(input, output) {  
  output$hist <- renderPlot({  
    hist(rnorm(input$num))  
  })  
}
```

## 3

# Access **input** values with **input\$**

```
sliderInput(inputId = "num", ...)
```



**input\$num**

# Input values

The input value changes whenever a user changes the input.

Choose a number

A slider input with a title "Choose a number". The slider has a blue track and a grey handle. The value "25" is displayed in a blue box above the slider. The slider scale shows tick marks at 1, 11, 21, 31, 41, 51, 61, 71, 81, 91, and 100.

input\$num = 25

Choose a number

A slider input with a title "Choose a number". The slider has a blue track and a grey handle. The value "50" is displayed in a blue box above the slider. The slider scale shows tick marks at 1, 11, 21, 31, 41, 51, 61, 71, 81, 91, and 100.

input\$num = 50

Choose a number

A slider input with a title "Choose a number". The slider has a blue track and a grey handle. The value "75" is displayed in a blue box above the slider. The slider scale shows tick marks at 1, 11, 21, 31, 41, 51, 61, 71, 81, 91, and 100.

input\$num = 75

# Input values

The input value changes whenever a user changes the input.

Choose a number

A slider input with a blue handle set to the value 25. The slider scale ranges from 1 to 100 with major tick marks every 10 units. The current value is displayed as 25 in a blue box above the slider.

input\$num = 25

Choose a number

A slider input with a blue handle set to the value 50. The slider scale ranges from 1 to 100 with major tick marks every 10 units. The current value is displayed as 50 in a blue box above the slider.

input\$num = 50

Choose a number

A slider input with a blue handle set to the value 75. The slider scale ranges from 1 to 100 with major tick marks every 10 units. The current value is displayed as 75 in a blue box above the slider.

input\$num =

Output will automatically update  
if you follow the 3 rules

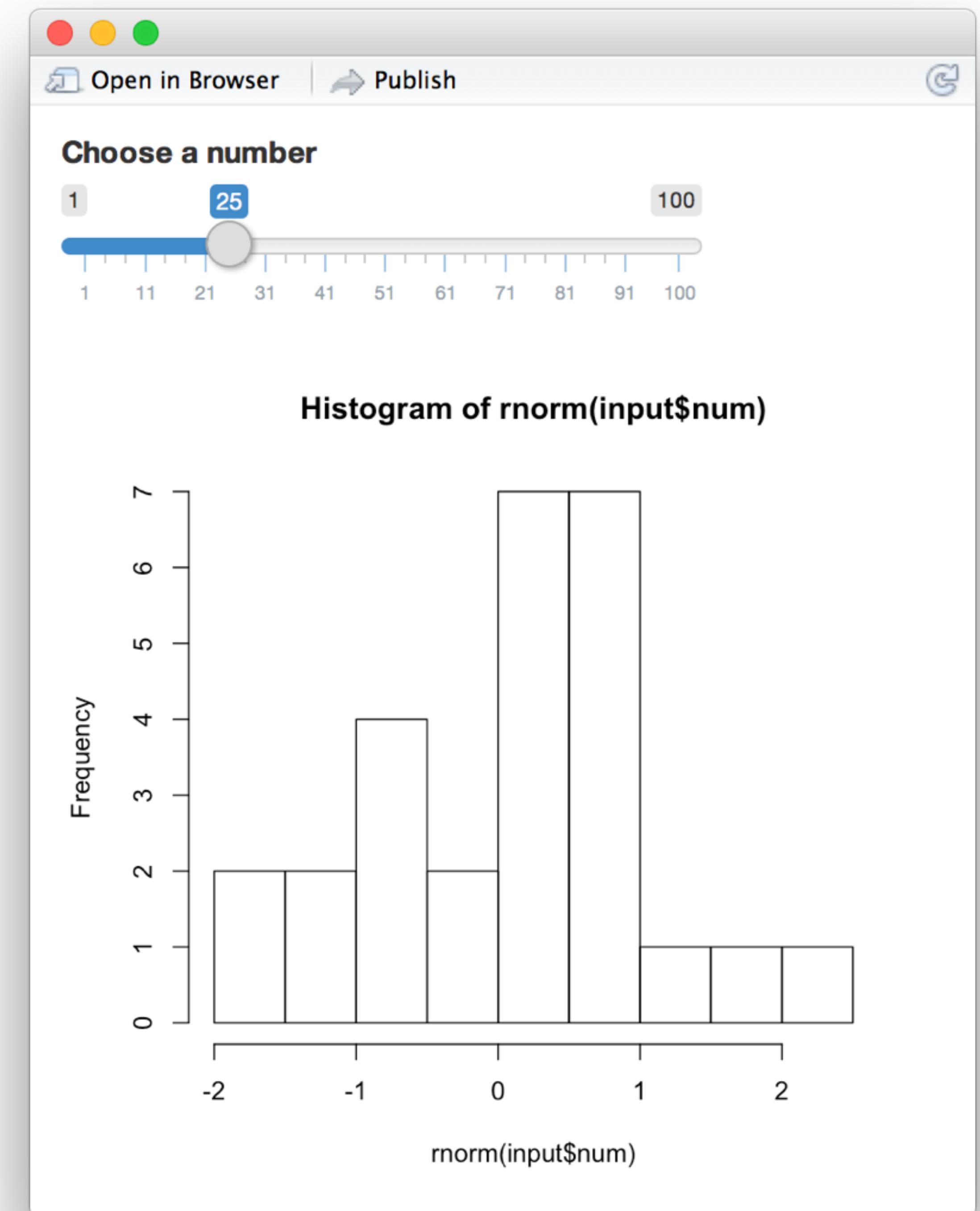
# Reactivity 101

Reactivity automatically occurs whenever you use an input value to render an output object

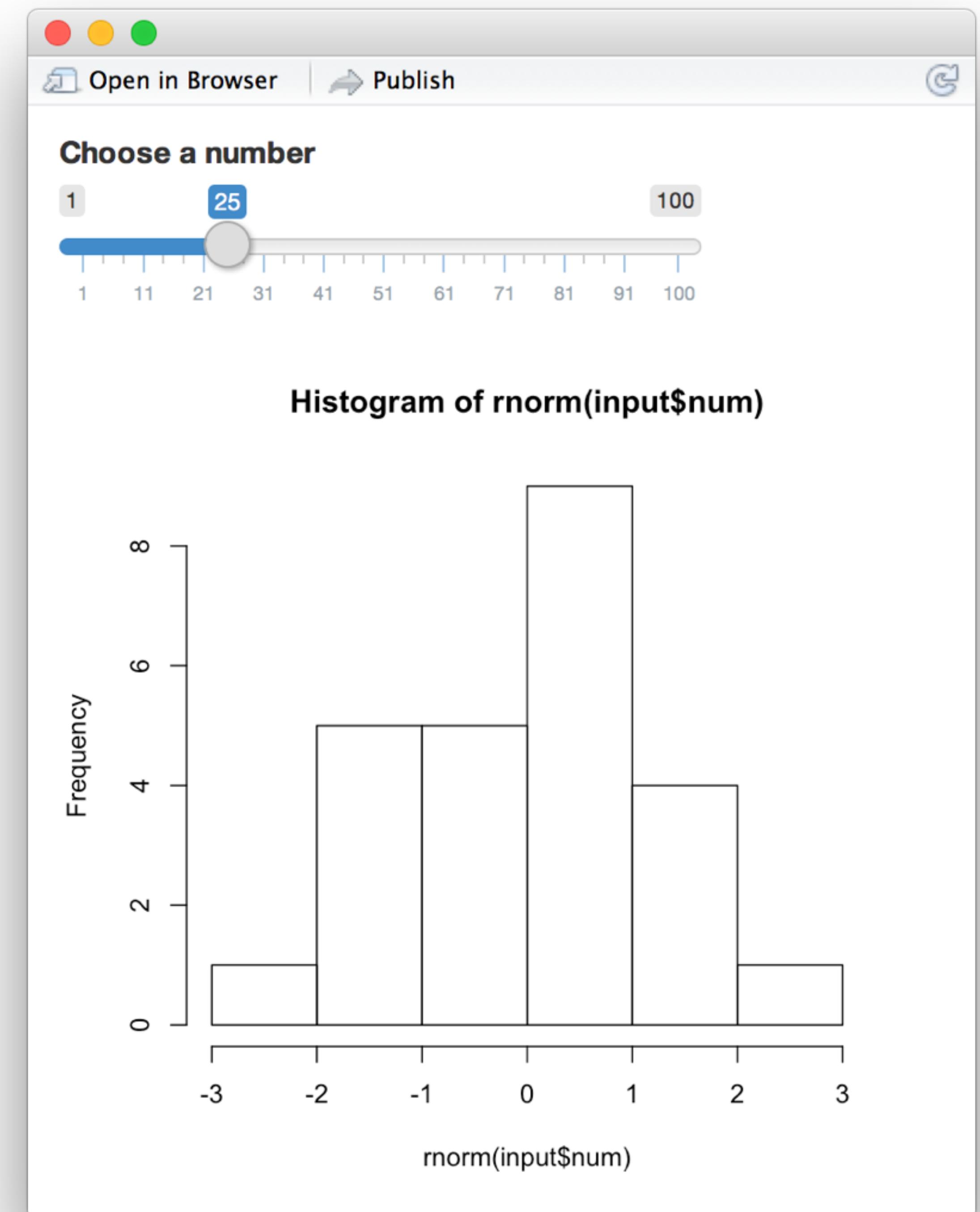
```
function(input, output) {  
  output$hist <- renderPlot({  
    hist(rnorm(input$num))  
  })  
}
```

input\$num

```
renderPlot({  
  hist(rnorm(input$num))  
})
```



```
input$num  
  
renderPlot({  
  hist(rnorm(input$num))  
})
```



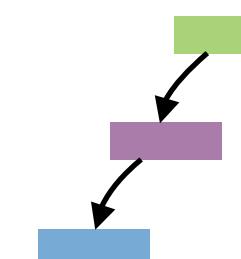
# Recap: Server



`output$hist <-`

```
renderPlot({  
  hist(rnorm(input$num))  
})
```

`input$num`



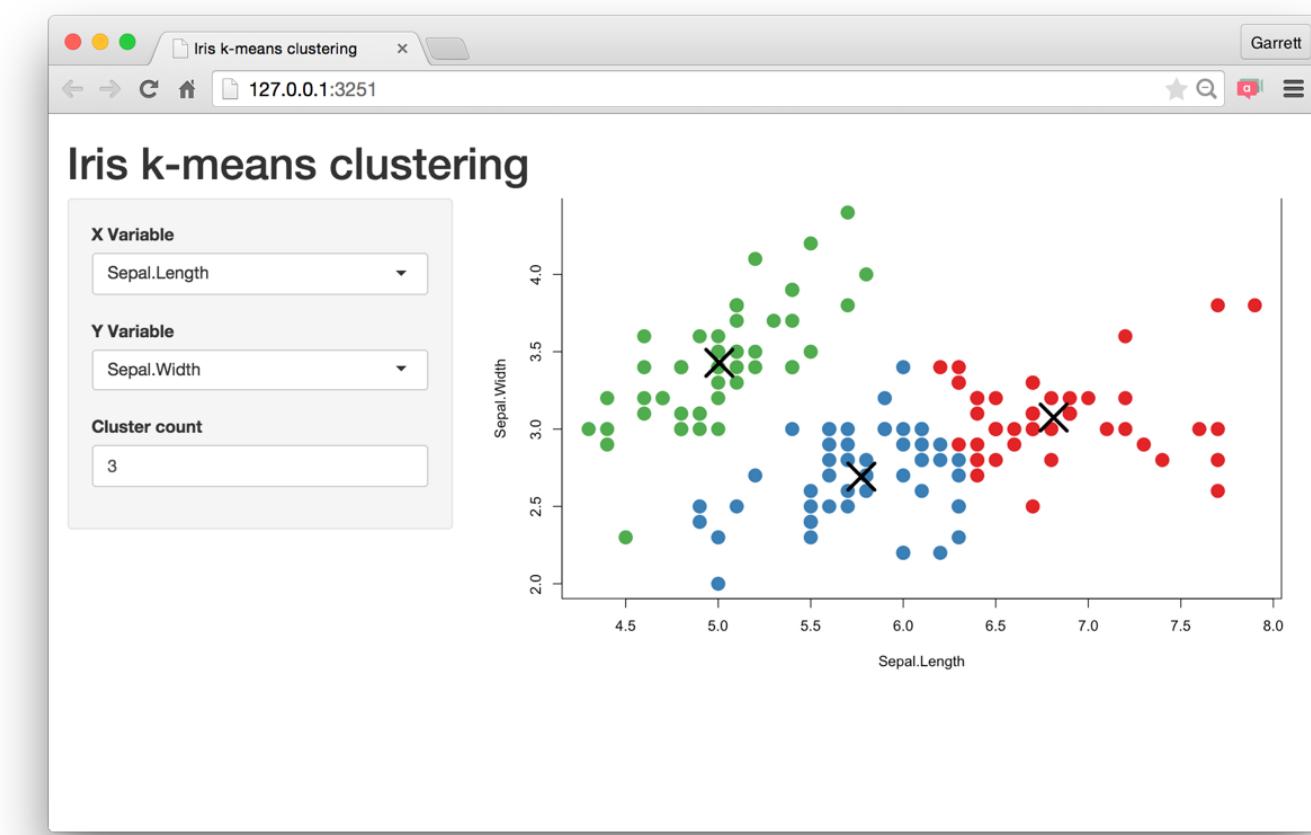
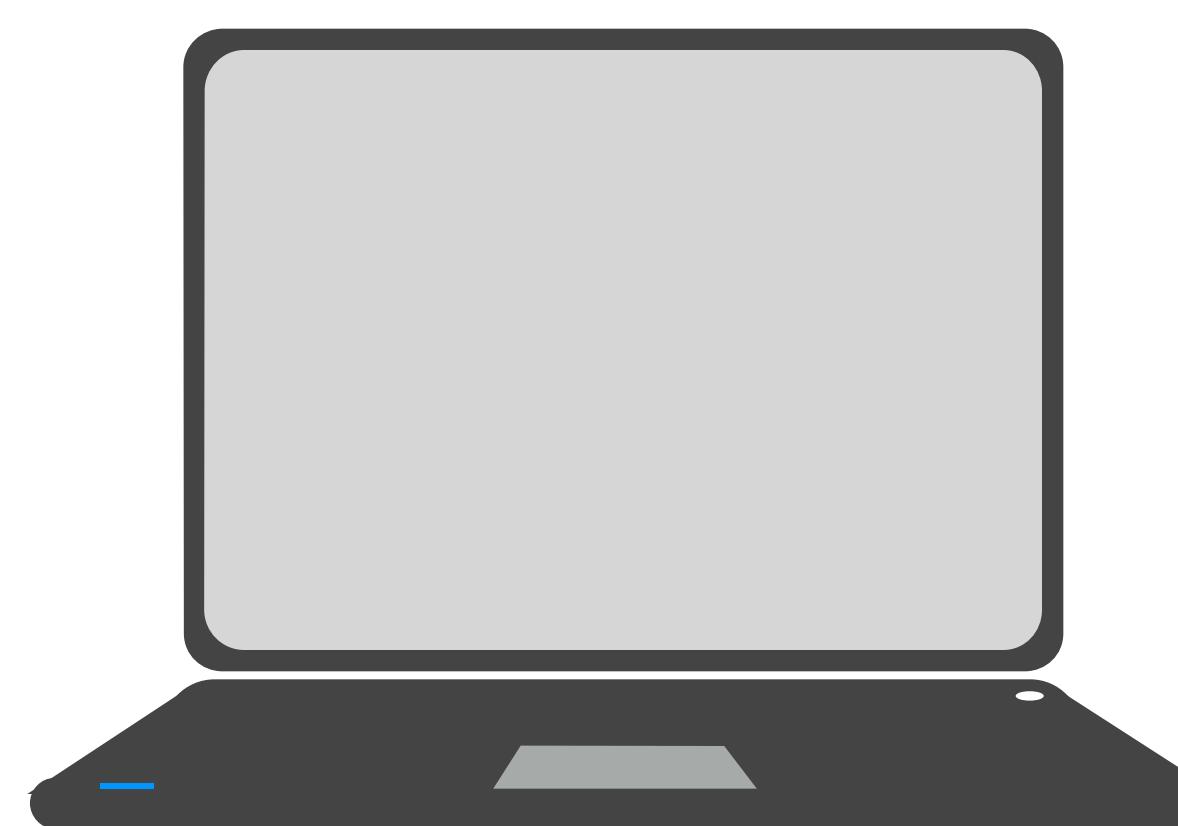
Use the `server` function to assemble inputs into outputs. Follow 3 rules:

1. Save the output that you build to `output$`
  2. Build the output with a `render*` function
  3. Access input values with `input$`
- Create reactivity by using **Inputs** to build **rendered Outputs**

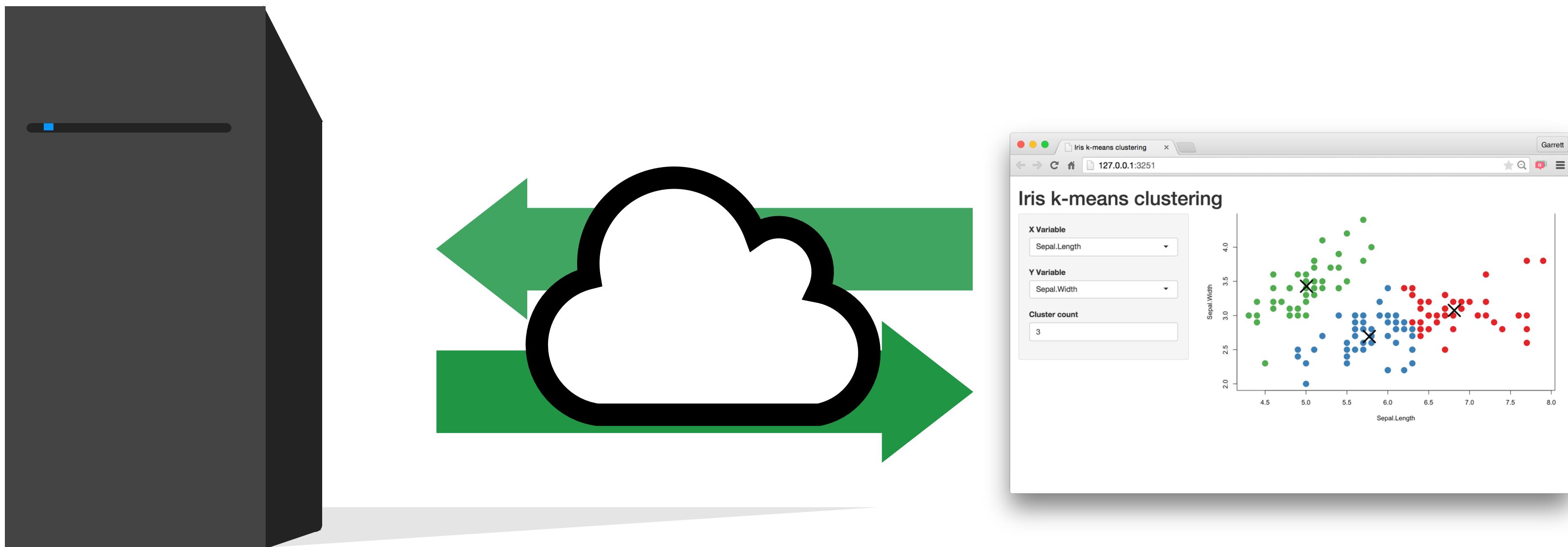
**Share  
your app**



Every Shiny app is maintained by a computer running R



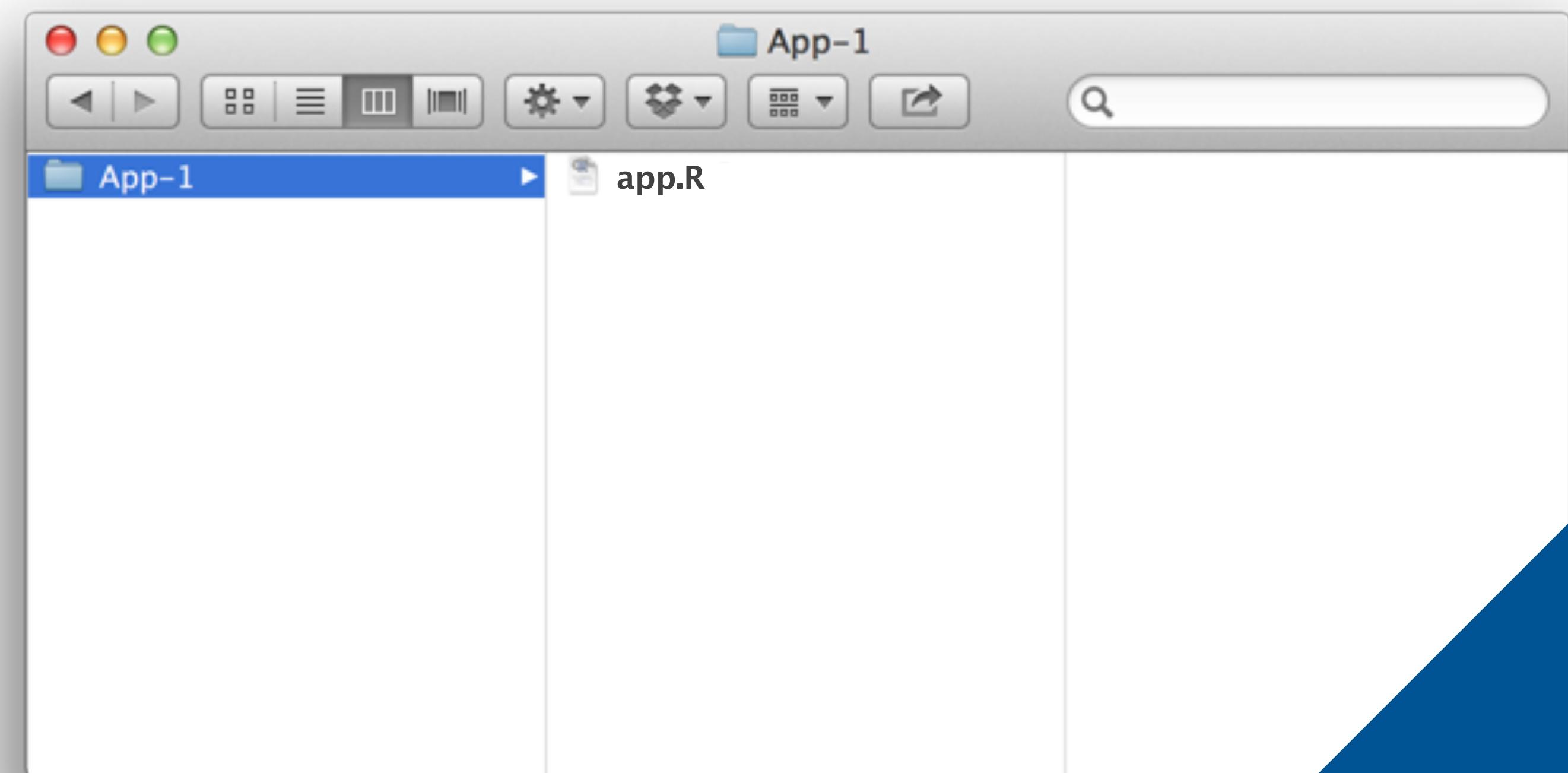
Every Shiny app is maintained by a computer running R



# How to save your 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.**



You must use this  
exact name (app.R)

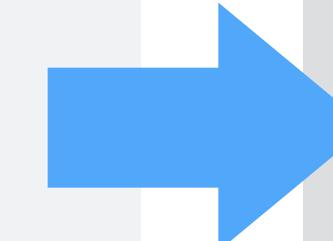
# Two file apps

```
library(shiny)

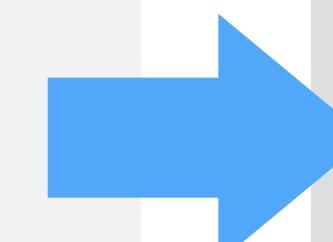
ui <- fluidPage(
  sliderInput(inputId = "num",
    label = "Choose a number",
    value = 25, min = 1, max = 100),
  plotOutput("hist")
)
```

```
server <- function(input, output) {
  output$hist <- renderPlot({
    hist(rnorm(input$num))
  })
}

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



```
# ui.R
library(shiny)
fluidPage(
  sliderInput(inputId = "num",
    label = "Choose a number",
    value = 25, min = 1, max = 100),
  plotOutput("hist")
)
```

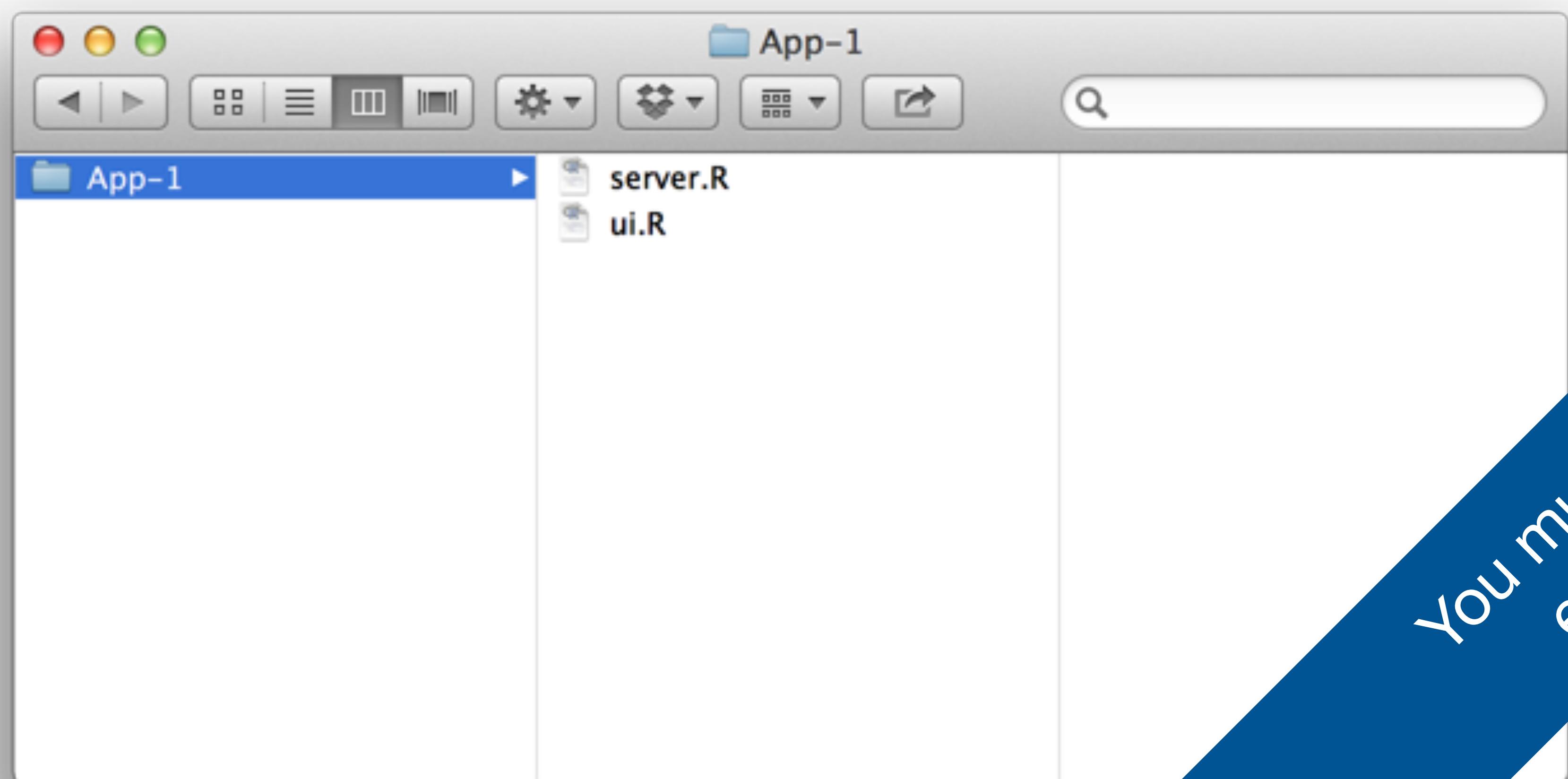


```
# server.R
library(shiny)
function(input, output) {
  output$hist <- renderPlot({
    hist(rnorm(input$num))
  })
}
```

# Two file apps

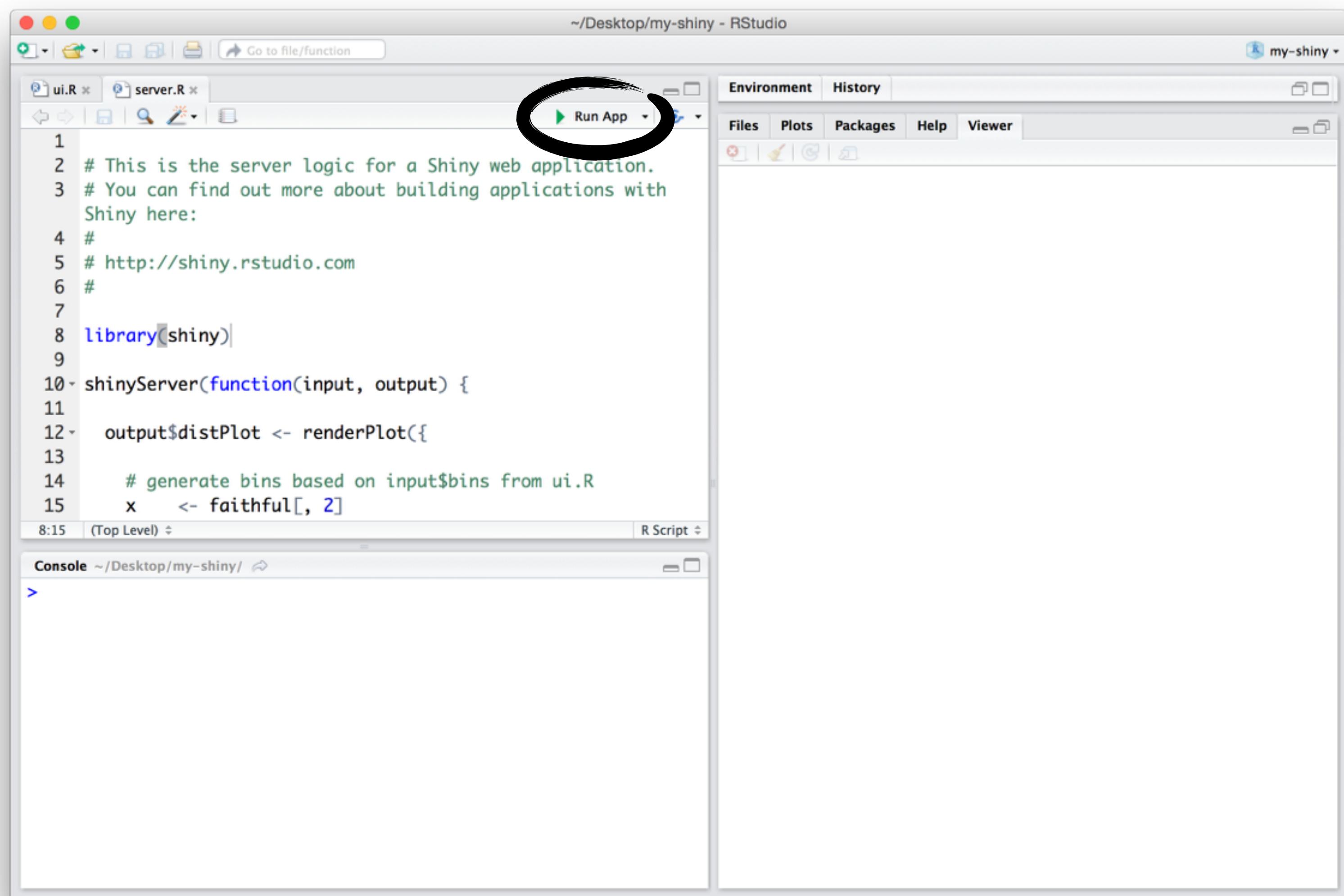
One directory with two files:

- `server.R`
- `ui.R`

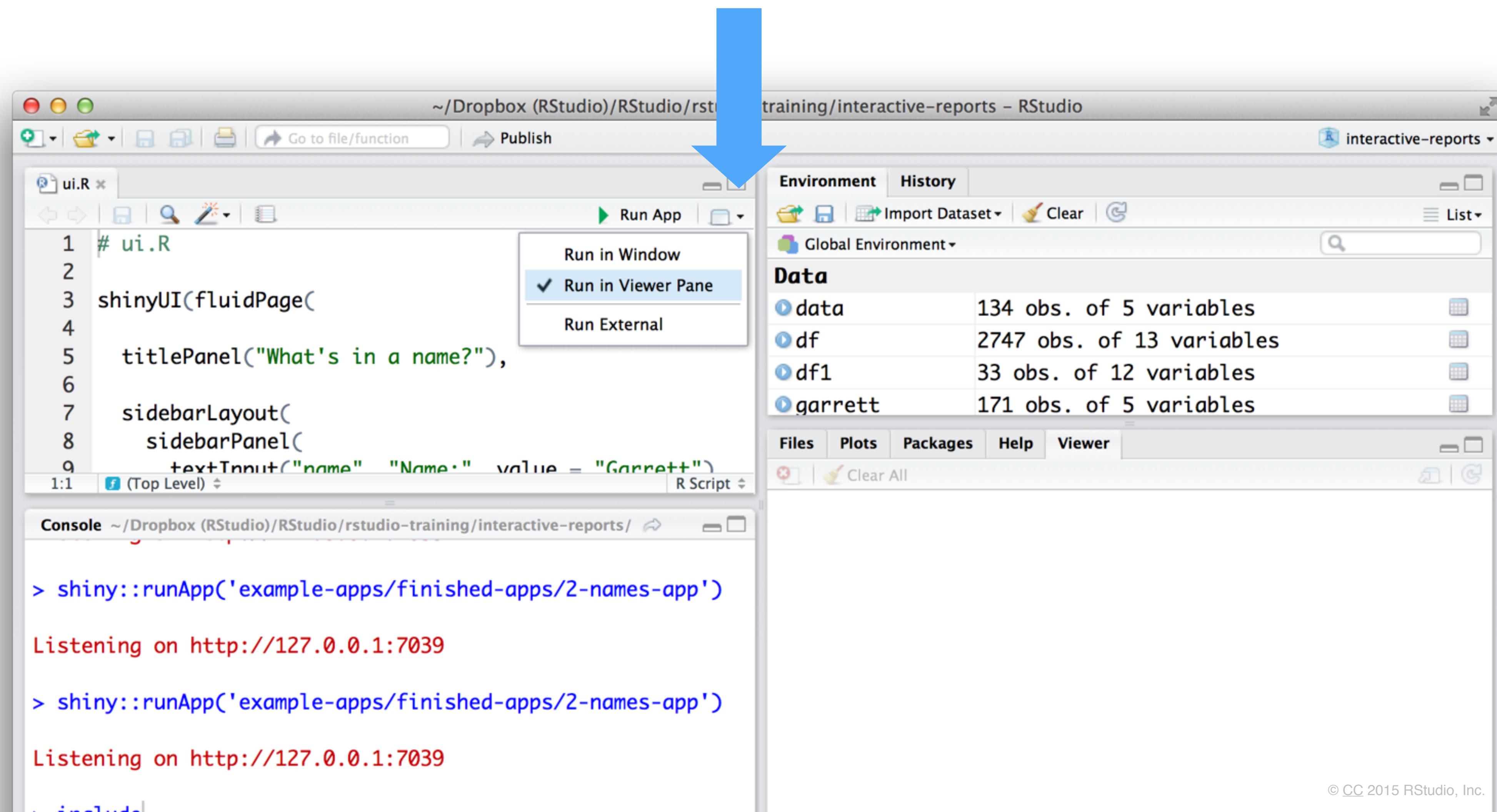


You must use these  
exact names

# Launch an app



# Display options



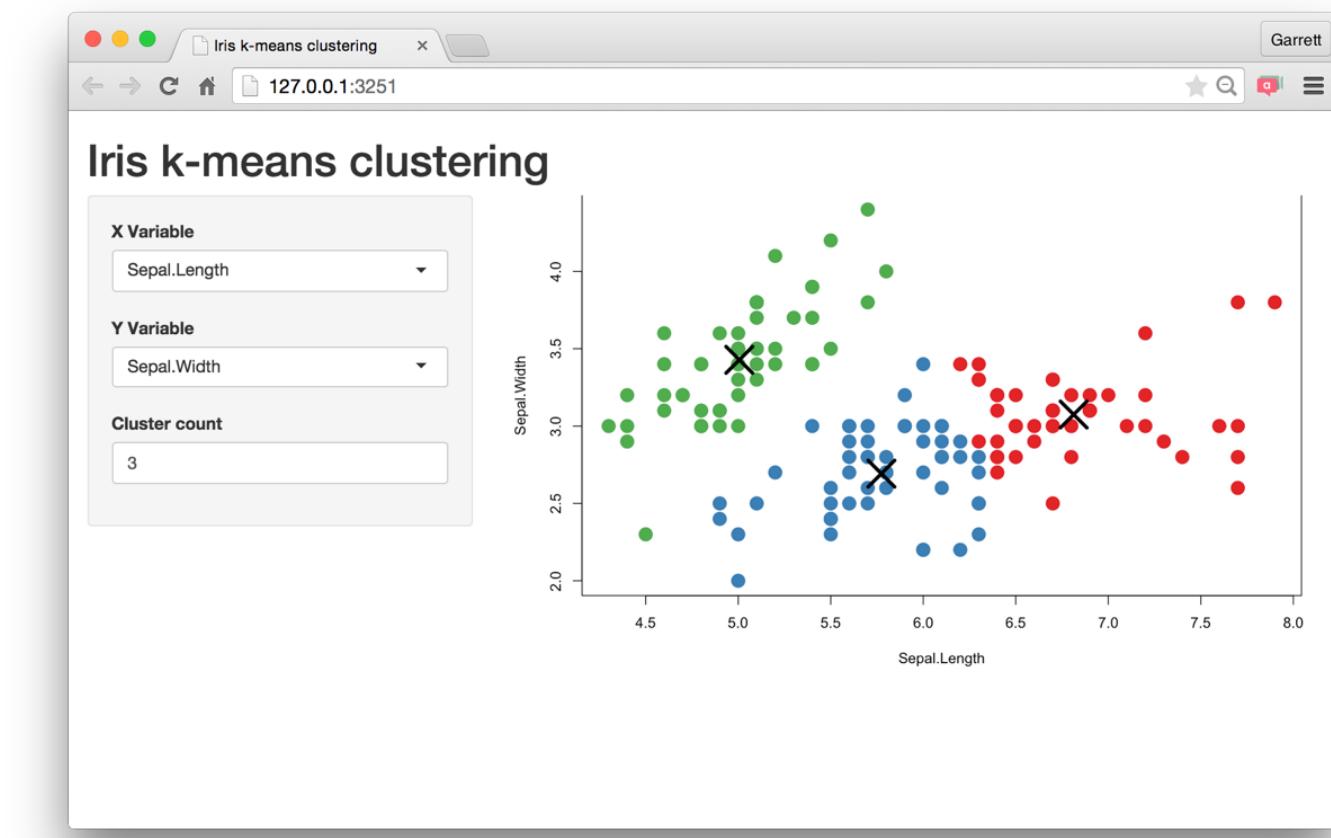
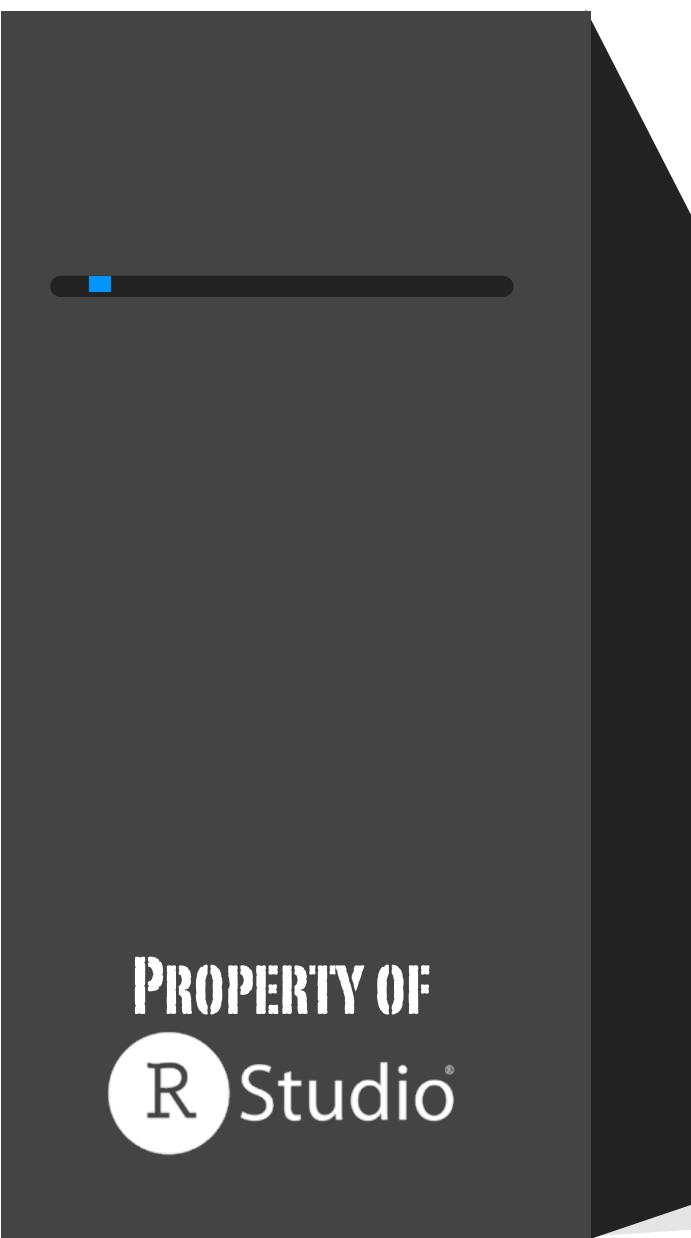
Use  
**shinyapps.io**

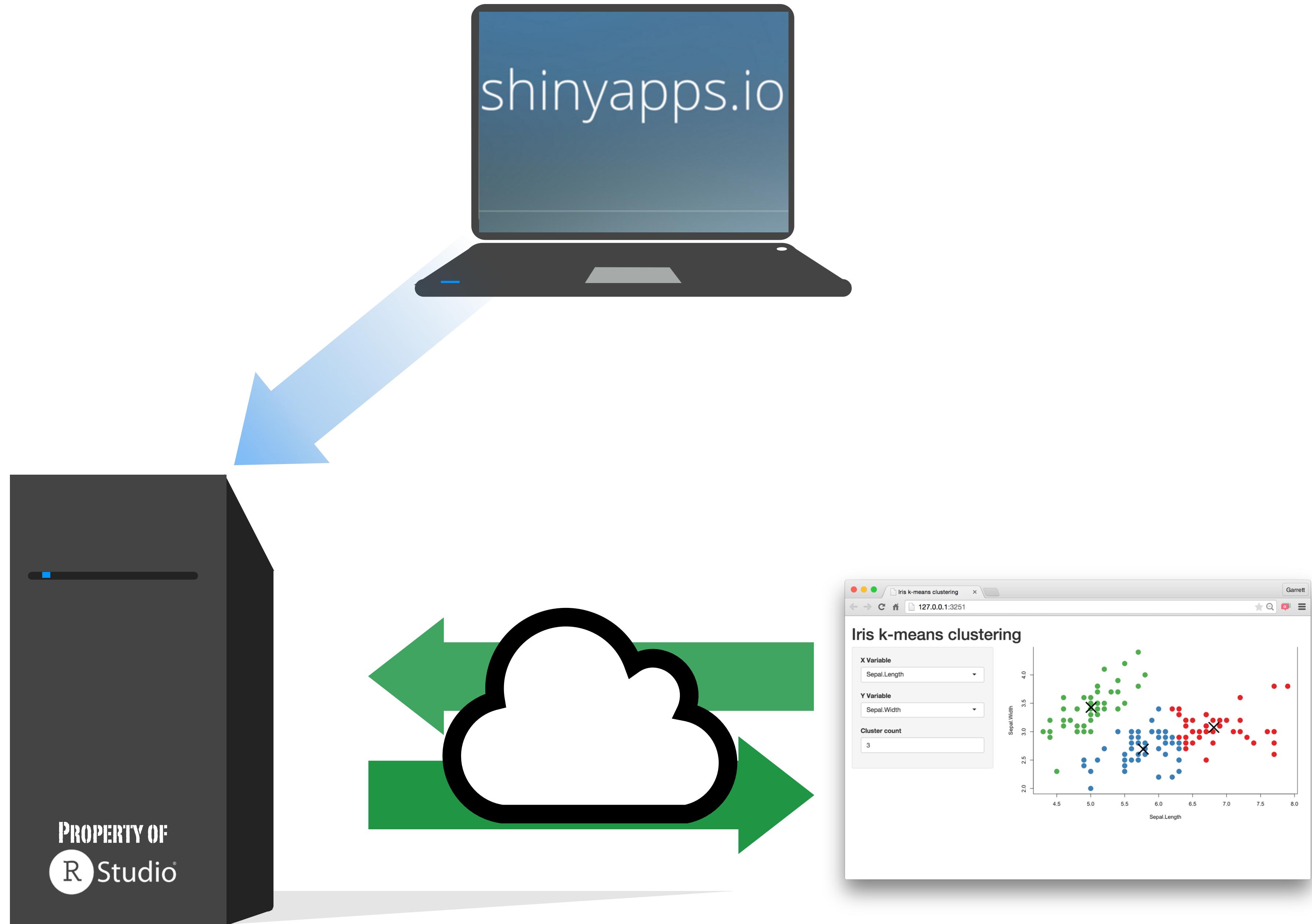


# Shinyapps.io

A server maintained by RStudio

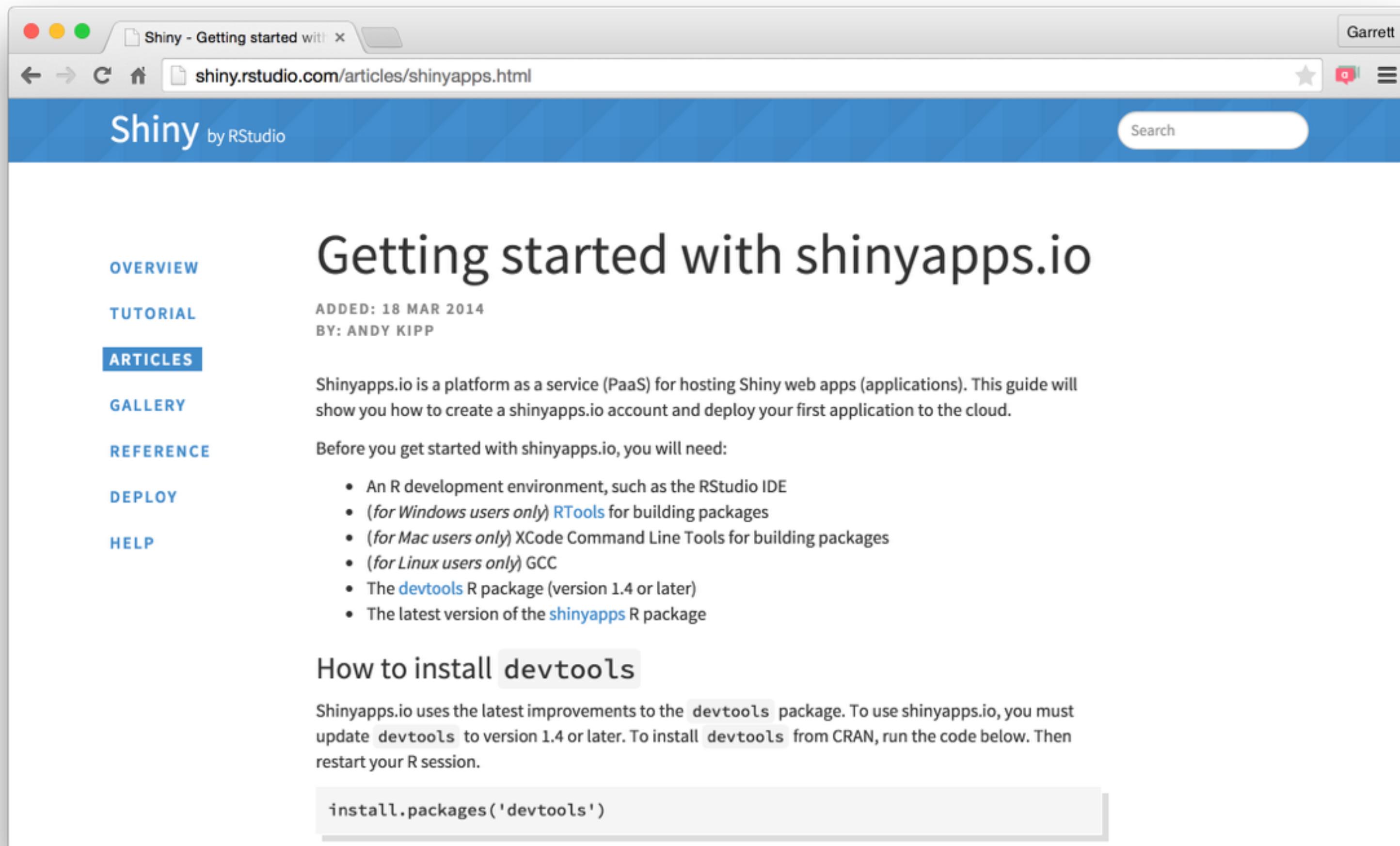
- free
- easy to use
- secure
- scalable





# Getting started guide

[shiny.rstudio.com/articles/shinyapps.html](http://shiny.rstudio.com/articles/shinyapps.html)



The screenshot shows a web browser window with the title bar "Shiny - Getting started with" and the address bar containing the URL "shiny.rstudio.com/articles/shinyapps.html". The browser interface includes standard controls like back, forward, and search, along with a user profile "Garrett". The main content area is titled "Getting started with shinyapps.io". On the left, a sidebar menu lists "OVERVIEW", "TUTORIAL", "ARTICLES" (which is selected), "GALLERY", "REFERENCE", "DEPLOY", and "HELP". The main content area includes the date "ADDED: 18 MAR 2014" and author "BY: ANDY KIPP". It describes Shinyapps.io as a PaaS for hosting Shiny web apps and provides instructions for getting started, listing requirements such as an R development environment, RTools, XCode Command Line Tools, GCC, devtools, and shinyapps packages. It also includes a section on how to install devtools and a code snippet for doing so.

Getting started with shinyapps.io

ADDED: 18 MAR 2014  
BY: ANDY KIPP

Shinyapps.io is a platform as a service (PaaS) for hosting Shiny web apps (applications). This guide will show you how to create a shinyapps.io account and deploy your first application to the cloud.

Before you get started with shinyapps.io, you will need:

- An R development environment, such as the RStudio IDE
- (for Windows users only) [RTools](#) for building packages
- (for Mac users only) XCode Command Line Tools for building packages
- (for Linux users only) GCC
- The [devtools](#) R package (version 1.4 or later)
- The latest version of the [shinyapps](#) R package

How to install `devtools`

Shinyapps.io uses the latest improvements to the `devtools` package. To use shinyapps.io, you must update `devtools` to version 1.4 or later. To install `devtools` from CRAN, run the code below. Then restart your R session.

```
install.packages('devtools')
```

**FREE****\$ 0** /month

New to Shiny? Deploy your applications to the cloud for FREE. Perfect for teachers and students or those who want a place to learn and play. No credit card required.

**5 Applications****25 Active Hours** Community Support RStudio Branding**BASIC****\$ 39** /month  
( or \$440/year )

Take your users' experience to the next level. shinyapps.io Basic lets you scale your application performance by adding R processes dynamically as usage increases.

**Unlimited Applications****250 Active Hours** Multiple Instances Email Support**STANDARD****\$ 99** /month  
( or \$1,100/year )

Need password protection? shinyapps.io Standard lets you authenticate your application users.

**Unlimited Applications****1000 Active Hours** Authentication Multiple Instances Email Support**PROFESSIONAL****\$ 299** /month  
( or \$3,300/year )

shinyapps.io Professional has it all. Share an account with others in your business or change your shinyapps.io domain into a URL of your own.

**Unlimited Applications****5000 Active Hours** Authentication Multiple Users Multiple Instances Custom Domains\* Email Support

**Build  
your own  
server**



# Shiny Server

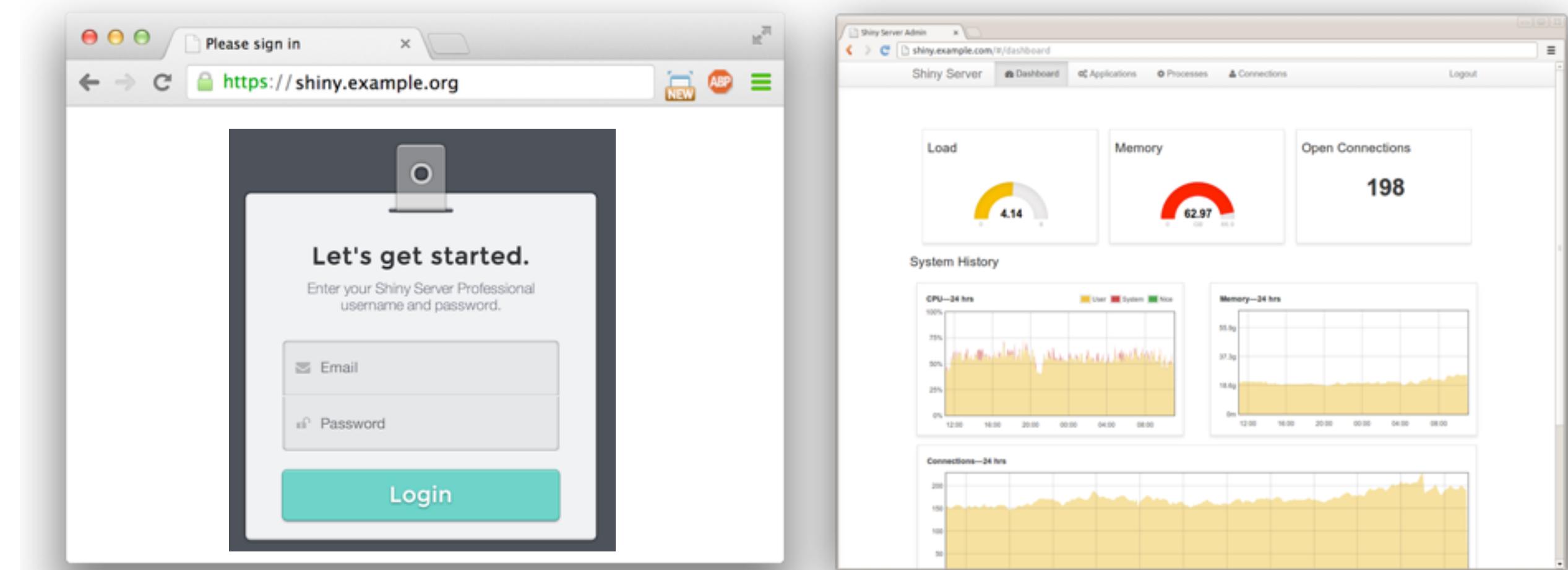
[www.rstudio.com/products/shiny/shiny-server/](http://www.rstudio.com/products/shiny/shiny-server/)

A back end program that builds a linux web server specifically designed to host Shiny apps.

# Shiny Server Pro

[www.rstudio.com/products/shiny/shiny-server/](http://www.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

# Recap: Sharing



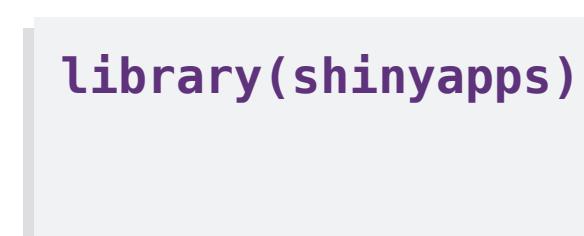
Save your app in its own directory as  
**app.R**, or **ui.R** and **server.R**



Host apps at **shinyapps.io** by:



1. Sign up for a free **shinyapps.io** account



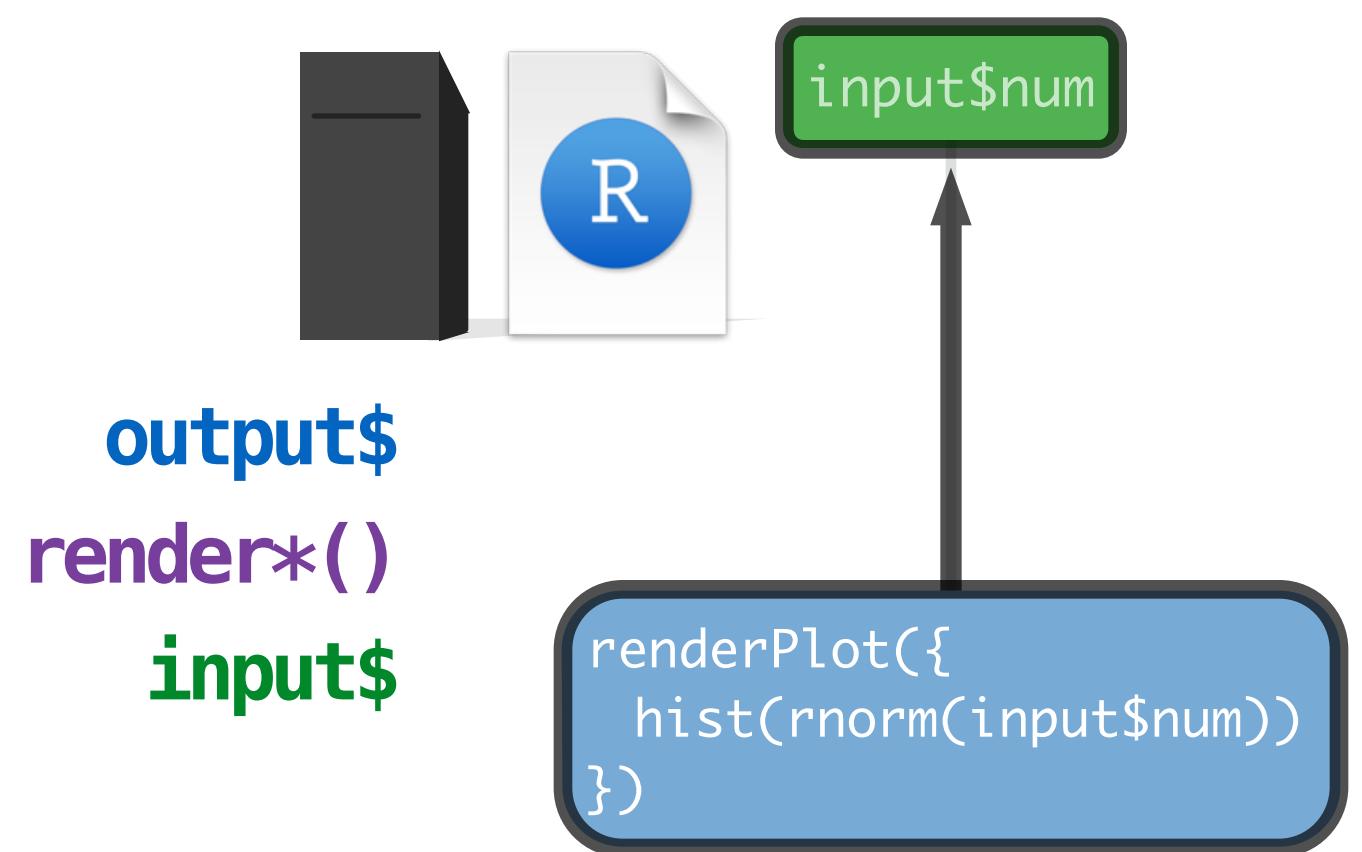
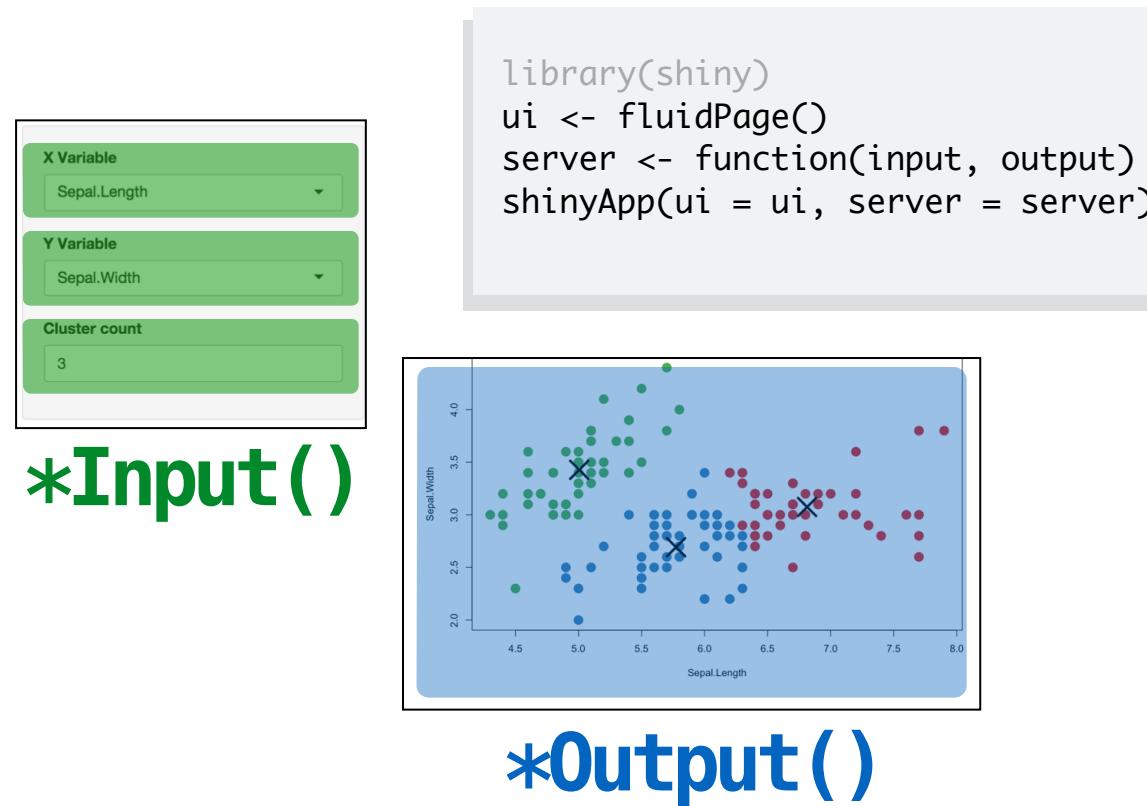
2. Install the **shinyapps** package



Build your own server with **Shiny Server**  
or **Shiny Server Pro**

**Learn**  
more

# You now how to



Build an app

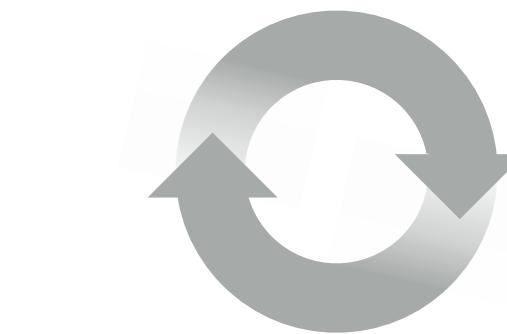
Create interactions

Share your apps

# How to start with Shiny



1. How to build a Shiny app (Today)
2. How to customize reactions (May 27)
3. How to customize appearance (June 3)



# The Shiny Development Center

[shiny.rstudio.com](http://shiny.rstudio.com)

