

Reactivity 101

BUILDING WEB APPLICATIONS WITH SHINY IN R



Ramnath Vaidyanathan

VP of Product Research

Greeting

Enter Name

Hello

app.R

↑ show with app

```
library(shiny)

ui <- fluidPage(
  titlePanel('Greeting'),
  textInput('name', 'Enter Name'),
  textOutput('greeting')
)

server <- function(input, output, session) {
  output$greeting <- renderText({
    paste('Hello', input$name)
  })
}
```

Reactive source

User input that comes through a browser interface, typically

```
ui <- fluidPage(  
  titlePanel('Greeting'),  
  textInput('name', 'Enter Name')  
)  
server <- function(input, output, session){  
  
}  
  
shinyApp(ui = ui, server = server)
```

Reactive endpoint

Output that typically appears in the browser window, such as a plot or a table of values

```
ui <- fluidPage(  
  titlePanel('Greeting'),  
  textInput('name', 'Enter Name'),  
  textOutput('greeting')  
)  
server <- function(input, output, session){  
  output$greeting <- renderText({  
    paste("Hello", input$name)  
  })  
}
```

Reactive conductor

An intermediate that depends on reactive sources, and/or updates reactive endpoints.

```
server <- function(input, output, session){  
  output$plot_trendy_names <- plotly::renderPlotly({  
    babynames %>%  
      filter(name == input$name) %>%  
      ggplot(val_bnames, aes(x = year, y = n)) +  
      geom_col()  
  })  
  output$table_trendy_names <- DT::renderDT({  
    babynames %>%  
      filter(name == input$name)  
  })  
}
```

Reactive expressions

Reactive expressions are **lazy** and **cached**.

```
server <- function(input, output, session){  
  rval_babynames <- reactive({  
    babynames %>%  
      filter(name == input$name)  
  })  
  output$plot_trendy_names <- plotly::renderPlotly({  
    rval_babynames() %>%  
      ggplot(val_bnames, aes(x = year, y = n)) +  
      geom_col()  
  })  
  output$table_trendy_names <- DT::renderDT({  
    rval_babynames()  
  })  
}
```

Let's practice!

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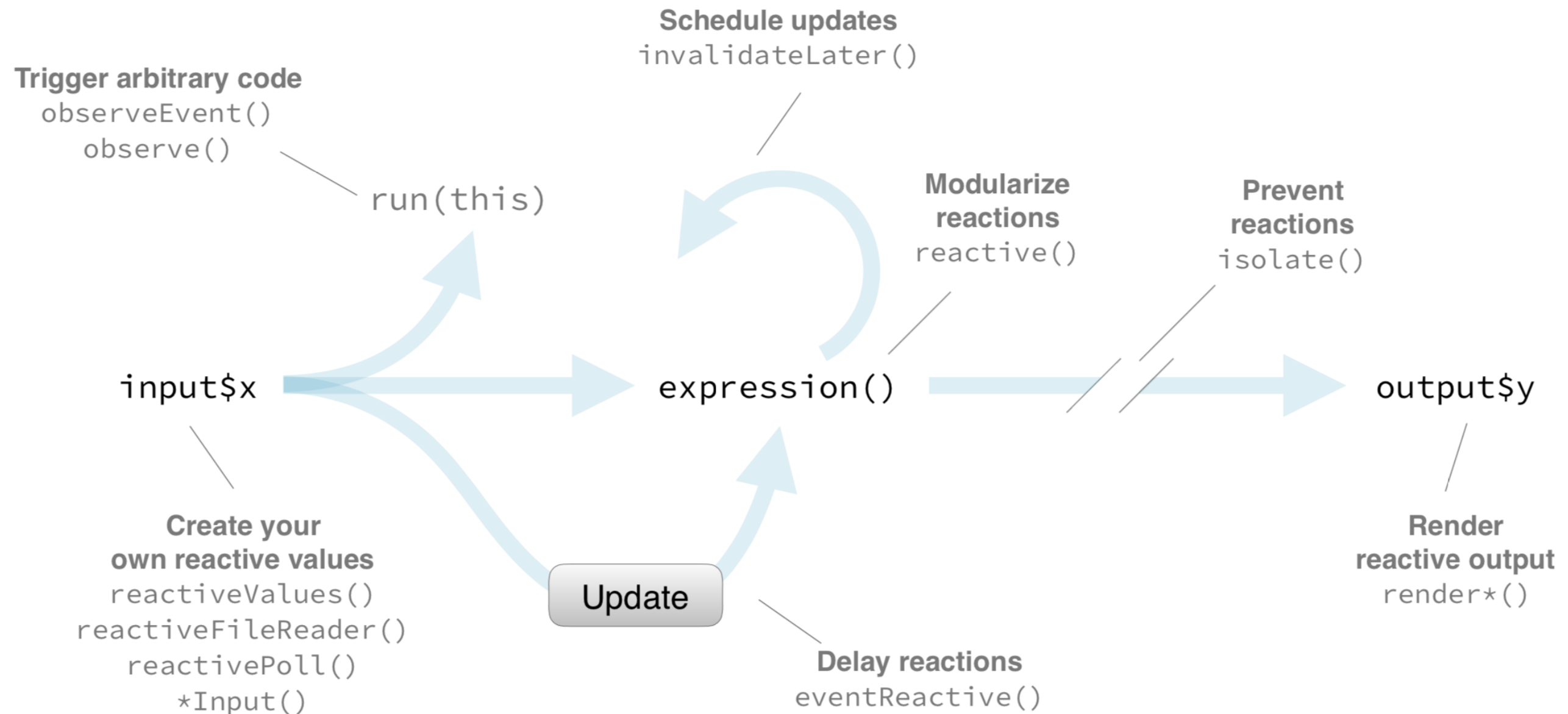
Observers vs. reactives

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VP of Product Research

Reactive flow



Observers (1/2)

Enter Name

app.R

⤴ show with app

```
ui <- fluidPage(  
  textInput('name', 'Enter Name'),  
)  
server <- function(input, output, session){  
  observe(  
    showModal(modalDialog(  
      paste("Hello", input$name)  
    ))  
  )  
}  
shinyApp(ui = ui, server = server)
```

Observers (2/2)

```
ui <- fluidPage(  
  textInput('name', 'Enter your name')  
)  
  
server <- function(input, output, session){  
  observe({  
    showNotification(  
      paste("You entered the name", input$name)  
    )  
  })  
}
```

Observers vs. reactives

Role

- `reactive()` is for calculating values, without side effects.
- `observe()` is for performing actions, with side effects.

Differences

- **Return Values:** Reactive expressions return values, but observers don't.
- **Evaluation:** Observers eagerly respond to changes in their dependencies, while reactive expressions are lazy.
- **Side Effects:** Observers are primarily useful for their side effects, whereas, reactive expressions must NOT have side effects

Let's practice!

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Stop - delay - trigger

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Isolating actions (1/3)

Select greeting

Hello

Hello,

Enter your name

app.R

↑ show with app

```
server <- function(input, output, session){
  output$greeting <- renderText({
    paste(input$greeting_type, input$name, sep = ", ")
  })
}

ui <- fluidPage(
  fluidRow(
```

Isolating actions (2/3)

Select greeting

Hello

Hello,

Enter your name

app.R

⤴ show with app

```
server <- function(input, output, session){  
  output$greeting <- renderText({  
    paste(isolate({input$greeting_type}), input$name, sep = ", ")  
  })  
}  
ui <- fluidPage(  
  fluidRow(  
    selectInput("greeting_type", "Select greeting", choices = c("Hello", "Hi", "Hey", "Howdy", "Yo", "Sup", "Greetings", "Salutations", "Greetings and Salutations", "Greetings and Salutations and Greetings and Salutations"))  
  )  
)
```


Isolating actions (3/3)

```
server <- function(input, output, session){  
  output$greeting <- renderText({  
    paste(  
      isolate(  
        input$greeting_type  
      )  
      , input$name, sep = " ,")  
    })  
}
```

Delaying actions (1/3)

Enter Name

Hello

app.R

↑ show with app

```
server <- function(input, output, session) {  
  rv_greeting <- reactive({  
    paste('Hello', input$name)  
  })  
  output$greeting <- renderText({  
    rv_greeting()  
  })  
}
```

Enter Name

Show Greeting

app.R

↑ show with app

```
server <- function(input, output, session) {  
  rv_greeting <- eventReactive(input$show_greeting, {  
    paste('Hello', input$name)  
  })  
  output$greeting <- renderText({  
    rv_greeting()  
  })  
}
```

Delaying actions (3/3)

```
server <- function(input, output, session){  
  rv_greeting <- eventReactive(input$show_greeting, {  
    paste("Hello", input$name)  
  })  
  output$greeting <- renderText({  
    rv_greeting()  
  })  
}
```

Triggering actions (1/2)

Enter Name

Show Greeting

app.R

📱 show with app

```
server <- function(input, output, session) {
  observeEvent(input$show_greeting, {
    showModal(modalDialog(paste('Hello', input$name)))
  })
}

ui <- fluidPage(
```

Triggering actions (2/2)

```
server <- function(input, output, session){  
  observeEvent(input$show_greeting, {  
    showModal(modalDialog(paste("Hello", input$name)))  
  })  
}
```

Let's practice!

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Applying reactivity concepts

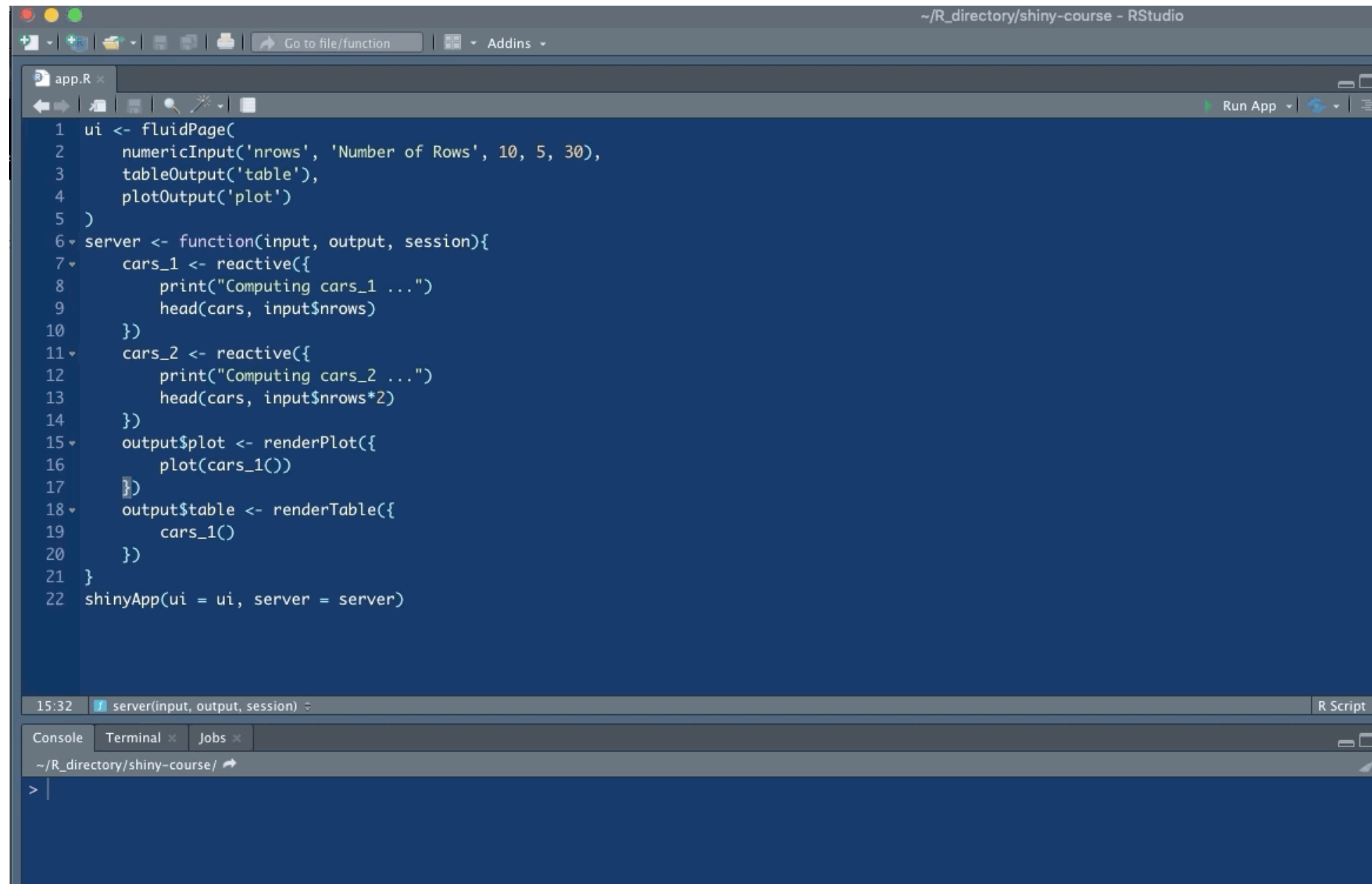
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Reactivity 101

A screenshot of the RStudio IDE. The main editor window shows a script for a Shiny application named 'app.R'. The script defines a user interface with a numeric input, a table output, and a plot output. The server logic uses reactive programming to compute the number of rows and render the outputs. The console at the bottom shows the R prompt and the current file path.

```
1 ui <- fluidPage(  
2   numericInput('nrows', 'Number of Rows', 10, 5, 30),  
3   tableOutput('table'),  
4   plotOutput('plot')  
5 )  
6 server <- function(input, output, session){  
7   cars_1 <- reactive({  
8     print("Computing cars_1 ...")  
9     head(cars, input$nrows)  
10  })  
11  cars_2 <- reactive({  
12    print("Computing cars_2 ...")  
13    head(cars, input$nrows*2)  
14  })  
15  output$plot <- renderPlot({  
16    plot(cars_1())  
17  })  
18  output$table <- renderTable({  
19    cars_1()  
20  })  
21 }  
22 shinyApp(ui = ui, server = server)
```

Reactives and observers

- Reactive sources are accessible through any `input$x`.
- Reactive conductors are good for slow or expensive calculations, and are placed between sources and endpoints.
- Reactive endpoints are accessible through any `output$y`, and are observers, primarily used for their side effects, and not directly to calculate things.

Stop, Delay, Trigger

- Stop with `isolate()`
- Delay with `eventReactive()`
- Trigger with `observeEvent()`

Let's practice!

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