

BUILDING INTERACTIVE, R-POWERED WEB APPLICATIONS WITH SHINY

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About Me

- MS Computer Science, SMU
- By day...
 - ▣ Computational Biologist at UT Southwestern
 - Use R to analyze biomedical data
 - Develop Java-based web application
- By night...
 - ▣ Freelance consultant as Trestle Technology
 - Web development
 - Data analysis
 - IT consulting

Overview

- Motivation
- Shiny
- Reactive Programming
- Code Walkthroughs
 - ▣ Simple histogram
 - ▣ Advanced histogram
 - ▣ Reactive histogram
 - ▣ Custom outputs
- Hosting



Motivation

“R is great!”

“The Internet is great!”



Motivation

- Want to get R into web browsers
- Previous approaches
 - rApache
 - Rserve (Java, C++, C#, Python, Ruby, .NET)
 - deployR
 - Custom hacks
- Just make R accessible to server-side programming languages (PHP, Ruby, Java, etc.)



Shiny

- Open-Sourced by RStudio 11 / 2012 on CRAN
- New model for web-accessible R code
- Able to generate basic web UIs
- Uses web sockets
 - ▣ “The new HTTP”
- Built on a “Reactive Programming” model
- Entirely extensible
 - ▣ Custom inputs and outputs



Reactive Programming

a <- 3

b <- a + 2

a <- 7

b == ?

Imperative: b = 5

Reactive: b = 9

Reactive Programming Example

	A	B	C	D
1				
2		A		B
3		3	=B3+2	
4				
5				
6				



Basic Shiny Example

Basic Shiny UI and Server

<http://trestletechnology.net:3838/simpleGeyeser/>

<https://github.com/trestletech/shiny-sandbox/tree/master/simpleGeyeser>



ui.R

shinyUI (

)

ui.R

```
shinyUI(bootstrapPage(
```

```
))
```

ui.R

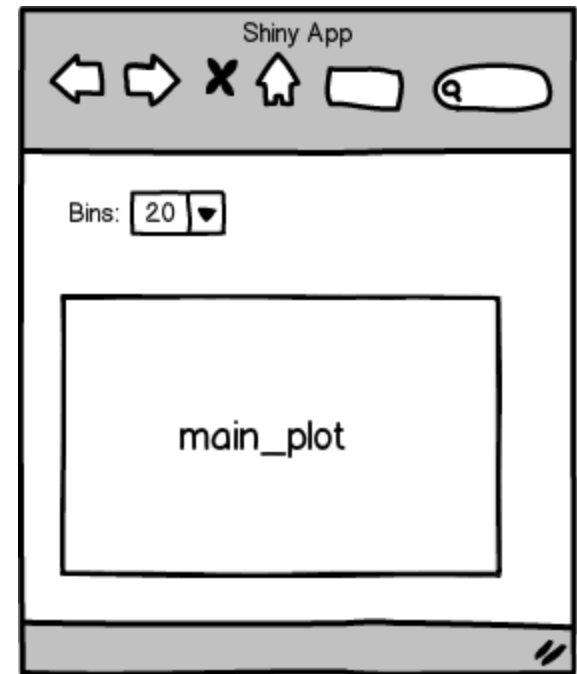
```
shinyUI(bootstrapPage(  
  selectInput(inputId = "n_breaks",  
    label = "Number of bins in  
    histogram (approximate):",  
    choices = c(10, 20, 35, 50),  
    selected = 20),  
))
```

ui.R

```
shinyUI(bootstrapPage(  
  selectInput(inputId = "n_breaks",  
    label = "Number of bins in  
histogram (approximate):",  
    choices = c(10, 20, 35, 50),  
    selected = 20),  
  
  plotOutput(outputId =  
"main_plot", height = "300px")  
))
```

ui.R

```
shinyUI(bootstrapPage(  
  selectInput(inputId = "n_breaks",  
    label = "Number of bins in  
    histogram (approximate):",  
    choices = c(10, 20, 35, 50),  
    selected = 20),  
  
  plotOutput(outputId =  
    "main_plot", height = "300px")  
))
```



server.R

```
shinyServer(function(input, output) {
```

```
})
```

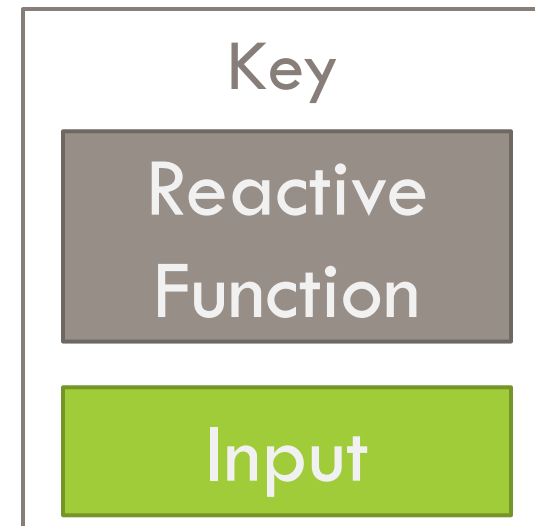
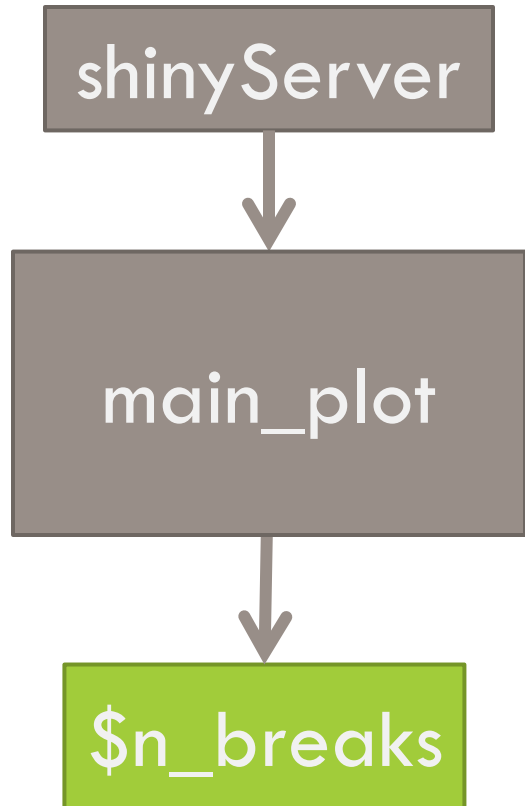

server.R

```
shinyServer(function(input, output) {  
  output$main_plot <- reactivePlot(  
    function() {  
  
    })  
  })  
})
```

server.R

```
shinyServer(function(input, output) {  
  output$main_plot <- reactivePlot(  
    function() {  
      hist(faithful$eruptions,  
           probability = TRUE,  
           breaks = as.numeric(input$n_breaks),  
           xlab = "Duration (minutes)",  
           main = "Geyser eruption duration")  
    })  
})
```

Dependency Graph – Simple





Intermediate Shiny Example

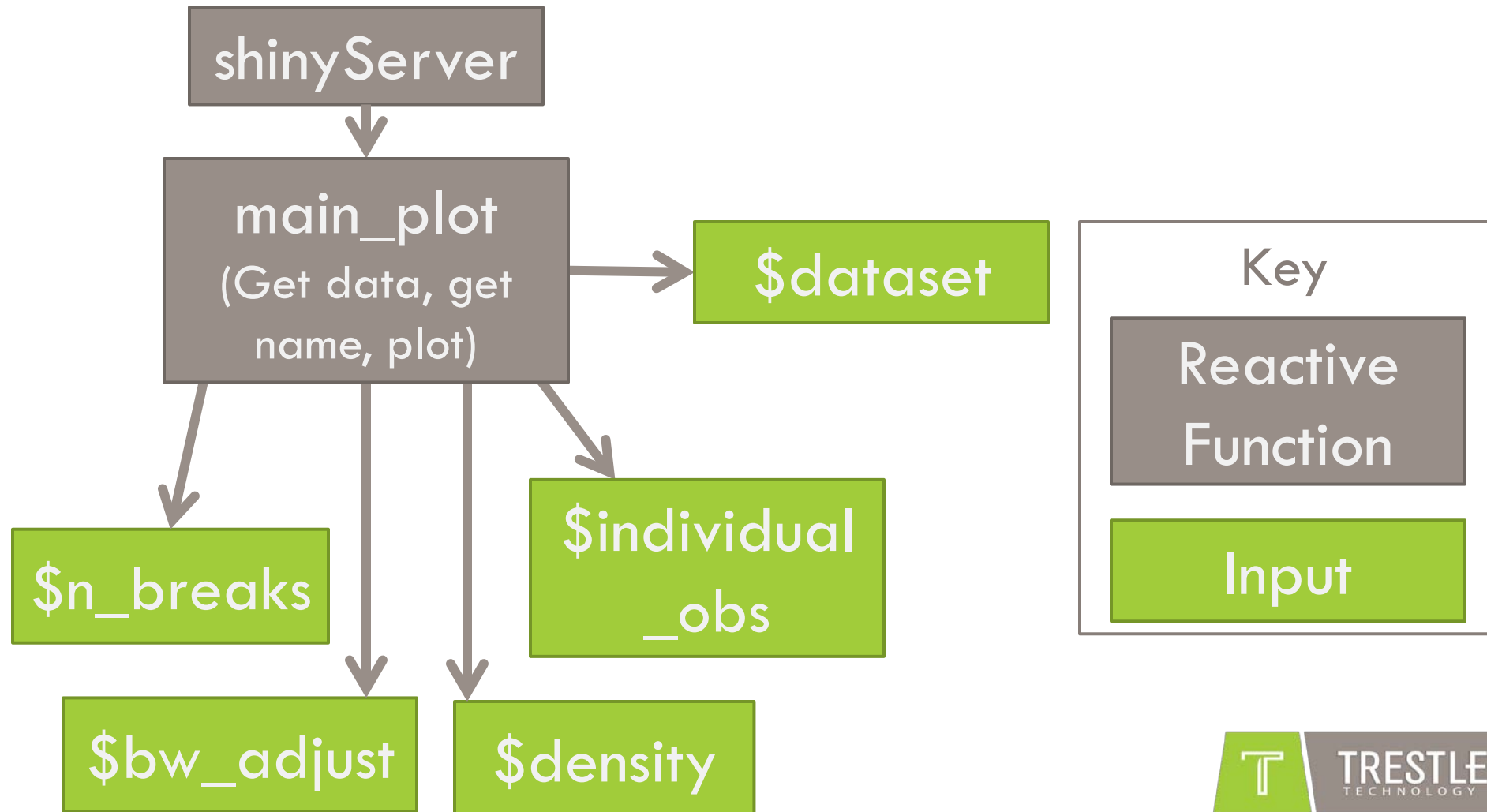
Additional UI Features

<http://trestletechnology.net:3838/naiveGeyeser/>

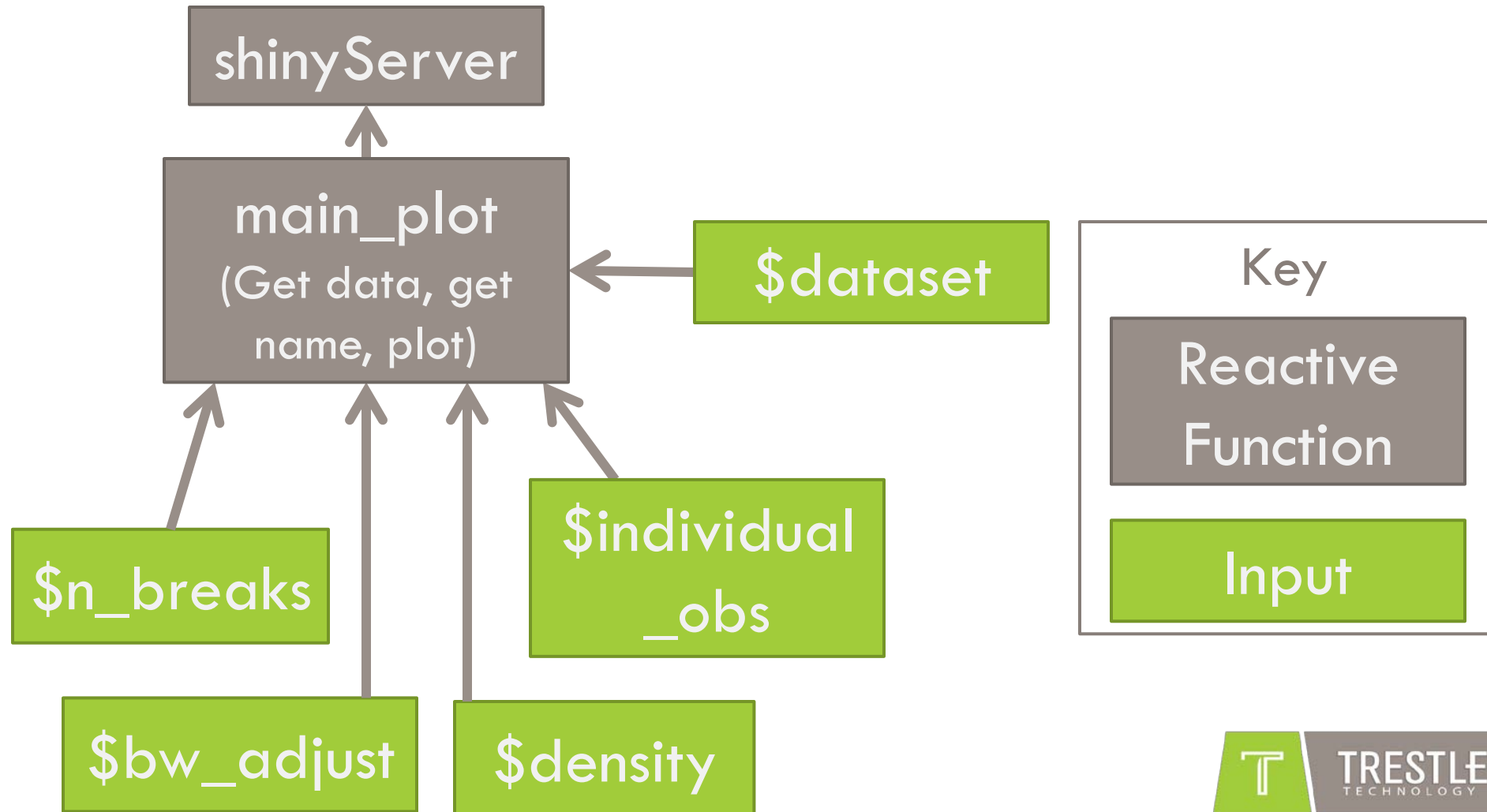
<https://github.com/trestletech/shiny-sandbox/tree/master/naiveGeyeser/>



Dependency Graph – Naïve



“Data Flow”– Naïve





Reactive Shiny Example

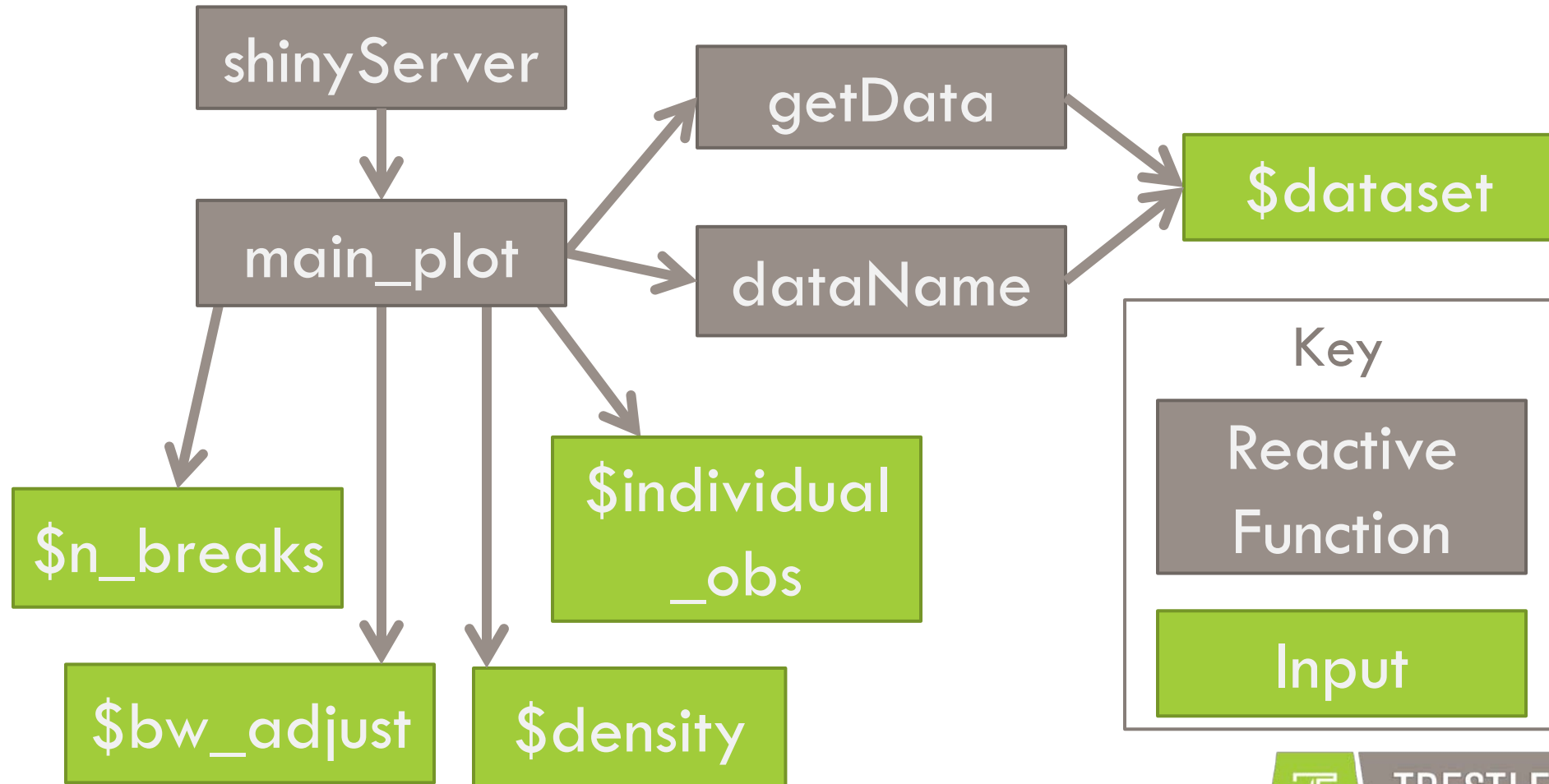
Optimized Reactive Server

<http://trestletechnology.net:3838/reactiveGeyeser/>

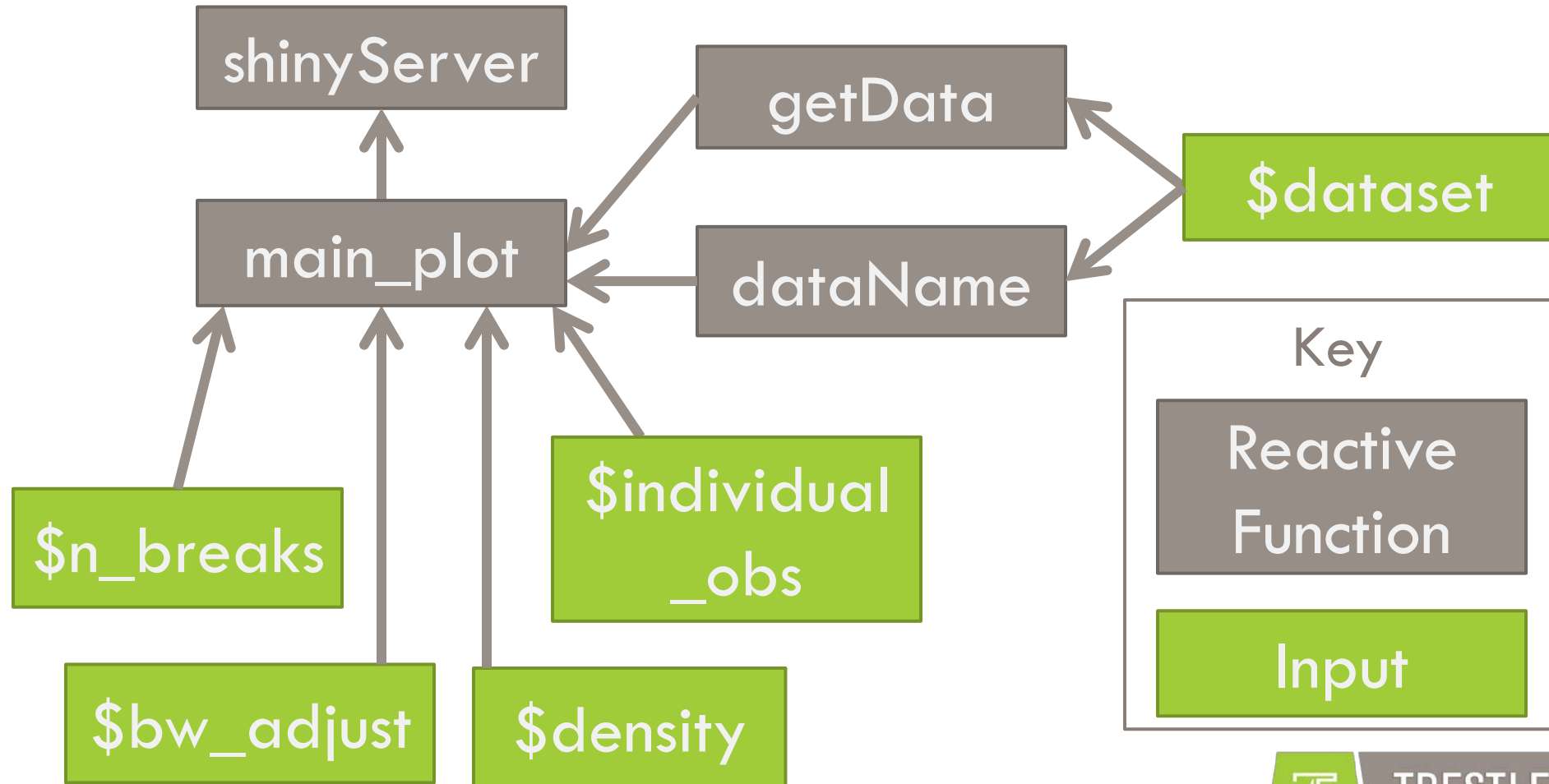
<https://github.com/trestletech/shiny-sandbox/tree/master/reactiveGeyeser/>



Dependency Graph – Reactive



“Data Flow” – Reactive



D3.JS Shiny Example

<http://trestletechnology.net:3838/grn/>

<https://github.com/trestletech/shiny-sandbox/tree/master/grn>



RGL Shiny Example

<http://trestletechnology.net:3838/rgl/>

<https://github.com/trestletech/shiny-sandbox/tree/master/rgl>



Hosting

- RStudio offers “Glimmer”
 - Free (for now) managed hosting platform for Shiny
- RStudio’s Shiny-Server
 - Open sourced 1/22/2013
 - Written in Node.js
 - Same software that powers Glimmer
 - “Some assembly required”
 - Hacks to support older IEs
- Amazon Machine Image on EC2

Questions?

- Code at
 - ▣ <http://github.com/trestletech/shiny-sandbox>
- Slides at
 - ▣ <http://trestletechnology.net/blog/>

Find me on:

