BUILDING INTERACTIVE, R-POWERED WEB APPLICATIONS WITH SHINY

2/9/2013 Jeff Allen, Dallas R Users Group

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

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Overview

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

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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.)

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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

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Reactive Programming

a <- 3

b <- a + 2

a <- 7

b == ?

Imperative: b = 5

Reactive: b = 9

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Reactive Programming Example

Basic Shiny Example

Basic Shiny UI and Server

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

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

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ui.R

shi nyUI (

)

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

```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(

)
```
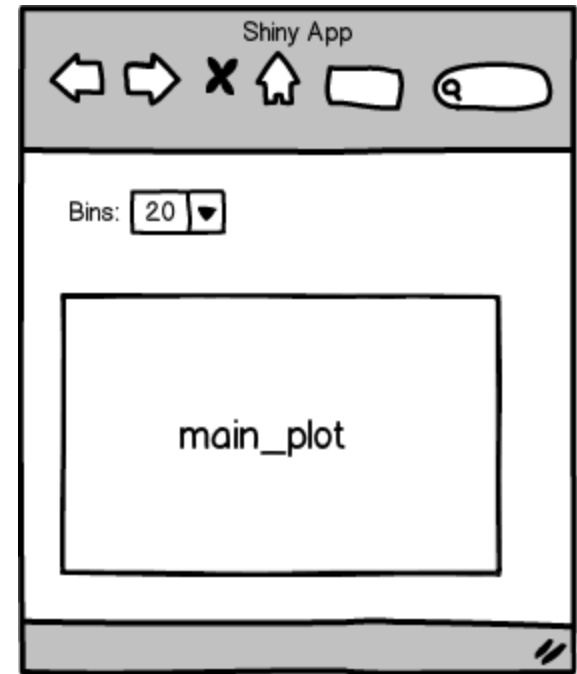
server.R

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




})
```

server.R

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


})
```
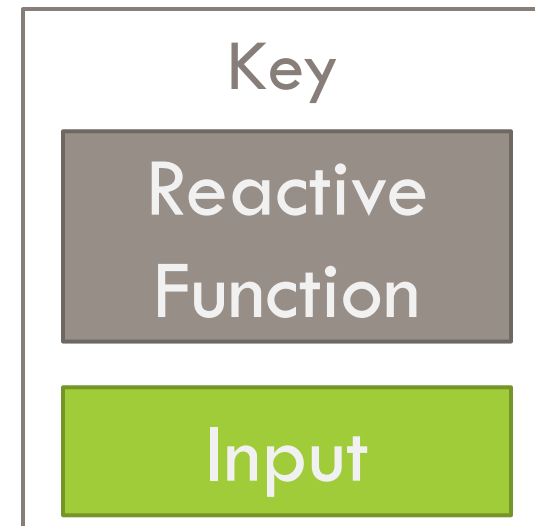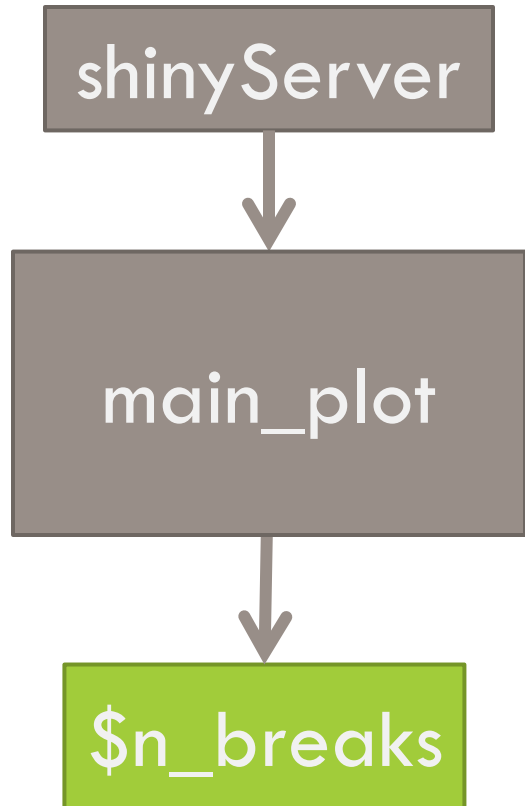
server.R

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



    })
})
```

server.R

```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
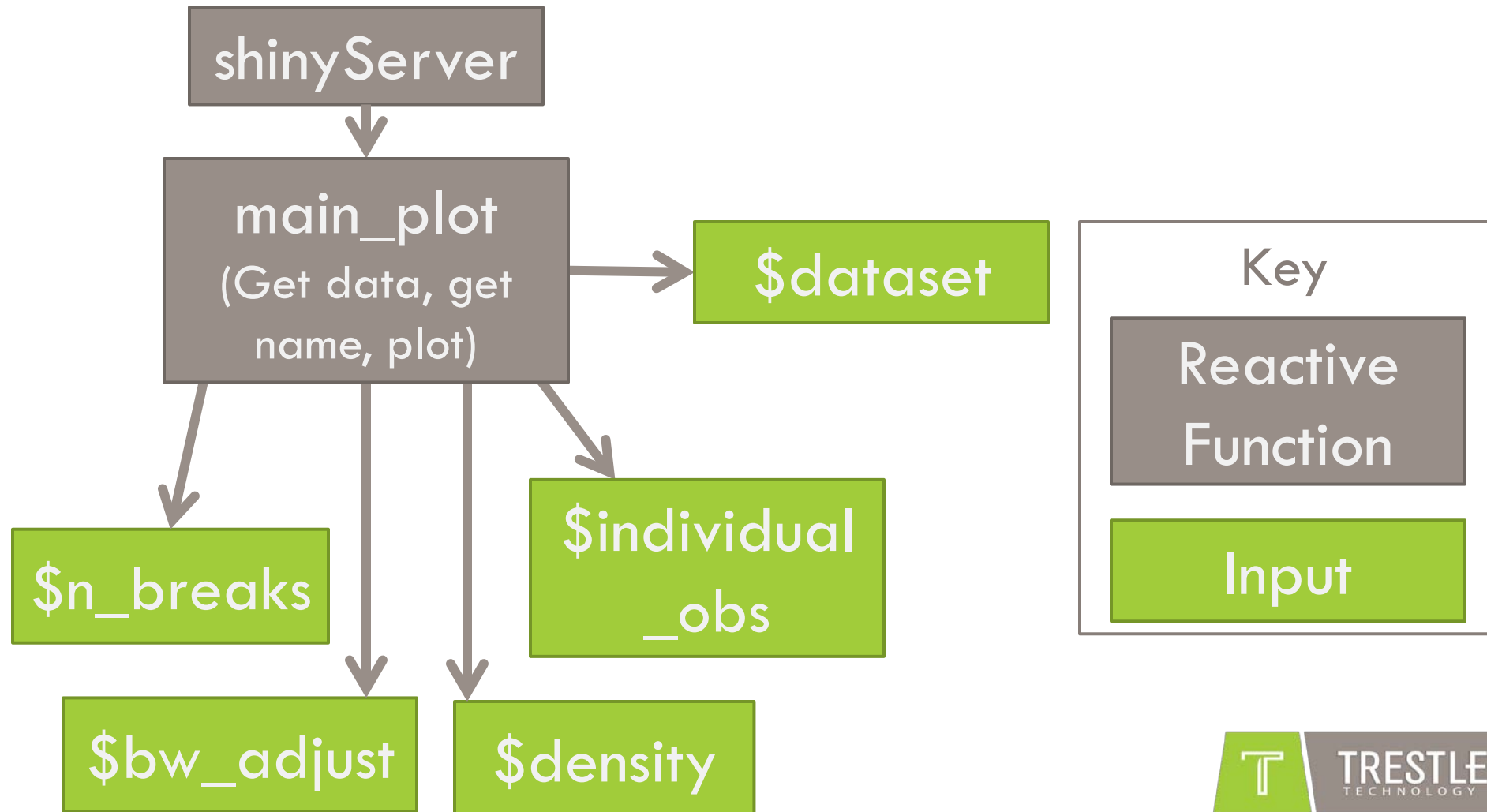
shinyServer

main_plot

$n_breaks

Key

Reactive Function

Input

Intermediate Shiny Example

Additional UI Features

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

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

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Dependency Graph – Naïve

shinyServer

main_plot
(Get data, get name, plot)

$dataset

$n_breaks

$individual_obs

$bw_adjust

$density

Key

Reactive Function

Input

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"Data Flow"– Naïve
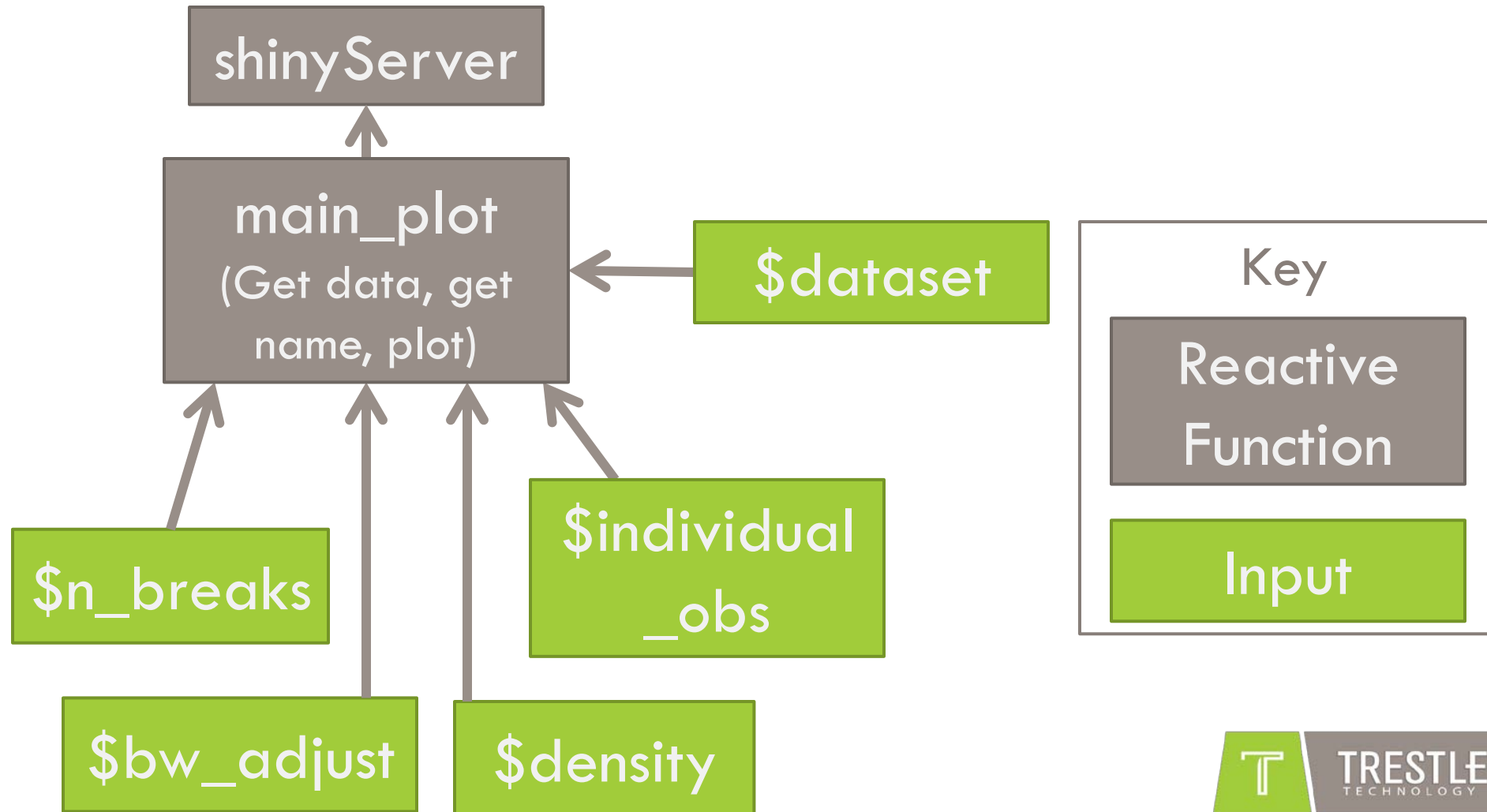
Reactive Shiny Example

Optimized Reactive Server

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

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

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Dependency Graph – Reactive
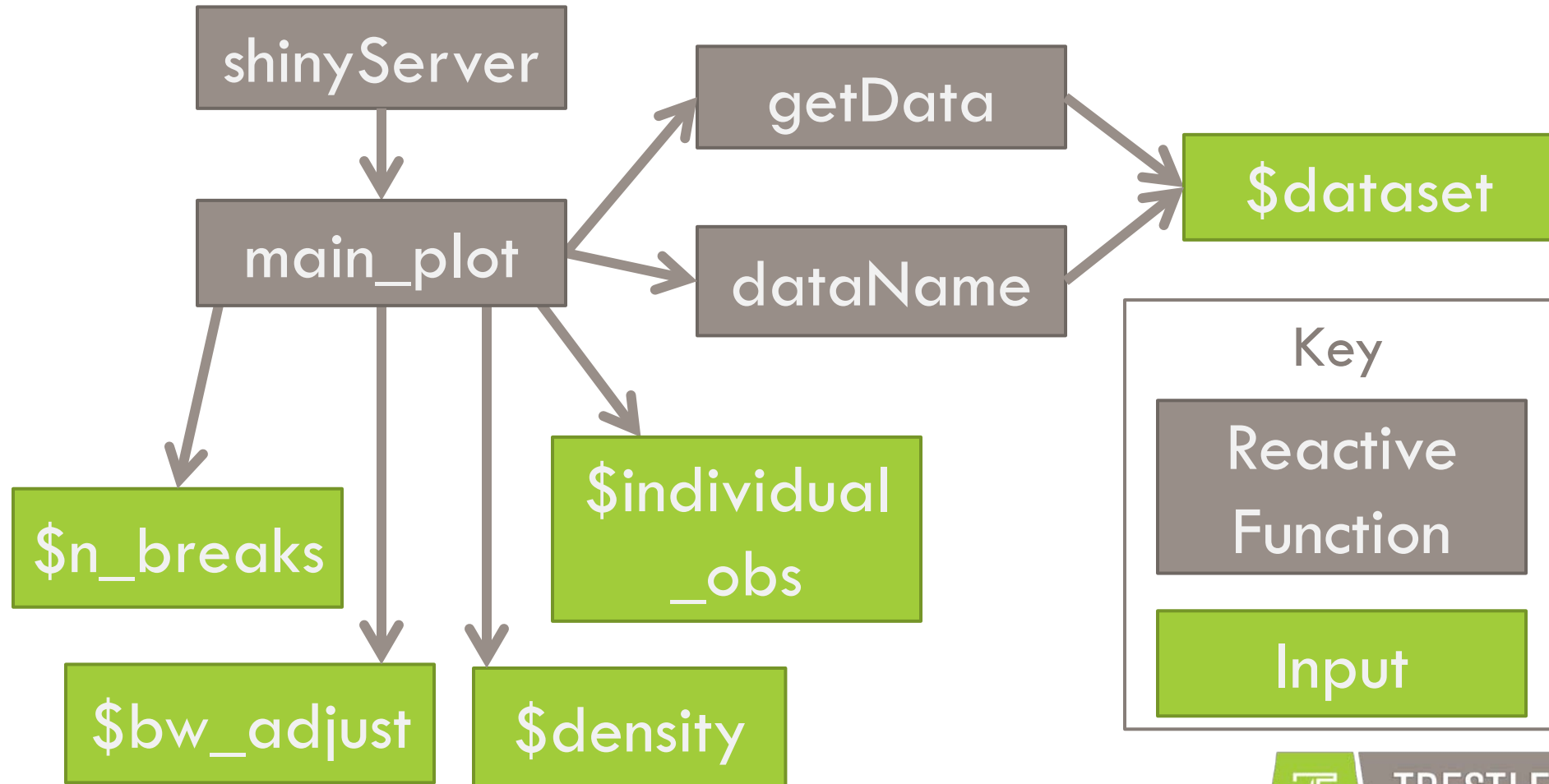
"Data Flow" – Reactive

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
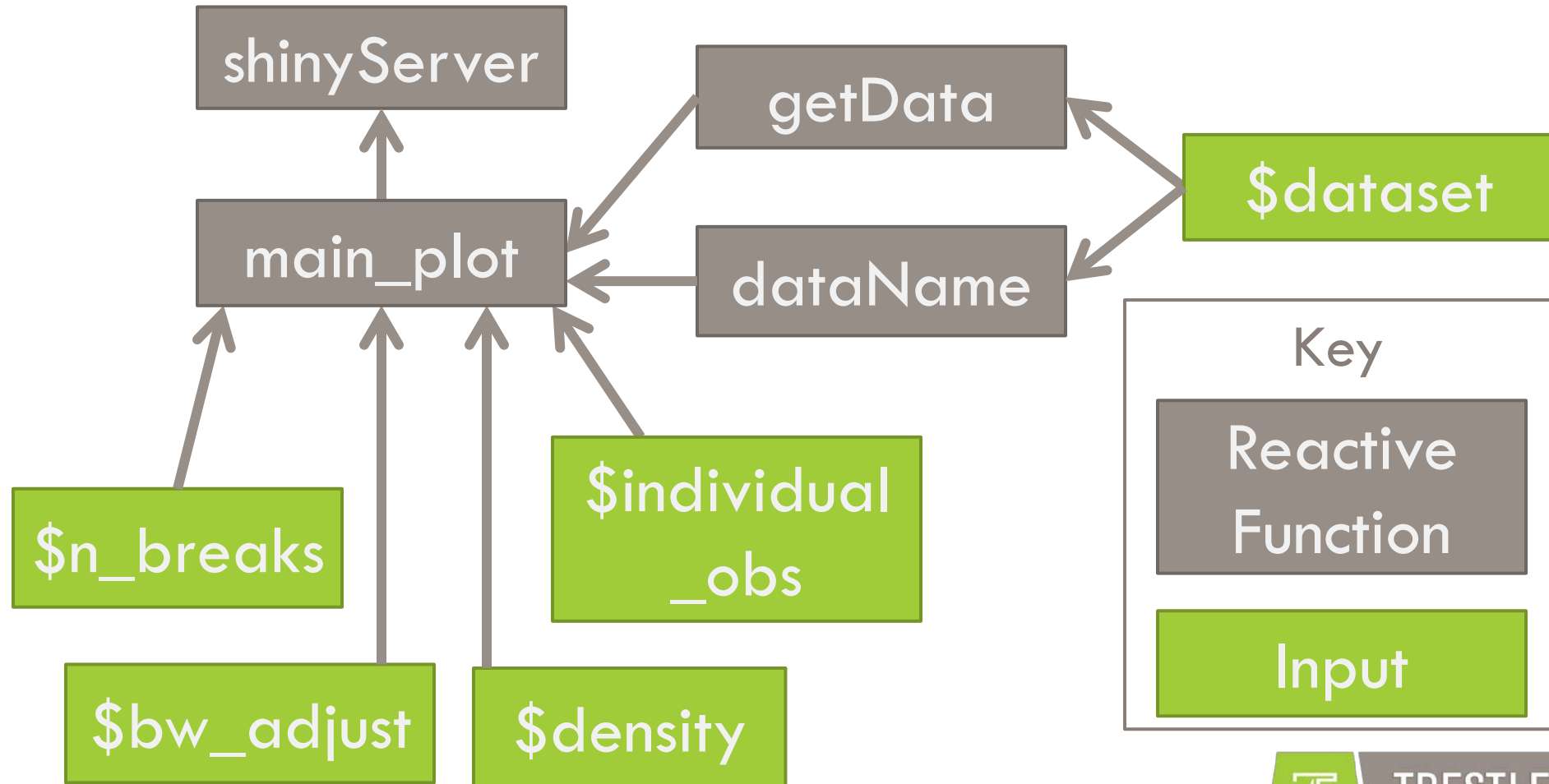
Hosting

- 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: