

# Styling Shiny apps

with Sass and Bootstrap 4

Joe Cheng (@jcheng)  
rstudio::conf

January 29, 2020

# The state of Shiny styling

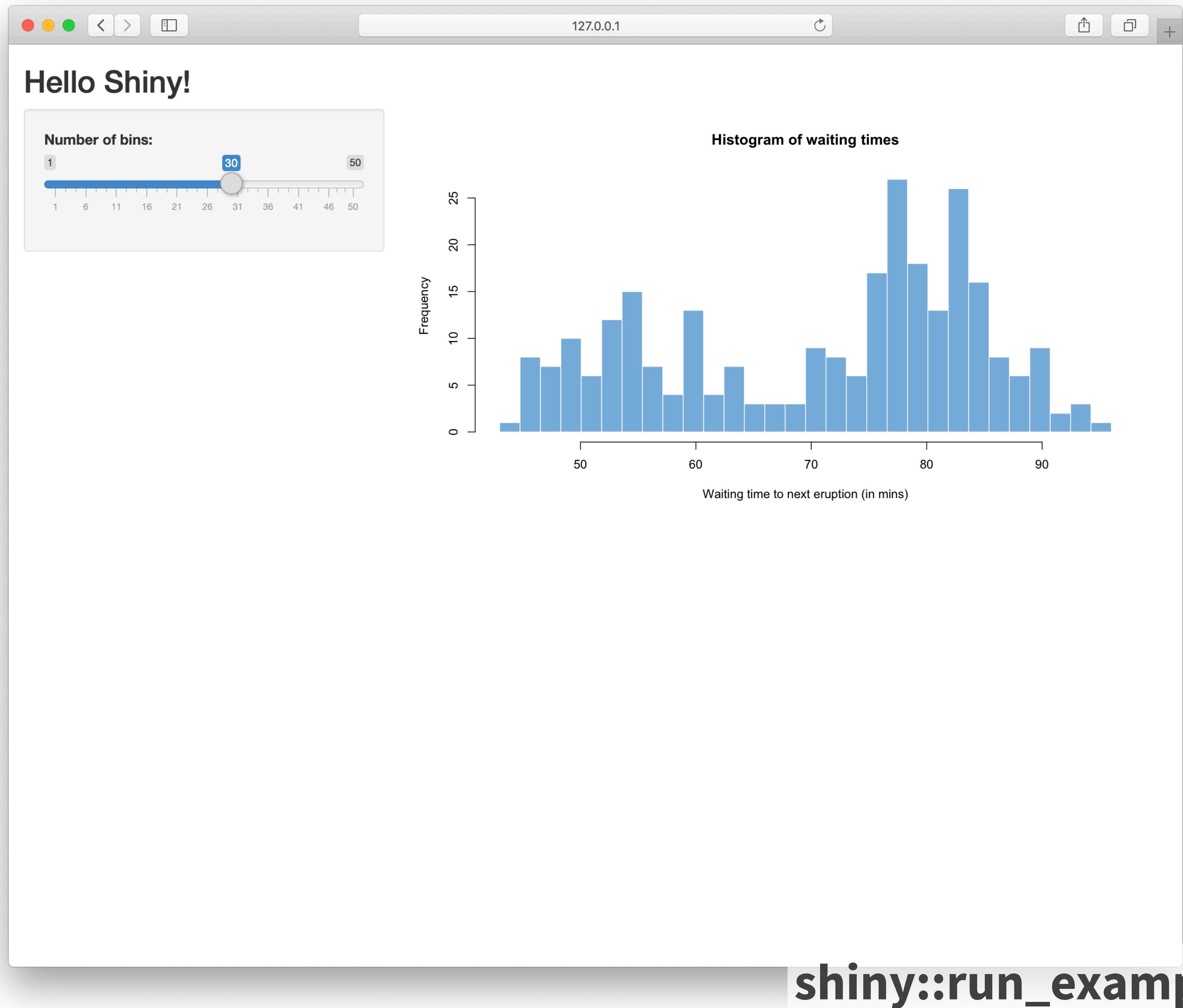
# The state of Shiny styling

The approaches I see people using:

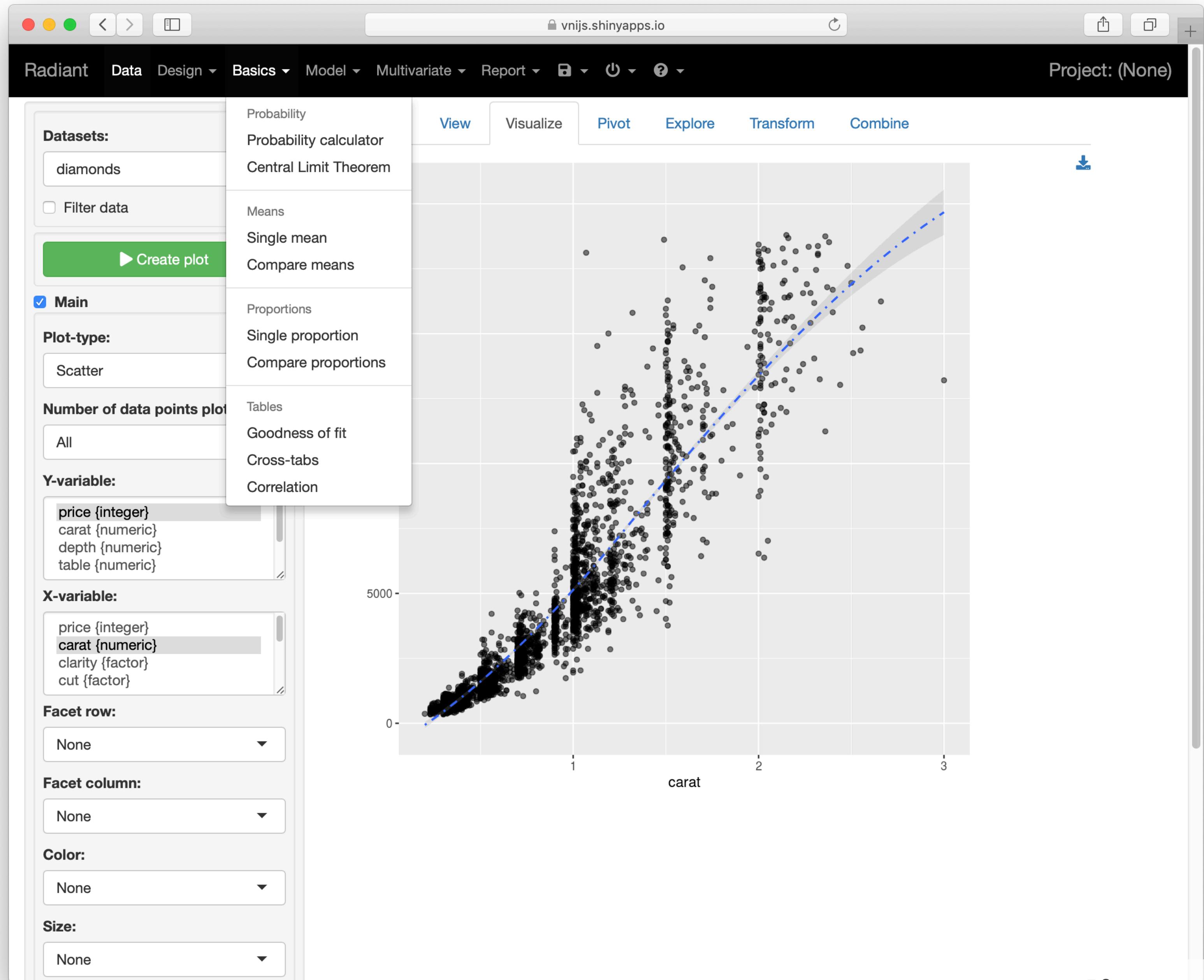
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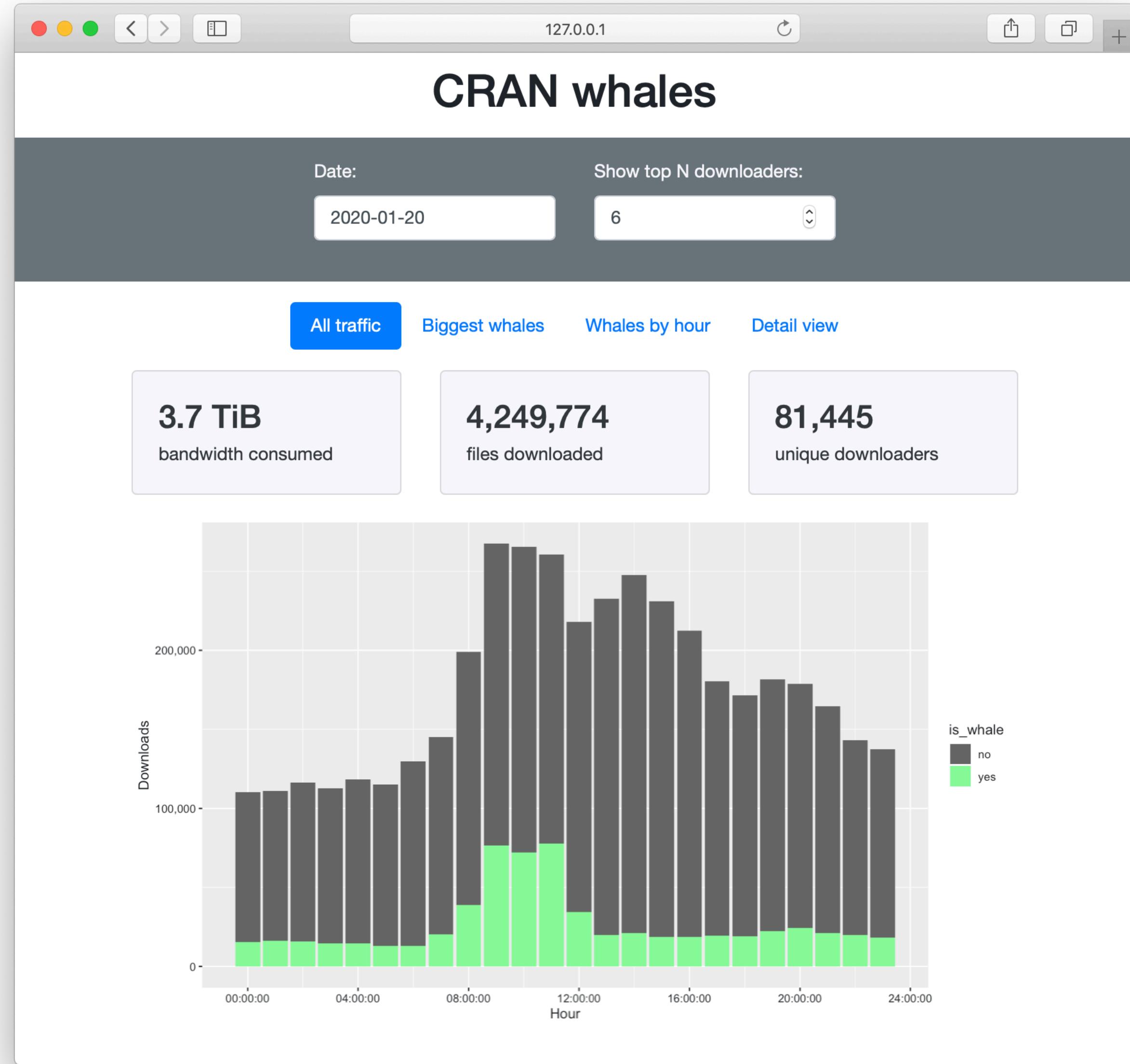
1. **I'm just happy it works:** Just accepts the defaults



**shiny::run\_example("01\_hello")**



Radiant, by Vincent Nijs



<https://github.com/rstudio/cranwhales/tree/bootstraplib>

# Shiny's default UI is powered by Bootstrap

- An open source CSS framework, originally started at Twitter
- Now ubiquitous: top 10 project on GitHub by stars, used by literally millions of websites
- Designed to be easily customized... by web designers

A screenshot of a web browser window displaying a Bootstrap template website. The browser has a dark grey header bar with standard OS X window controls (red, yellow, green, close, minimize, maximize) and a search bar containing the URL 'getbootstrap.com'. The main content area features a large 'Hello, world!' heading at the top. Below it is a brief description: 'This is a template for a simple marketing or informational website. It includes a large callout called a jumbotron and three supporting pieces of content. Use it as a starting point to create something more unique.' A blue button labeled 'Learn more »' is positioned below the description. The main content area is divided into three columns, each containing a 'Heading' section with placeholder text and a 'View details »' button.

Navbar Home Link Disabled Dropdown ▾

Search Search

# Hello, world!

This is a template for a simple marketing or informational website. It includes a large callout called a jumbotron and three supporting pieces of content. Use it as a starting point to create something more unique.

[Learn more »](#)

## Heading

Donec id elit non mi porta gravida at eget metus. Fusce dapibus, tellus ac cursus commodo, tortor mauris condimentum nibh, ut fermentum massa justo sit amet risus. Etiam porta sem malesuada magna mollis euismod. Donec sed odio dui.

[View details »](#)

## Heading

Donec id elit non mi porta gravida at eget metus. Fusce dapibus, tellus ac cursus commodo, tortor mauris condimentum nibh, ut fermentum massa justo sit amet risus. Etiam porta sem malesuada magna mollis euismod. Donec sed odio dui.

[View details »](#)

## Heading

Donec sed odio dui. Cras justo odio, dapibus ac facilisis in, egestas eget quam. Vestibulum id ligula porta felis euismod semper. Fusce dapibus, tellus ac cursus commodo, tortor mauris condimentum nibh, ut fermentum massa justo sit amet risus.

[View details »](#)

© Company 2017-2019

A screenshot of a web browser window displaying a website template from getbootstrap.com. The browser has a standard OS X interface with red, yellow, and green window control buttons. The address bar shows the URL 'getbootstrap.com'. The page content includes a navigation bar with links to Home (current), Link, Disabled, and Dropdown, along with Action, Another action, and Something else here. Below the navbar is a search bar with a placeholder 'Search' and a button labeled 'Search'. A large heading 'Hello, world!' is displayed in bold black font. A descriptive text block follows, stating: 'This is a template for a simple marketing or informational website. It includes a large callout called ajumbotron and three supporting pieces of content. Use it as a starting point to create something more unique.' A 'Learn more »' link is provided. Three identical content blocks are shown, each featuring a heading 'Heading' and a paragraph of placeholder text: 'Donec id elit non mi porta gravida at eget metus. Fusce dapibus, tellus ac cursus commodo, tortor mauris condimentum nibh, ut fermentum massa justo sit amet risus. Etiam porta sem malesuada magna mollis euismod. Donec sed odio dui.' Each block also includes a 'View details »' link. At the bottom of the page is a copyright notice: '© Company 2017-2019'.

[Navbar](#)

- [Home \(current\)](#)
- [Link](#)
- [Disabled](#)
- [Dropdown](#)

[Action](#) [Another action](#) [Something else here](#)

Search

# Hello, world!

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[Learn more »](#)

## Heading

Donec id elit non mi porta gravida at eget metus. Fusce dapibus, tellus ac cursus commodo, tortor mauris condimentum nibh, ut fermentum massa justo sit amet risus. Etiam porta sem malesuada magna mollis euismod. Donec sed odio dui.

[View details »](#)

## Heading

Donec id elit non mi porta gravida at eget metus. Fusce dapibus, tellus ac cursus commodo, tortor mauris condimentum nibh, ut fermentum massa justo sit amet risus. Etiam porta sem malesuada magna mollis euismod. Donec sed odio dui.

[View details »](#)

## Heading

Donec sed odio dui. Cras justo odio, dapibus ac facilisis in, egestas eget quam. Vestibulum id ligula porta felis euismod semper. Fusce dapibus, tellus ac cursus commodo, tortor mauris condimentum nibh, ut fermentum massa justo sit amet risus.

[View details »](#)

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# The state of Shiny styling

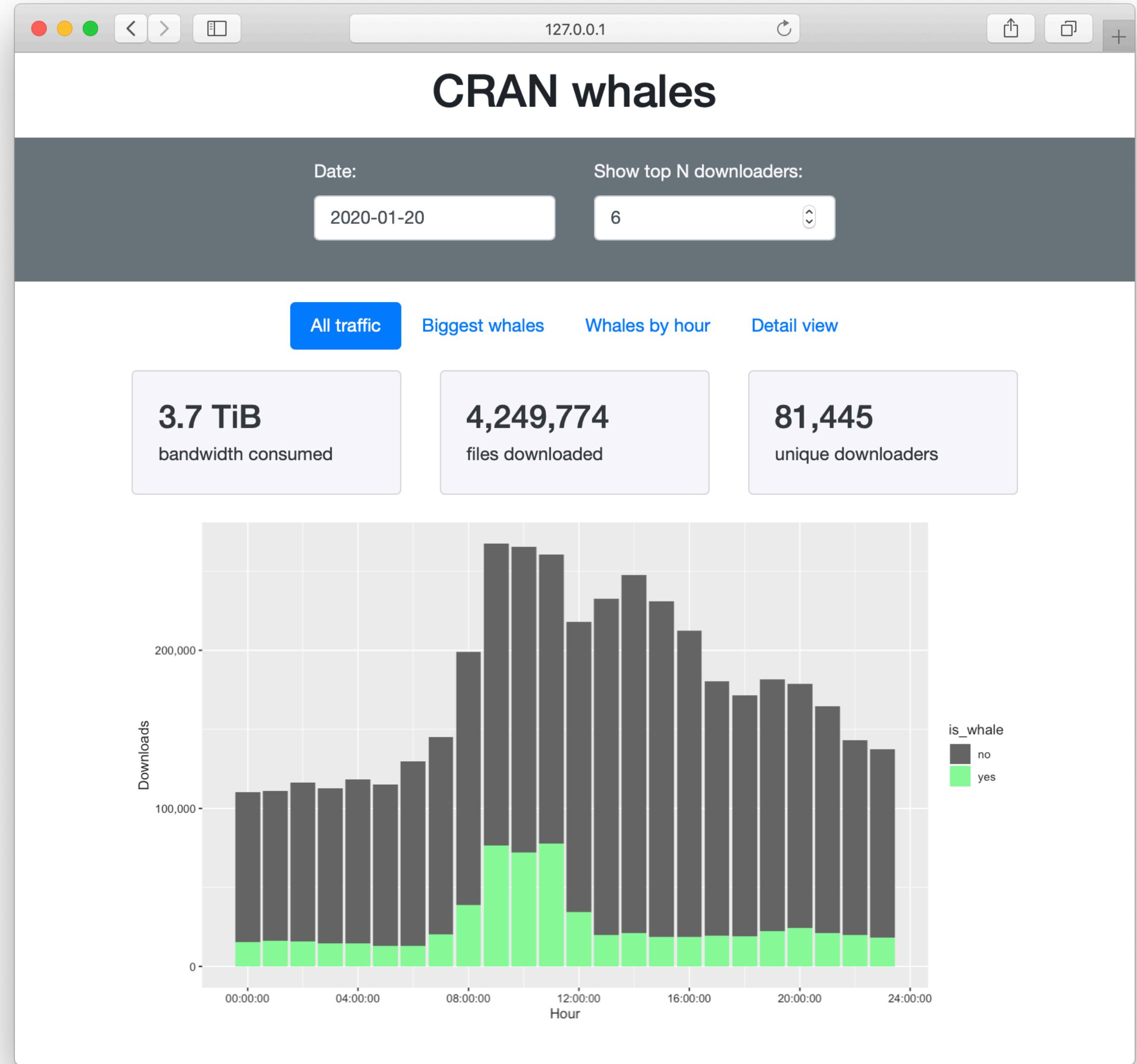
The approaches I see people using:

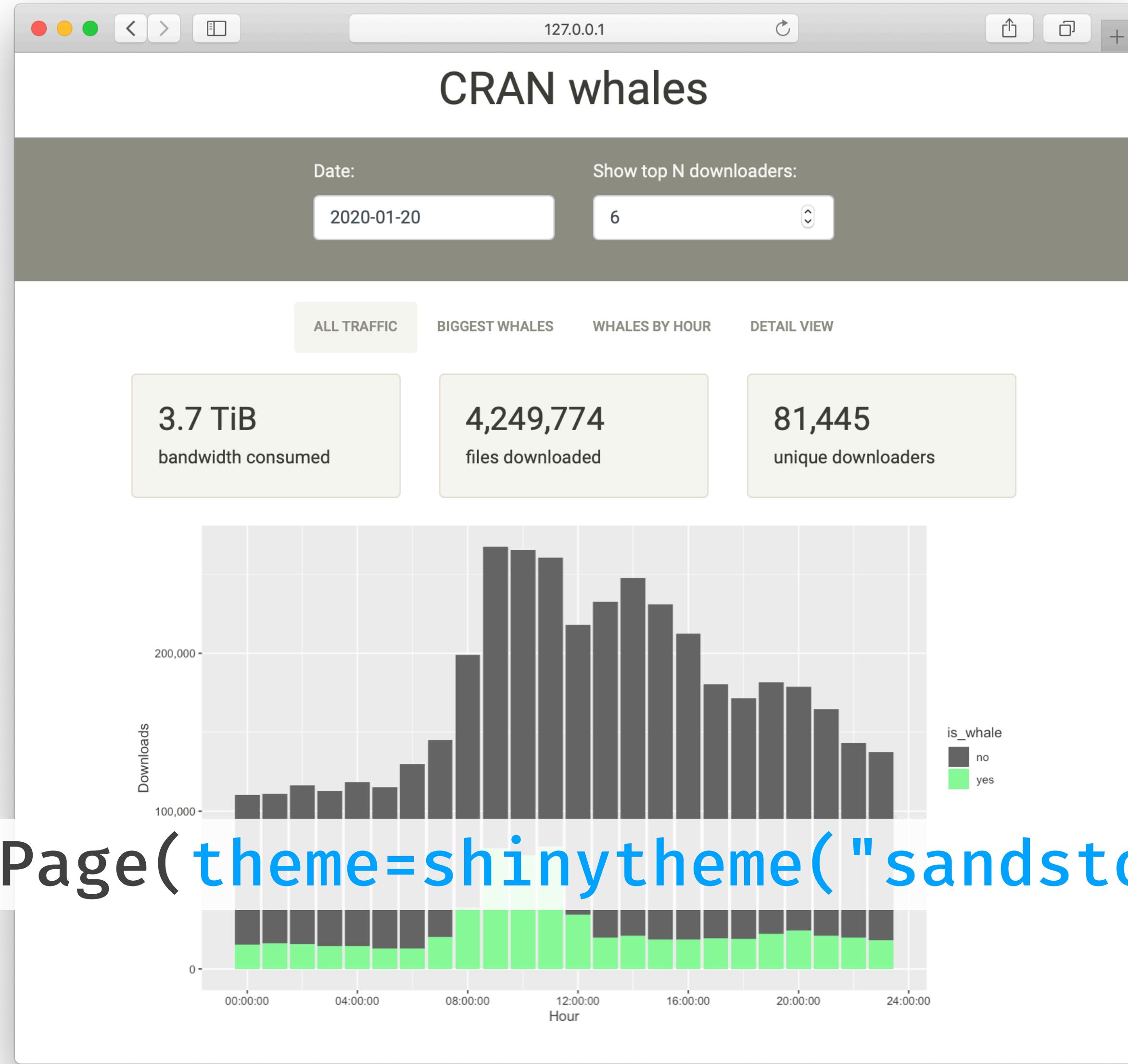
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# The state of Shiny styling

The approaches I see people using:

1. **I'm just happy it works:** Just accepts the defaults
2. **I want it punched up a bit:** Uses shinythemes





The screenshot displays the Bootswatch website interface, featuring a grid of six theme cards. Each card includes a preview of the theme, its name, a description, and download options.

- Cerulean**: A calm blue sky. Includes a color palette bar with Primary (blue), Secondary (light gray), Success (green), Info (dark blue), Warning (orange), and Danger (red). Buttons for PREVIEW and DOWNLOAD.
- Cosmo**: An ode to Metro. Includes a color palette bar with Primary (blue), Secondary (gray), Success (green), Info (purple), Warning (orange), and Danger (red). Buttons for PREVIEW and DOWNLOAD.
- Cyborg**: Jet black and electric blue. Includes a color palette bar with Primary (blue), Secondary (black), Success (green), Info (purple), Warning (orange), and Danger (red). Buttons for PREVIEW and DOWNLOAD.
- Darkly**: Flatly in night mode. Includes a color palette bar with Primary (blue), Secondary (gray), Success (green), Info (dark blue), Warning (orange), and Danger (red). Buttons for PREVIEW and DOWNLOAD.
- Flatly**: Flat and modern. Includes a color palette bar with Primary (dark blue), Secondary (gray), Success (green), Info (blue), Warning (orange), and Danger (red). Buttons for PREVIEW and DOWNLOAD.
- Journal**: Crisp like a new sheet of paper. Includes a color palette bar with Primary (red), Secondary (gray), Success (green), Info (blue), Warning (yellow), and Danger (red). Buttons for PREVIEW and DOWNLOAD.

# The state of Shiny styling

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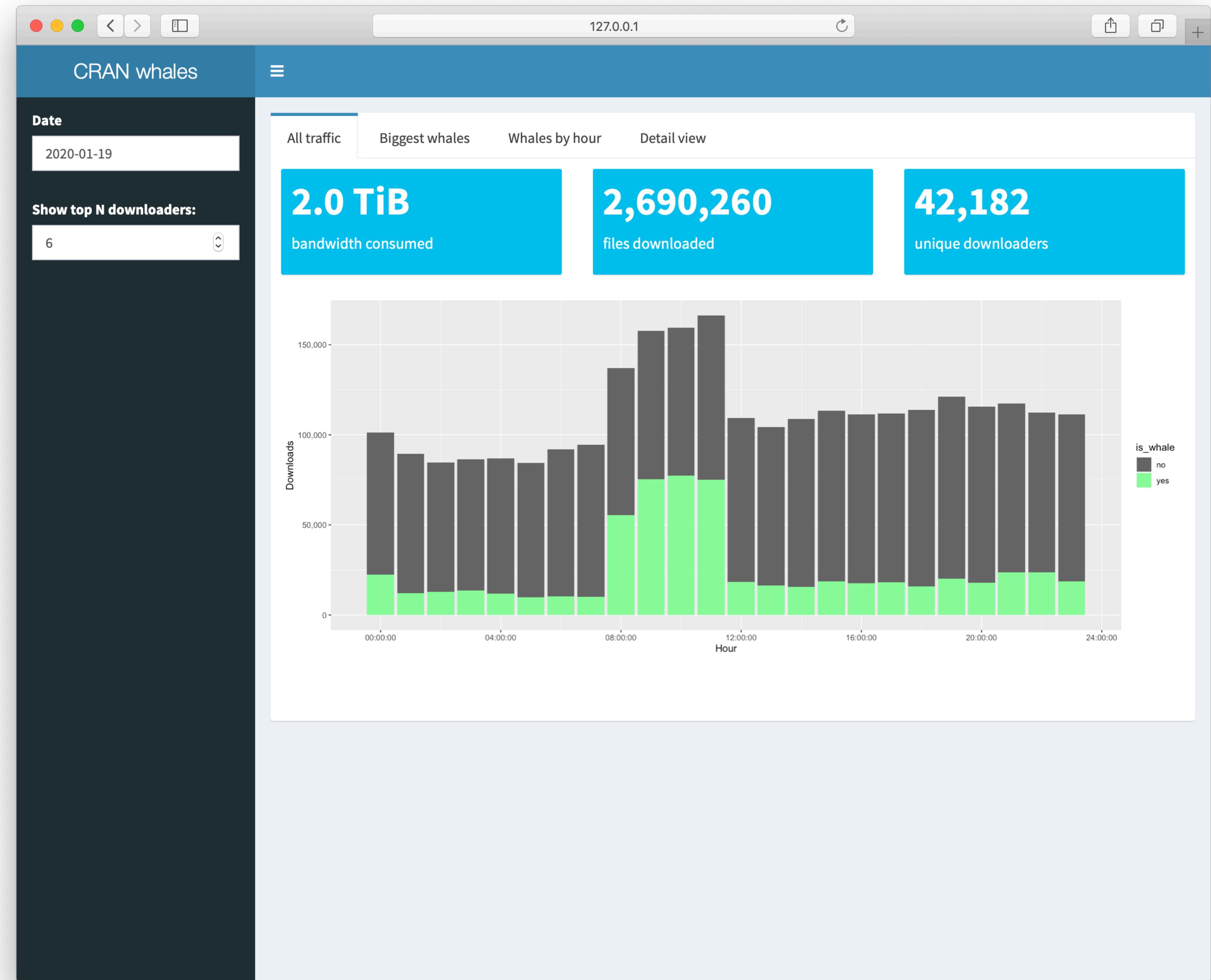
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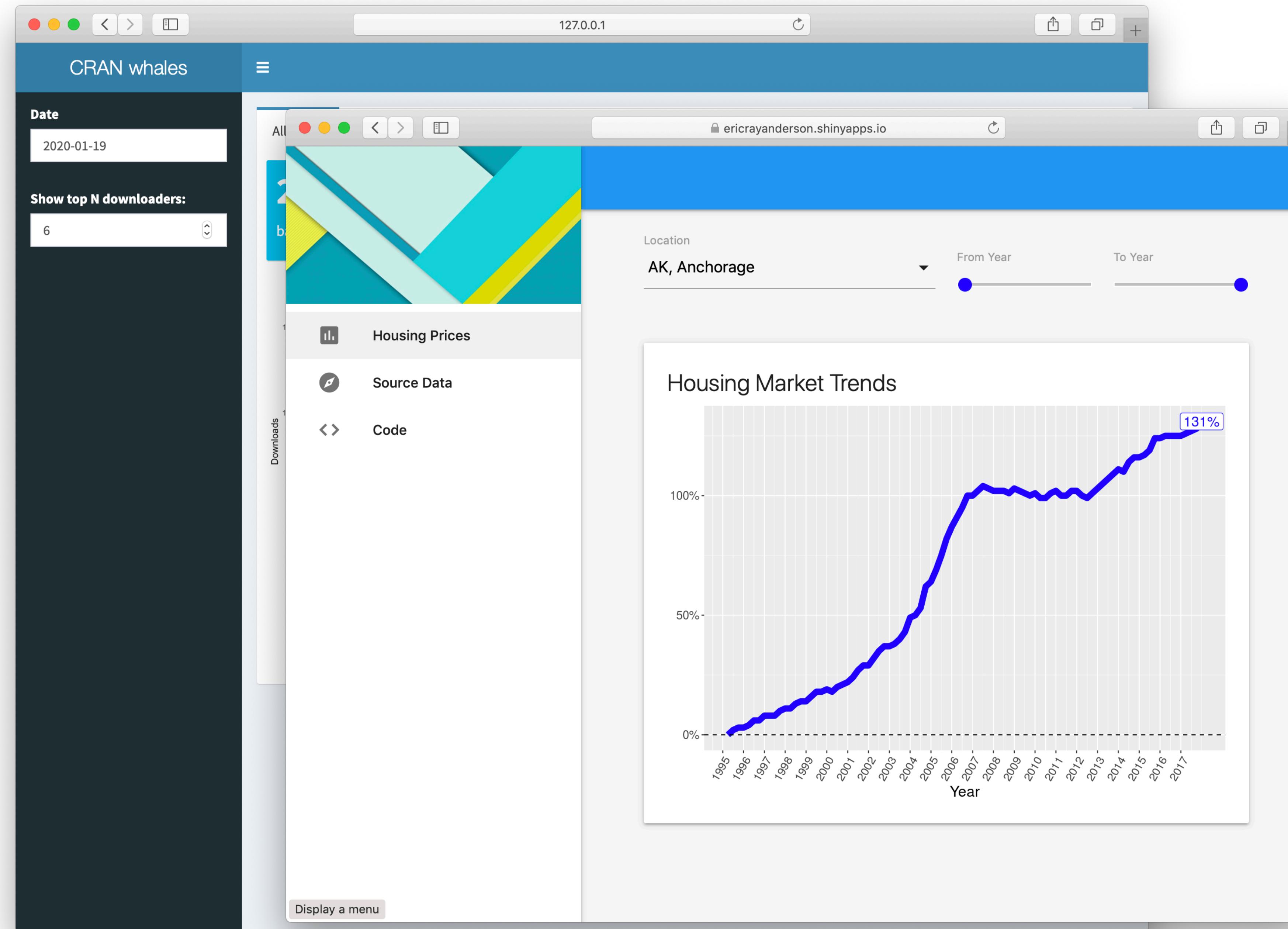
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The approaches I see people using:

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3. **I want it to look a lot different:** Uses alternate Shiny UI toolkit like shinydashboard, shinymaterial, Rinterface







**CRAN whales**

Date: 2020-01-19

Show top N downloaders: 6

**Downloads**

- Housing Prices
- Source Data
- Code

Display a menu

**argon**

**MAIN MENU**

- Cards
- Tabs
- Alerts
- Images
- Badges
- Progress
- Profile
- CSS effects
- Sections

**OTHER ITEMS**

Display a menu

**Dropdown Menu**

**ARGON CARD**

This is the content

**More**

**TRAFFIC**  
350,897  
↑ 3.48%  
Since last month

**NEW USERS**  
2,356  
↓ -3.48%  
Since last week

**SALES**  
924  
↓ -1.1%  
Since yesterday

**PERFORMANCE**  
49,65%  
↑ 12%  
Since last month

@Divad Nojnarg, 2018  
RinteRface argon

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4. **I want specific fonts/colors/styles:** Writes lots of custom CSS to modify Bootstrap

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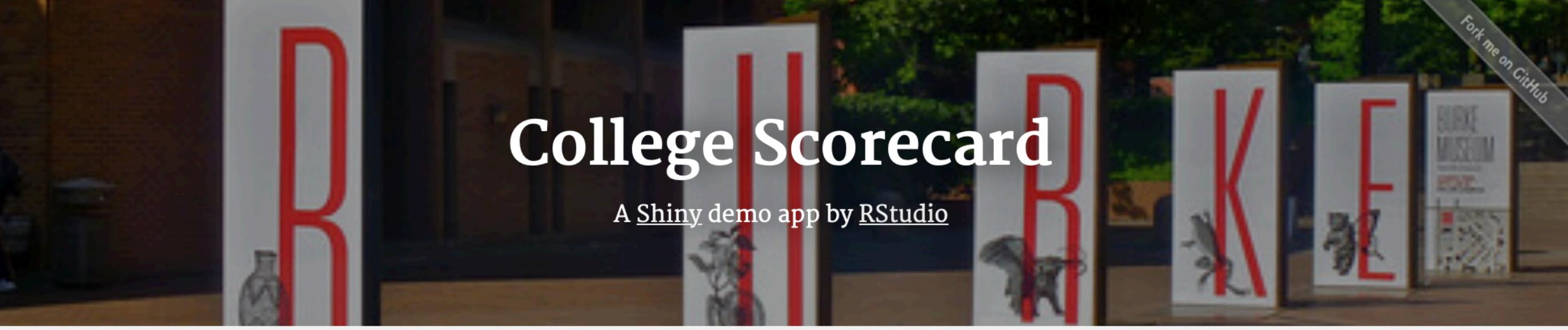
**Shouldn't this  
be easier?**



# The state of Shiny styling

The approaches I see people using:

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4. **I want specific fonts/colors/styles:** Writes lots of custom CSS to modify Bootstrap
5. **Native HTML:** Writes custom HTML/CSS using HTML template

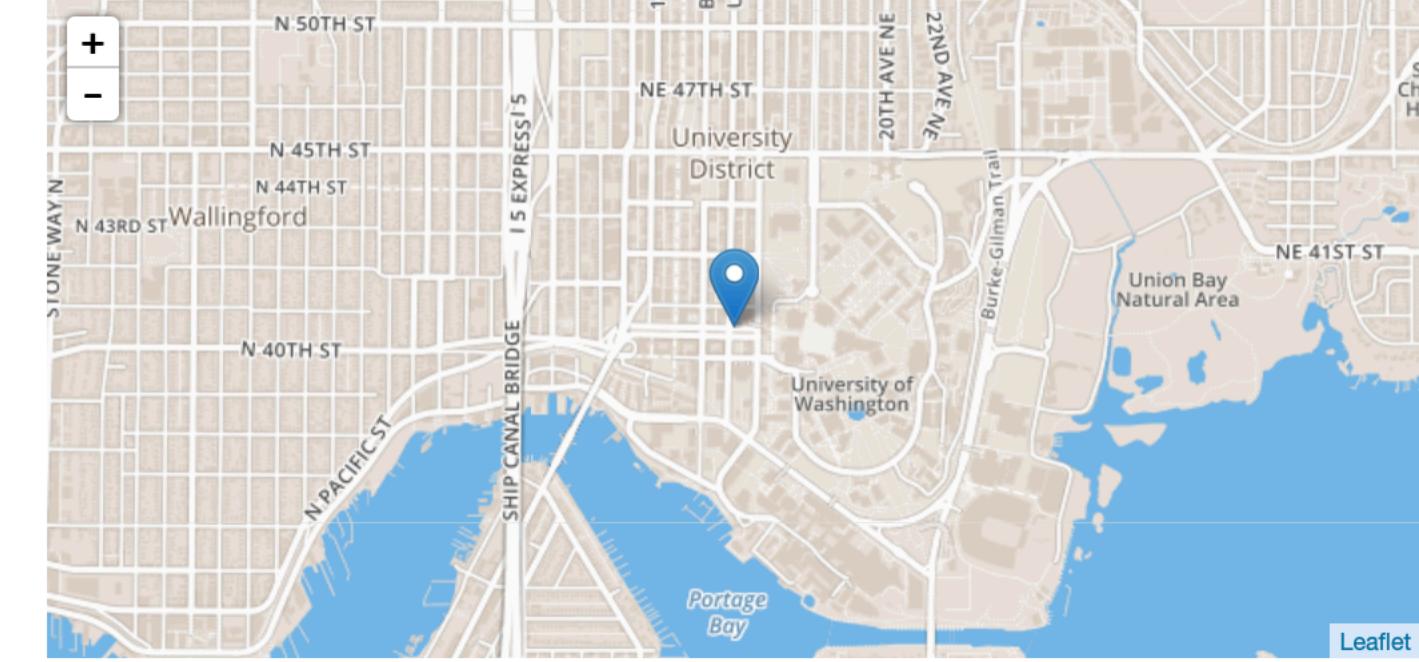
A Shiny demo app by RStudio

College or city, e.g. Stanford or Boston

## University of Washington–Seattle Campus

Seattle, WA  
28,754 undergraduate students  
[www.washington.edu](http://www.washington.edu)





**AVERAGE ANNUAL COST**  
**\$11,904**  
NATIONAL AVERAGE: \$15,628.42

**ADMISSION RATE**  
**55.23%**  
NATIONAL AVERAGE: 68.24%

**SALARY AFTER ATTENDING**  
**\$52,100**  
NATIONAL AVERAGE: \$33,137.77

### Average annual cost, by family income

Income	Cost
\$0 to \$30,000	\$6,220
\$30,001 to \$48,000	\$6,639
\$48,001 to \$75,000	\$9,161
\$75,001 to \$110,000	\$18,199

### Average annual cost, over time



Year	Cost
2010	\$13,963
2011	\$12,880
2012	\$12,255
2013	\$12,462
2014	\$11,904

“How can I get my Shiny app to match  
the official fonts and colors of my  
company?”

*-So many people*

“How can I get my Shiny app to match  
the official fonts and colors of my  
client?”

*-So many people*

“How can I get my Shiny app to match  
the official fonts and colors of my  
university?”

*-So many people*

“How can I get my Shiny app to match  
the official fonts and colors of my  
fantasy baseball league?”

*-So many people*

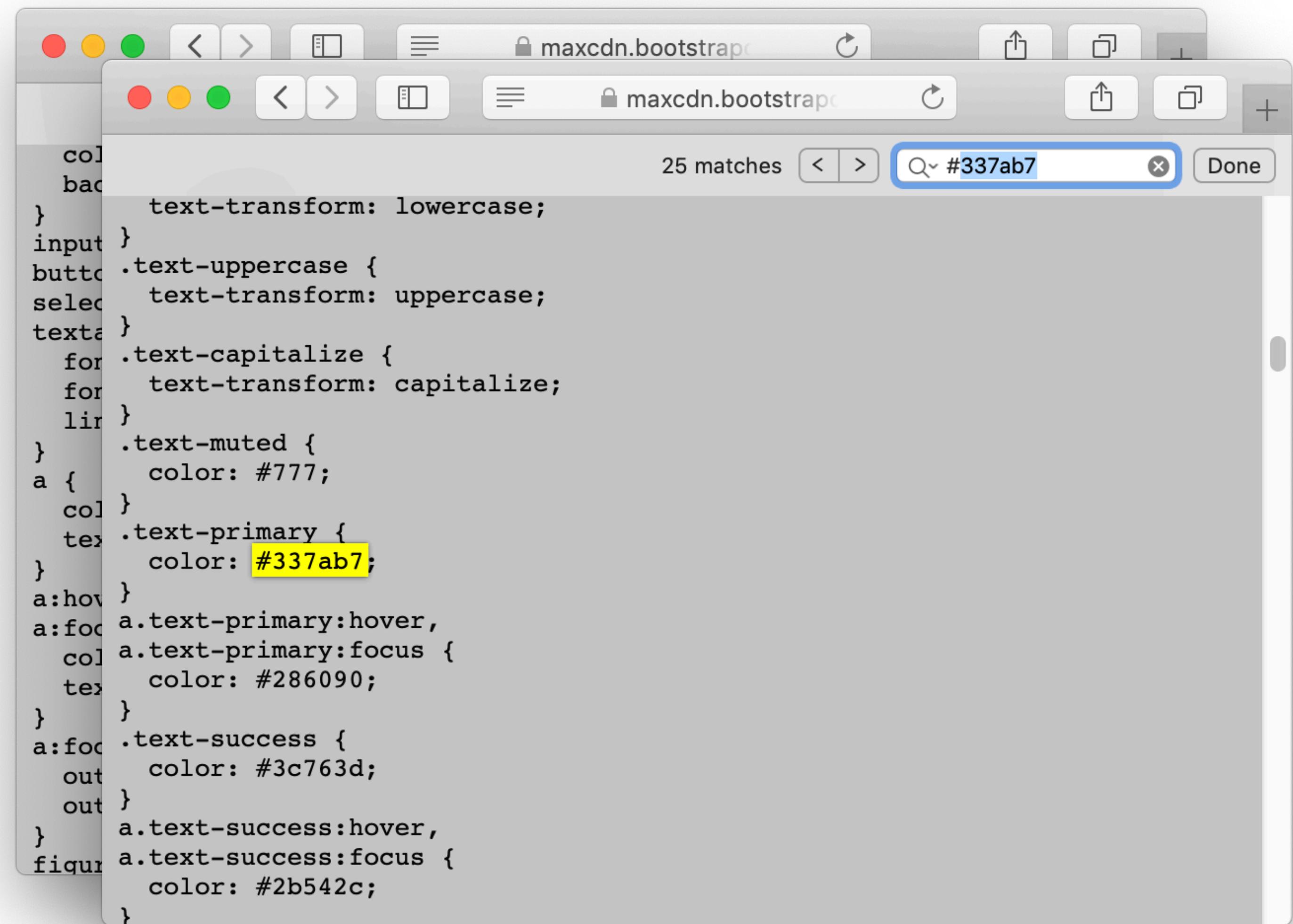
# Changing colors in CSS is surprisingly hard

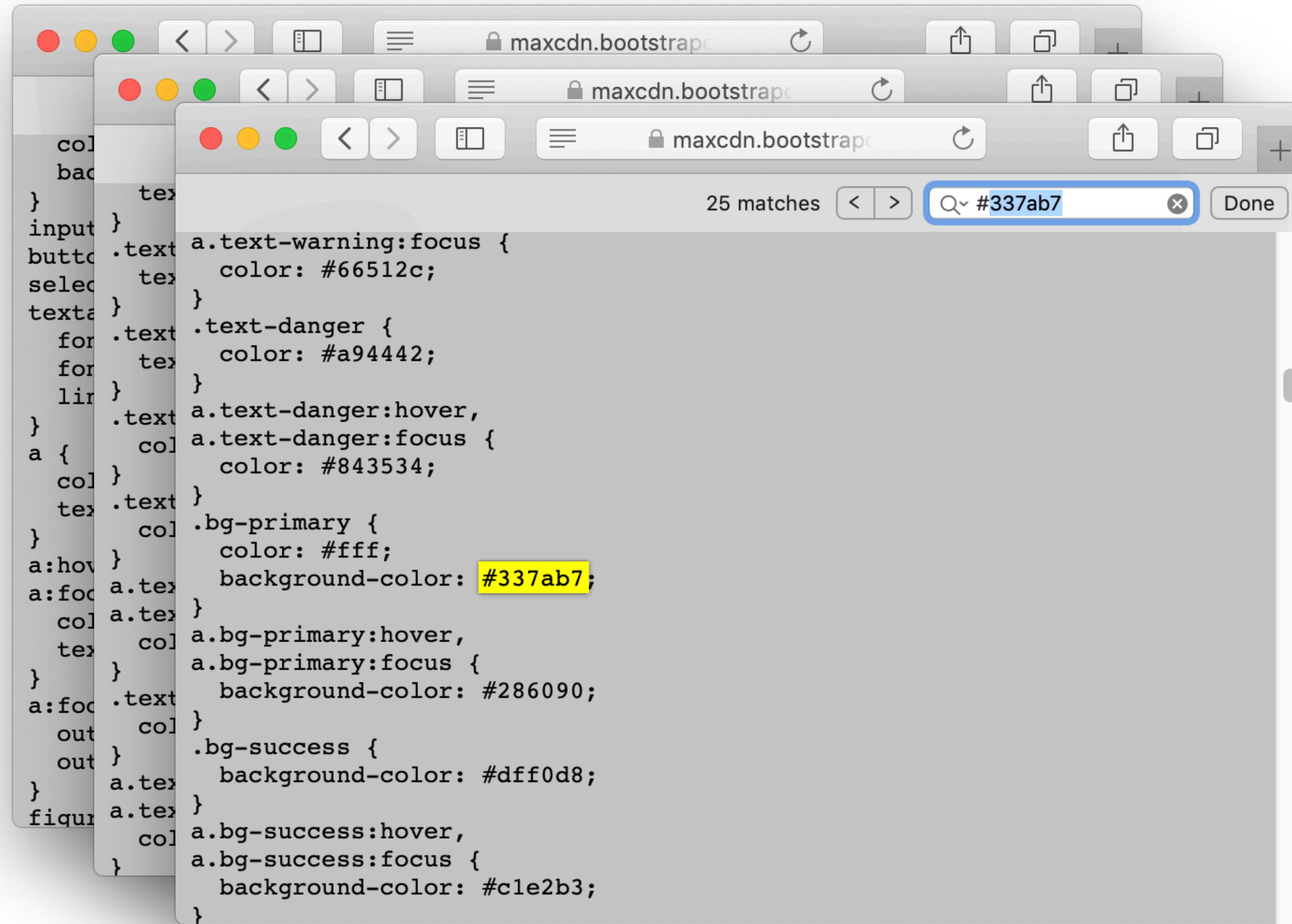
- Each color value appears in dozens of places in bootstrap.css
- For robust color changing, *each* instance must be overridden with a CSS rule

bootstrap.css

A screenshot of a web browser window displaying a block of CSS code. The browser has a light gray header bar with standard OS X-style controls (red, yellow, green buttons, back/forward arrows, etc.). The address bar shows the URL "maxcdn.bootstrapcdn.com". Below the address bar is a search bar containing the text "#337ab7" with a magnifying glass icon, which is highlighted with a blue border. To the right of the search bar are buttons for "Done" and other search-related functions. The main content area contains the following CSS code:

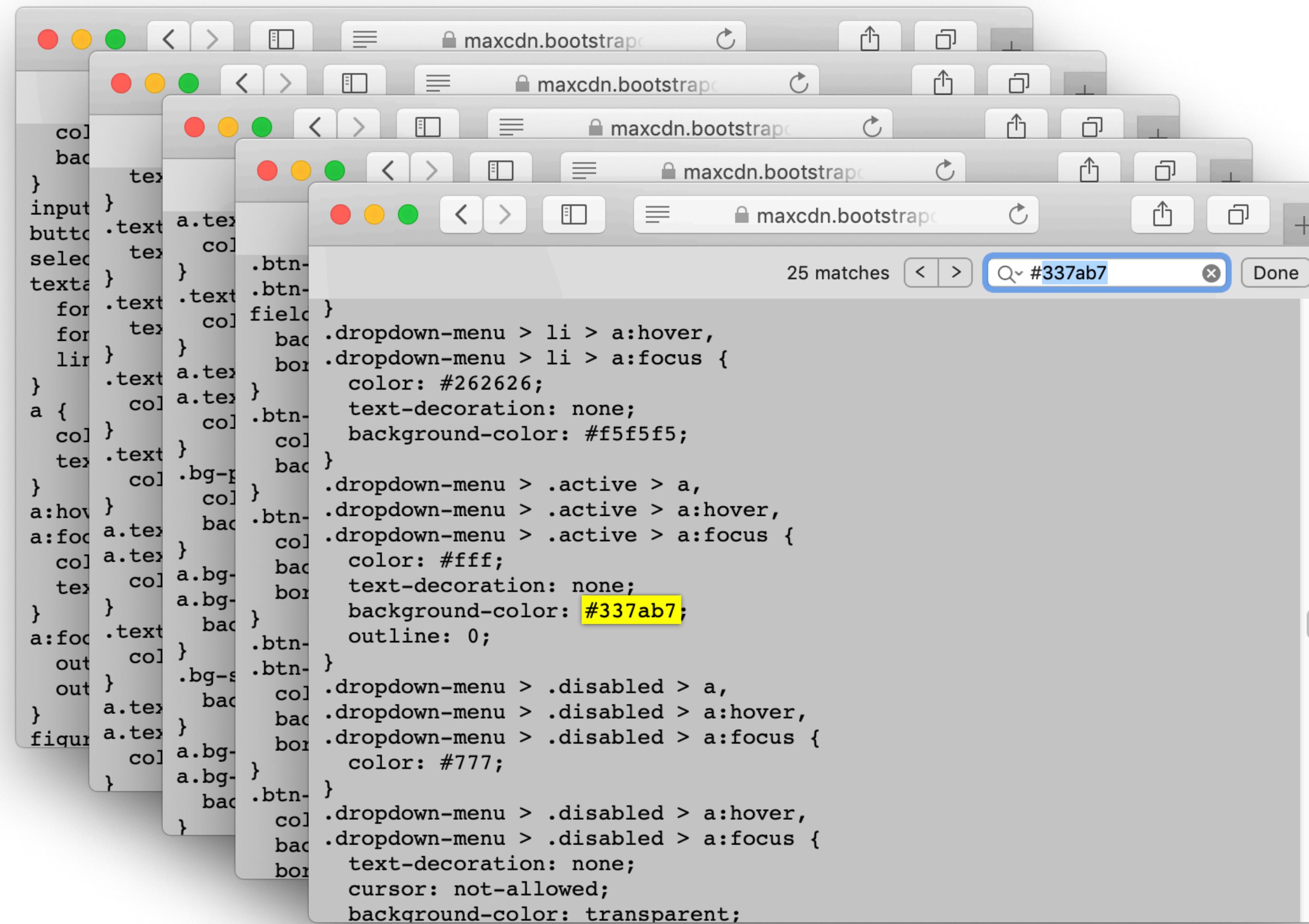
```
color: #333;
background-color: #fff;
}
input,
button,
select,
textarea {
    font-family: inherit;
    font-size: inherit;
    line-height: inherit;
}
a {
    color: #337ab7;
    text-decoration: none;
}
a:hover,
a:focus {
    color: #23527c;
    text-decoration: underline;
}
a:focus {
    outline: 5px auto -webkit-focus-ring-color;
    outline-offset: -2px;
}
figure {
```





The image shows three identical browser windows side-by-side, each displaying the same snippet of Bootstrap CSS code. The CSS is focused on button styles, specifically for the primary button class. The search bar in the top-right window is highlighted with the color #337ab7, which is the value being searched for.

```
.btn-default.disabled.focus,  
.btn-default[disabled].focus,  
fieldset[disabled] .btn-default.focus {  
    background-color: #fff;  
    border-color: #ccc;  
}  
a {  
    color: #337ab7;  
    text-decoration: none;  
}  
a:hover {  
    color: #337ab7;  
}  
a:focus {  
    color: #337ab7;  
    outline: 0;  
    border-bottom: 2px solid #337ab7;  
}  
a:active {  
    color: #337ab7;  
    outline: 0;  
    border-bottom: 2px solid #337ab7;  
}  
a:disabled {  
    color: #337ab7;  
    background-color: #337ab7;  
    border-color: #2e6da4;  
}  
a:disabled:active {  
    color: #337ab7;  
    background-color: #337ab7;  
    border-color: #2e6da4;  
}  
.btn-primary {  
    color: #fff;  
    background-color: #337ab7;  
    border-color: #2e6da4;  
}  
.btn-primary:disabled {  
    color: #fff;  
    background-color: #337ab7;  
    border-color: #2e6da4;  
}  
.btn-primary:disabled:active {  
    color: #fff;  
    background-color: #337ab7;  
    border-color: #2e6da4;  
}  
.btn-primary:disabled:disabled {  
    color: #fff;  
    background-color: #337ab7;  
    border-color: #2e6da4;  
}  
.btn-primary:disabled:disabled:active {  
    color: #fff;  
    background-color: #337ab7;  
    border-color: #2e6da4;  
}
```



The image shows a Mac OS X desktop with four browser windows stacked vertically. Each window displays the same CSS file: [maxcdn.bootstrapcdn.com/bootstrap/3.3.7/css/bootstrap.css](https://maxcdn.bootstrapcdn.com/bootstrap/3.3.7/css/bootstrap.css). The search bar in the bottom-right window contains the hex code `#337ab7`, which is highlighted in yellow. The status bar at the bottom of the screen indicates "25 matches". The CSS code snippet shown includes several rules for the color `#337ab7`:

```
25 matches < > Q #337ab7 Done
.panel-primary {
    color: #337ab7;
    border-color: #337ab7;
}
.panel-primary > .panel-heading {
    color: #fff;
    background-color: #337ab7;
}
.panel-primary > .panel-heading + .panel-collapse > .panel-body {
    border-top-color: #337ab7;
}
.panel-primary > .panel-heading .badge {
    color: #337ab7;
    background-color: #fff;
}
.panel-primary > .panel-footer + .panel-collapse > .panel-body {
    border-bottom-color: #337ab7;
}
.panel-success {
    border-color: #d6e9c6;
}
.panel-success > .panel-heading {
    color: #3c763d;
    background-color: #dff0d8;
    border-color: #d6e9c6;
```



css with superpowers

# Sass is a better way to write CSS

**styles.scss**

```
$primary: #337ab7;

a {
  color: $primary;
  text-decoration: n
}

button {
  color: $primary;
}
```



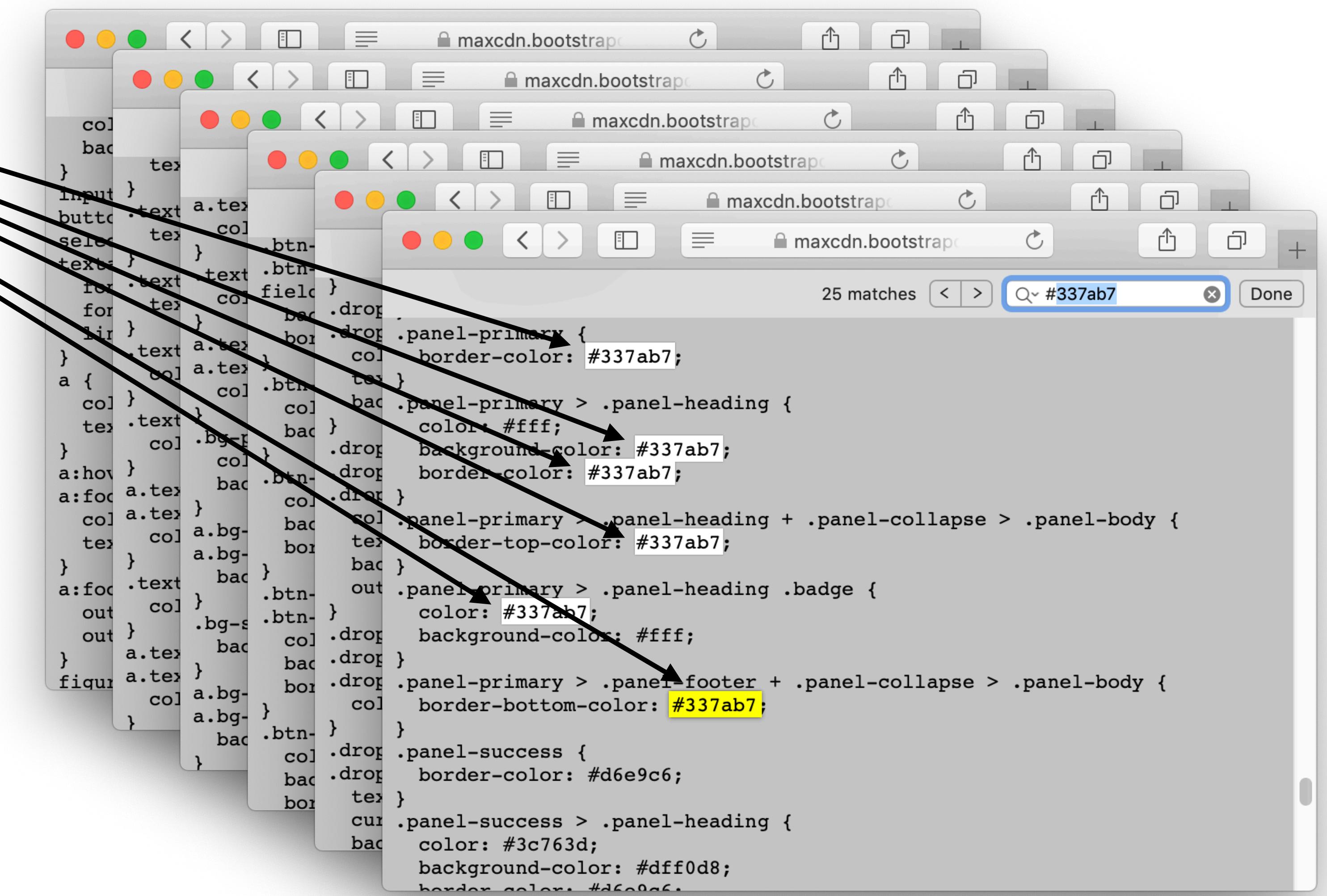
sass compiler

**styles.css**

```
a {
  color: #337ab7;
  text-decoration: n
}

button {
  color: #337ab7;
}
```

**\$primary: #337ab7**

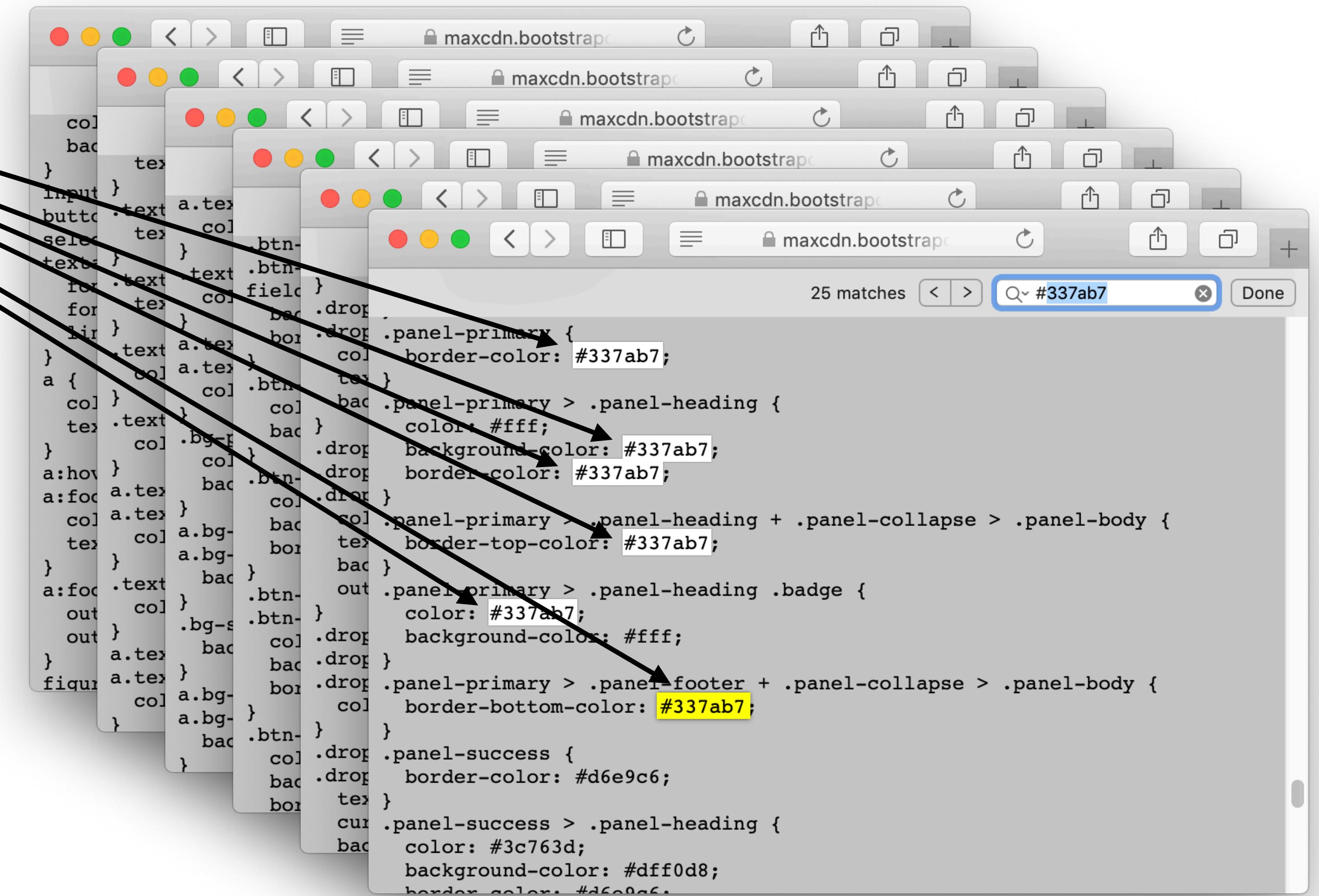


The screenshot shows four instances of a web browser window side-by-side, all displaying the same page from [maxcdn.bootstrapcdn.com/bootstrap/3.3.7/css/bootstrap.css](https://maxcdn.bootstrapcdn.com/bootstrap/3.3.7/css/bootstrap.css). Each window has a search bar at the top with the query `#337ab7`. The results show numerous matches where the color `#337ab7` is used, primarily for primary buttons and panels. In the bottom right window, a specific match for a badge's color is highlighted in yellow, while other matches are highlighted in black. The code snippets shown include:

```
panel-primary { border-color: #337ab7; }
.panel-primary > .panel-heading { color: #fff; background-color: #337ab7; border-color: #337ab7; }
.panel-primary > .panel-heading + .panel-collapse > .panel-body { border-top-color: #337ab7; }
.panel-primary > .panel-footer + .panel-collapse > .panel-body { border-bottom-color: #337ab7; }
.panel-success { border-color: #d6e9c6; }
.panel-success > .panel-heading { color: #3c763d; background-color: #dff0d8; border-color: #d6e9c6; }
```

CHANGE ME PLZ

\$primary: #337ab7



25 matches < > Q: #337ab7 Done

```
.panel-primary {  
    border-color: #337ab7;  
}  
.panel-primary > .panel-heading {  
    color: #fff;  
}  
.panel-primary > .panel-collapse > .panel-body {  
    border-top-color: #337ab7;  
}  
.panel-primary > .panel-footer + .panel-collapse > .panel-body {  
    border-bottom-color: #337ab7;  
}  
.panel-success {  
    border-color: #d6e9c6;  
}  
.panel-success > .panel-heading {  
    color: #3c763d;  
    background-color: #dff0d8;  
    border-color: #d6e9c6;  
}
```

# Customizing Bootstrap with Sass

**If we could set Bootstrap variable overrides from R, we could bend Bootstrap to our will!**

To that end, we've developed two new R packages:

- **sass** – Compile Sass to CSS from R
- **bootstraplib** – Customize and use Bootstrap from R

# Customizing Bootstrap with Sass

**If we could set Bootstrap variable overrides from R, we could bend Bootstrap to our will!**

To that end, we've developed two new R packages:

- **sass** – Compile Sass to CSS from R
- **bootstraplib** – Customize and use Bootstrap from R

**Our focus  
for today**



# The `bootstraplib` package

- R bindings for Bootstrap
- Designed to be used from Shiny apps, R Markdown, HTML widget packages, and anywhere else Bootstrap might be needed
- Customize and re-customize Bootstrap with your own variables and rules, straight from R!
- Built-in support for bootswatch (i.e. `shinythemes`), which can also be combined with your own customizations

# Customizing styles with **bootstraplib**

```
library(shiny)

ui <- fluidPage(
  ...
)
```

# Customizing styles with **bootstraplib**

```
library(shiny)
library(bootstraplib)

ui <- fluidPage(
  ...
)
```

Step 1. Load library

# Customizing styles with **bootstraplib**

```
library(shiny)
library(bootstraplib)

bs_theme_new()

ui <- fluidPage(
  ...
)
```

Step 2. Initialize bootstraplib

# Customizing styles with `bootstraplib`

```
library(shiny)
library(bootstraplib)

bs_theme_new()

bs_theme_add_variables(
  "body-bg" = "pink",
  "primary" = "maroon"
)

ui <- fluidPage(
  ...
)
```

Step 3. Set Bootstrap overrides

# Customizing styles with `bootstraplib`

```
library(shiny)
library(bootstraplib)

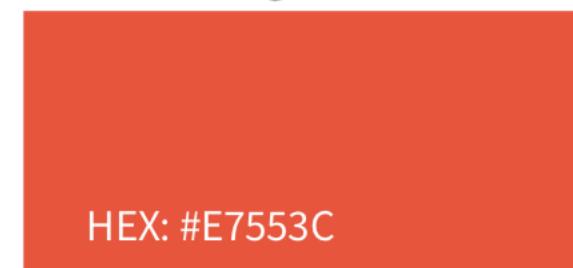
bs_theme_new()

bs_theme_add_variables(
  "body-bg" = "pink",
  "primary" = "maroon"
)

ui <- fluidPage(bootstrap(),
  ...
)
```

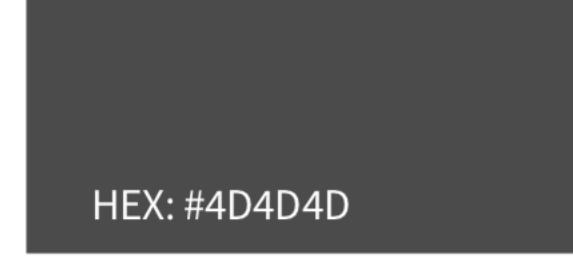
Step 4. Build and insert Bootstrap

Accent Orange

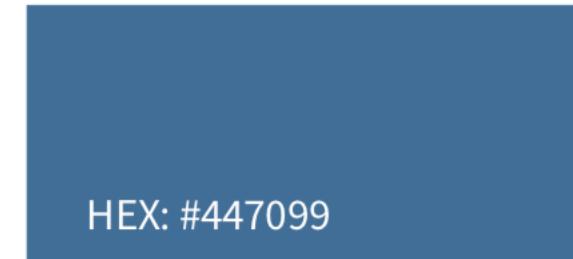


HEX: #E7553C

Logo Gray



Dark Blue



HEX: #447099

# CRAN whales

Date:

2020-01-31

Show top N:

6

All traffic

Biggest whales

Whales by hour

Detail view

4.1 TiB

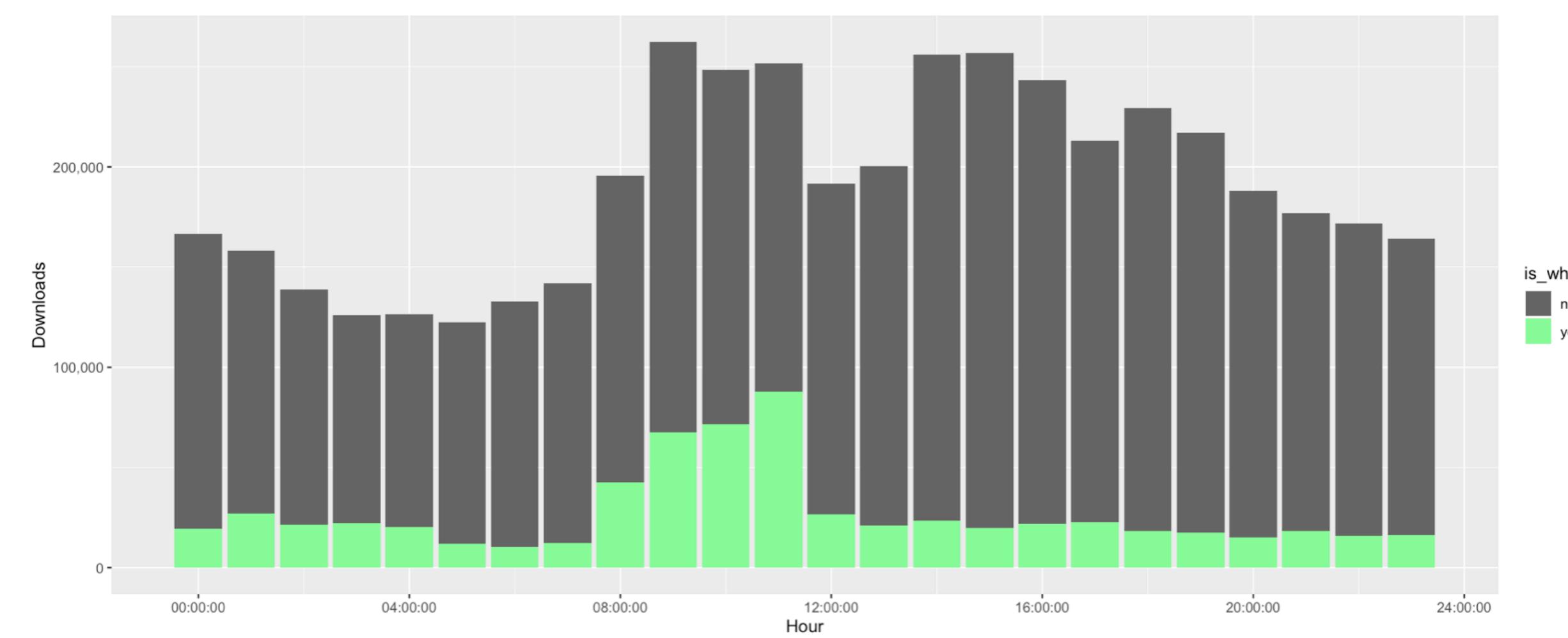
bandwidth consumed

4,580,160

files downloaded

88,782

unique downloaders



# Which variables should I change?

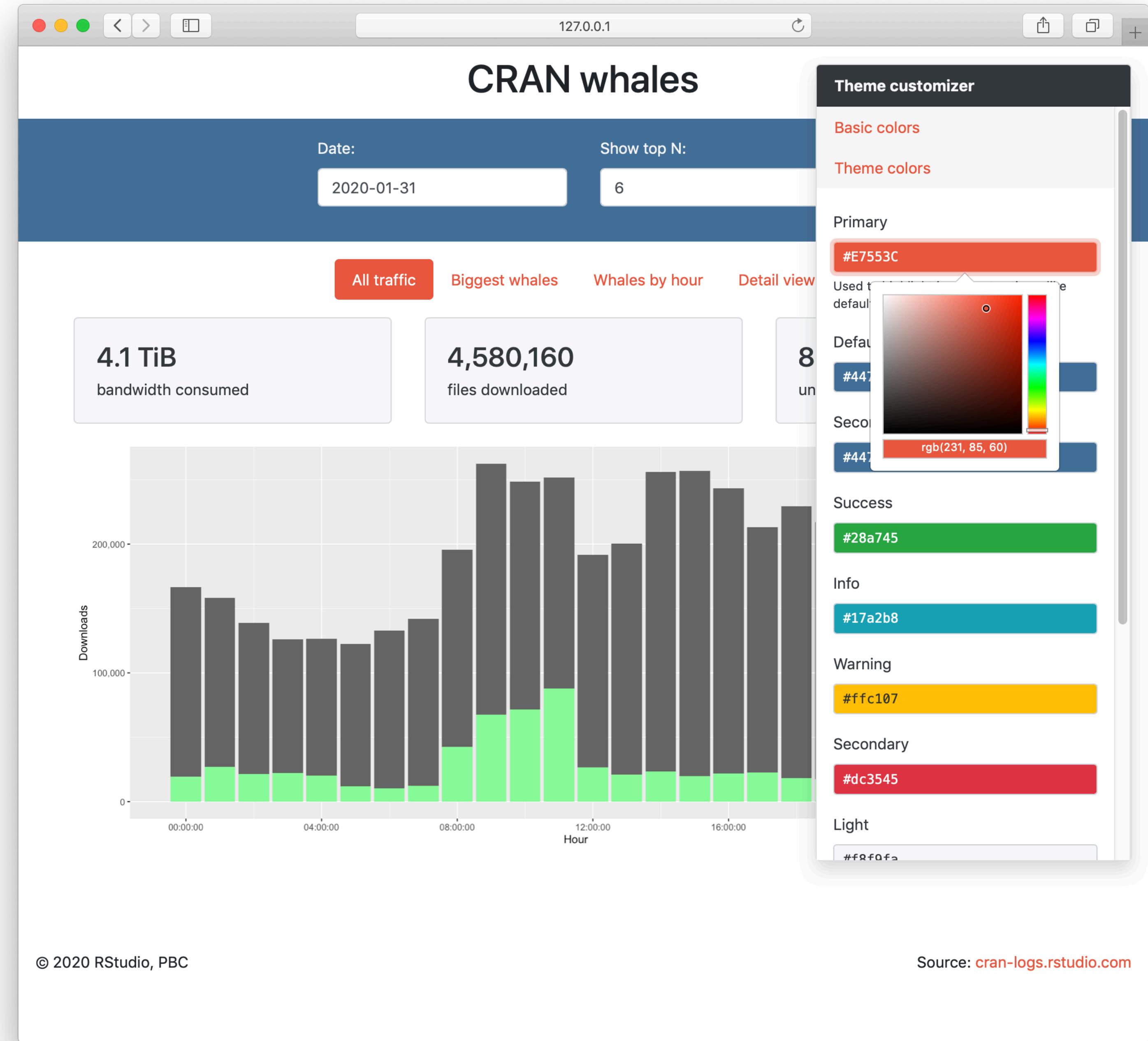
Tools for configuring Bootstrap are only useful if you can figure out which variables to configure!

- **Bootstrap 3 variable list**  
<https://bit.ly/bs3-sass-vars>
- **Bootstrap 4 variable list**  
<https://bit.ly/bs4-sass-vars>
- **bootstraplib docs**  
<https://rstudio.github.io/bootstraplib/articles/recipes.html>

There are hundreds of variables, but they're pretty sensibly named and grouped

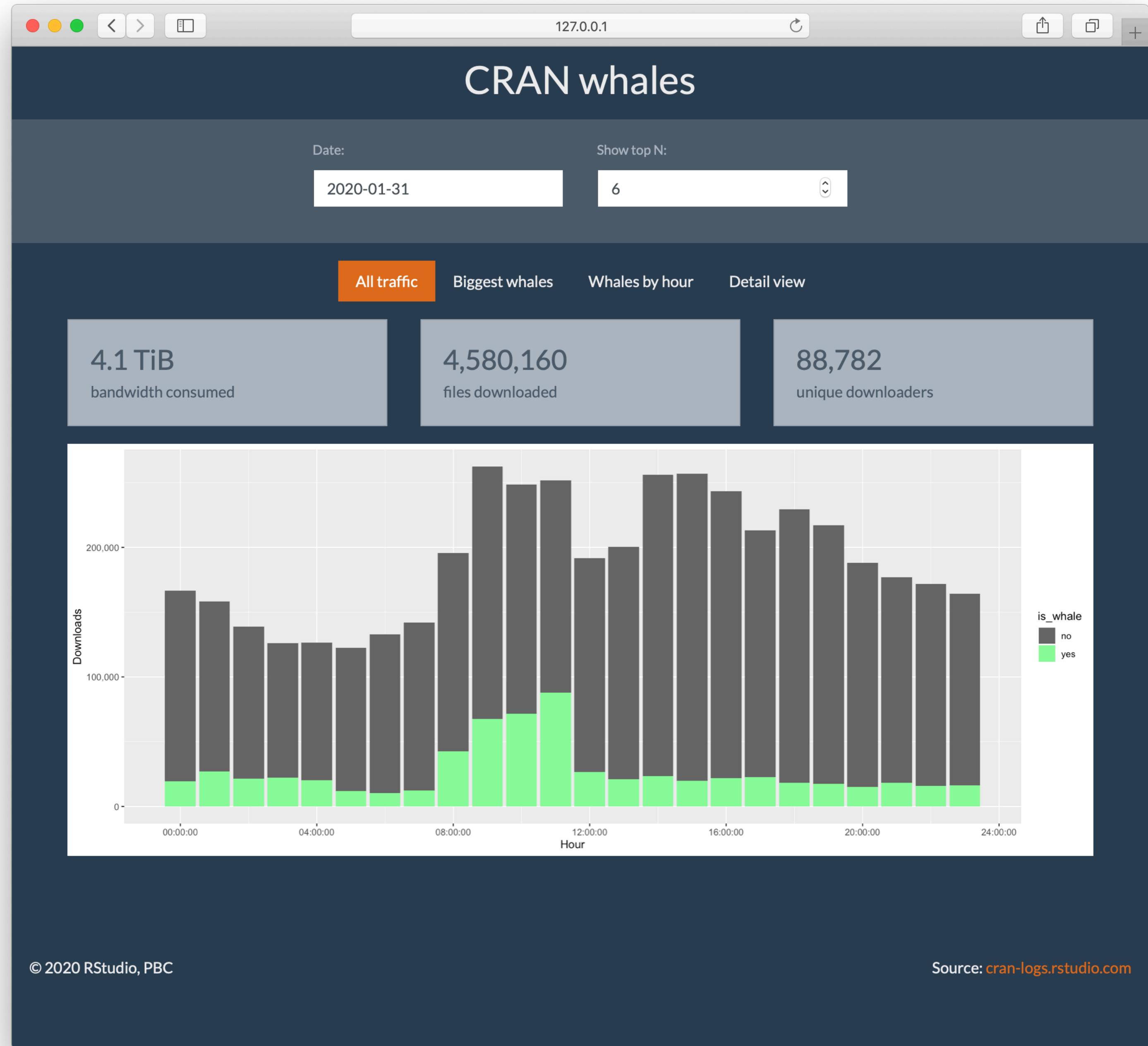
# Realtime theme preview (experimental!)

1. Run app using `run_with_themer`
2. Make changes using the UI
3. Copy code from console and add it to your app



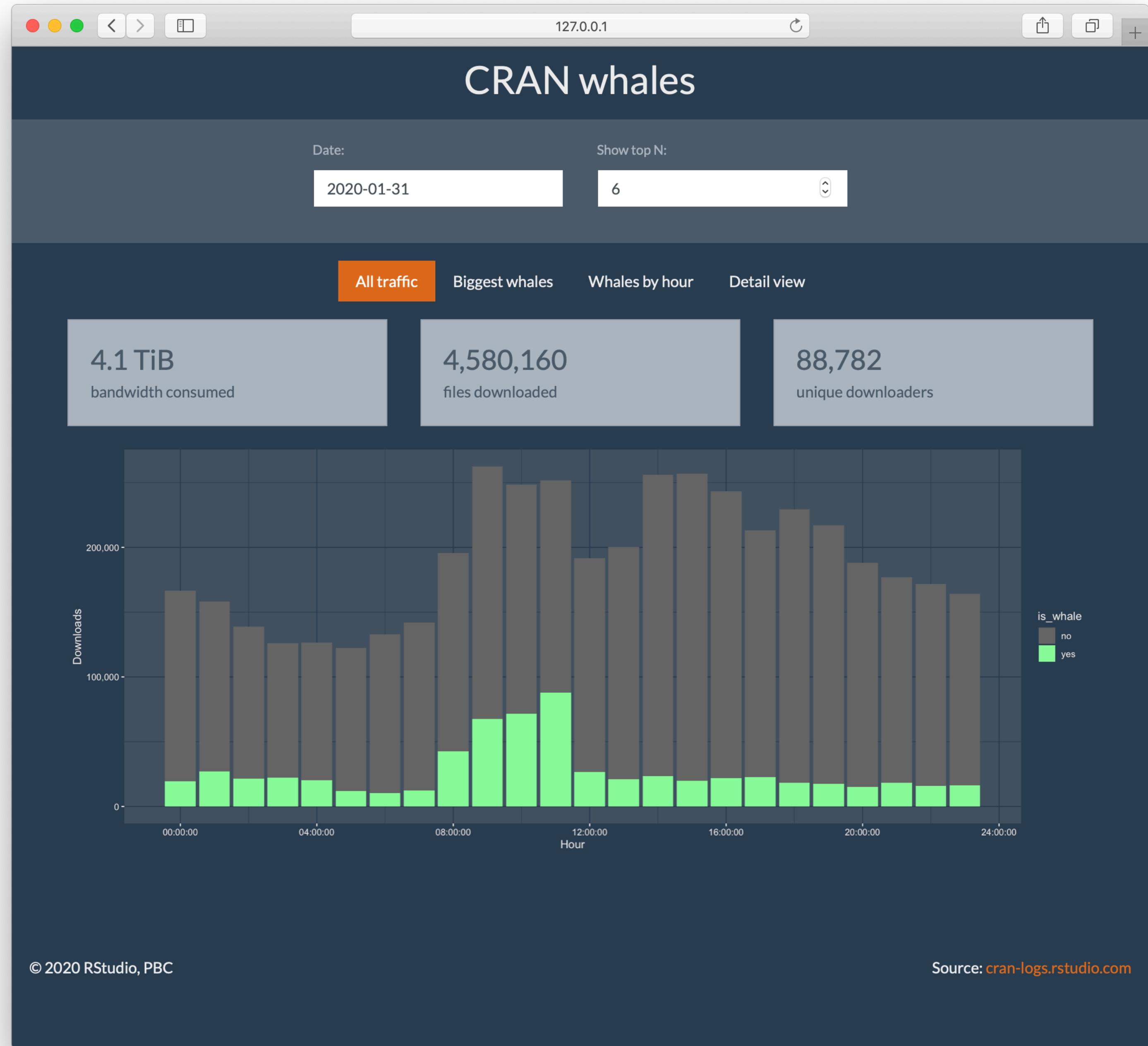
# Plot theming

- Static plots (`plotOutput`) don't respect CSS styles
- This is an especially big problem with dark backgrounds



# Plot theming

- Static plots (`plotOutput`) don't respect CSS styles
  - This is an especially big problem with dark backgrounds
  - Requires opt-in (for backward compatibility reasons)
    - Add `shinyOptions(plot.autocolors=TRUE)` to the top of your app
    - Or, pass `autocolors=TRUE` to `renderPlot()`
  - This is an upcoming feature of Shiny itself and should work with any CSS framework



# 3rd party components

These types of packages will need to be updated to work with **bootstraplib** if they have their own CSS rules and want them to respect theming:

- HTML widgets (**DT**)
- R Markdown document formats (**flexdashboard**)
- Shiny extensions (**shinydashboard** (but see **bs4dash**),  
**shinyBS**, **shinyWidgets**)

We will be updating RStudio-maintained packages, and supporting other package maintainers who want to be compatible.

# Towards Bootstrap 4

**bootstraplib** lays a lot of the groundwork we'll use to move the Shiny community beyond Bootstrap 3

- Supports multiple versions of Bootstrap
- Lots of effort spent on improving Bootstrap 4 backward compatibility
- The styling work we've talked about today

You can use **bootstraplib** to move your Shiny apps and Rmd docs to Bootstrap 4 today, but the real benefits will come later this year

# Acknowledgements

- Prior art: <https://github.com/dreamRs/fresh>
- **sass**: Tim Mastny (RStudio summer intern)
- **bootstraplib**: Carson Sievert (RStudio software engineer)

# Thank you!

- **bootstraplib pkgdown site**  
<https://rstudio.github.io/bootstraplib/>
- **Bootstrap 3 variable list**  
<https://bit.ly/bs3-sass-vars>
- **Bootstrap 4 variable list**  
<https://bit.ly/bs4-sass-vars>
- Today's demos require specific GitHub branches:  
`remotes :: install_github("rstudio/bootstraplib")  
remotes :: install_github("rstudio/shiny#2740")  
remotes :: install_github("rstudio/DT#740")`
- **Slide deck**  
<https://speakerdeck.com/jcheng5/styling-shiny>