JavaScript for the useR

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Agenda

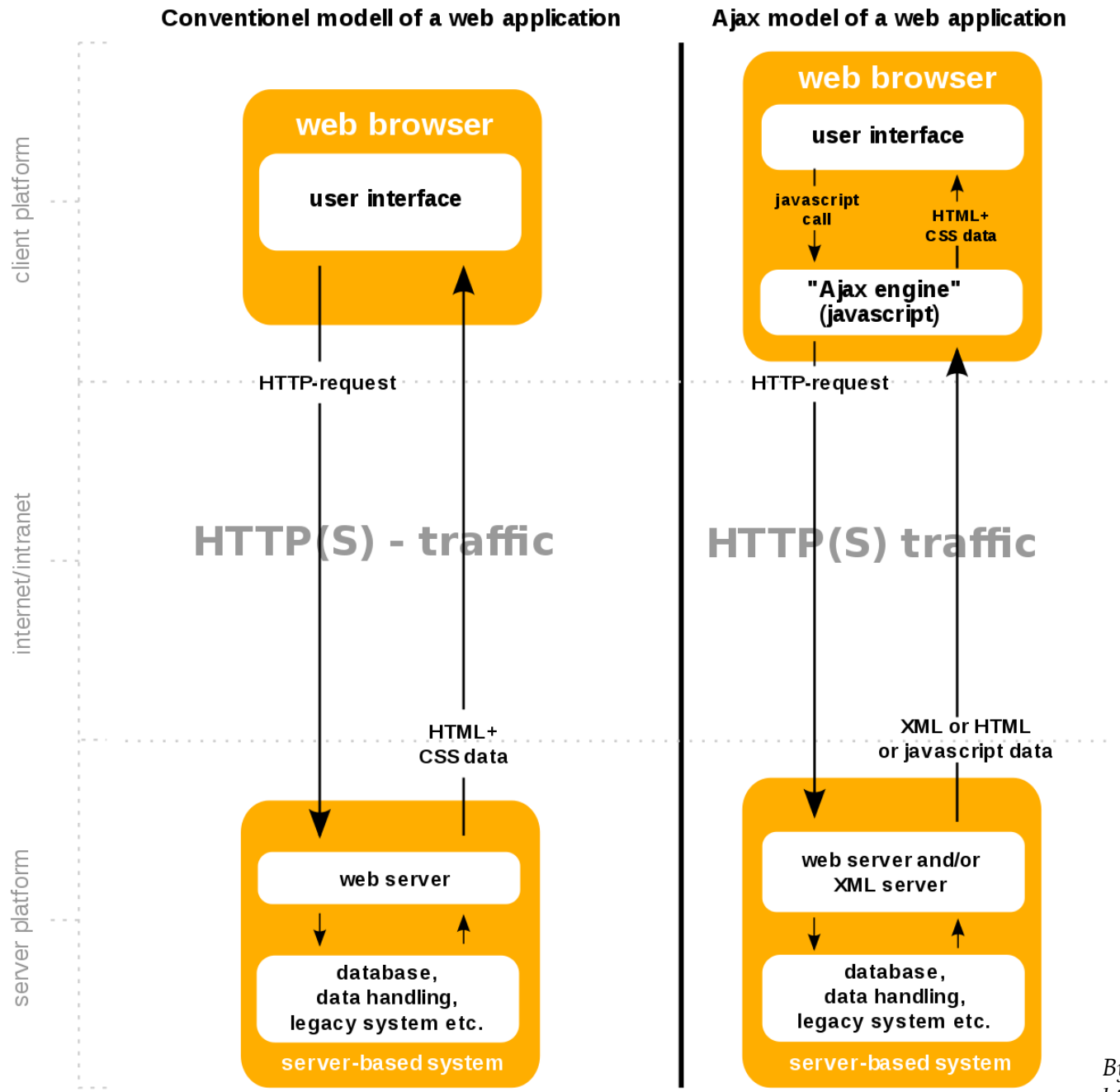
- Why Learn JavaScript?
- JavaScript: A Short History
- The Browser Environment: HTML and DOM
- Comparing R and JavaScript
- JavaScript Tools
- Demo of Stuff I'm Super Into Right Now: React.js and Shiny
- Learning more

Why Learn JavaScript?

- Deliver applications in the browser (without Shiny)
  - Every computer that has a browser can run it
  - Lucrative career path (front-end application development)
- Extend Shiny in ways that interest you
  - Make your own inputs
  - Make your own outputs
  - Make your own htmlwidgets
- Share your extensions as R packages

JavaScript: A Short History

- Invented in 1995 by Brendan Eich at Netscape
- Called Mocha, then LiveScript, then JavaScript
  - Has nothing to do with Java but is syntactically similar
- Standardized as ECMA-262 in 1997
  - Standardization has continued; latest is ECMAScript 2017
- Used lightly and not taken seriously until *Ajax* in 1999
  - Since then, used for large-scale *single-page application* (SPA) development
- Node.js (2009) is a JavaScript platform for servers



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HTML and DOM

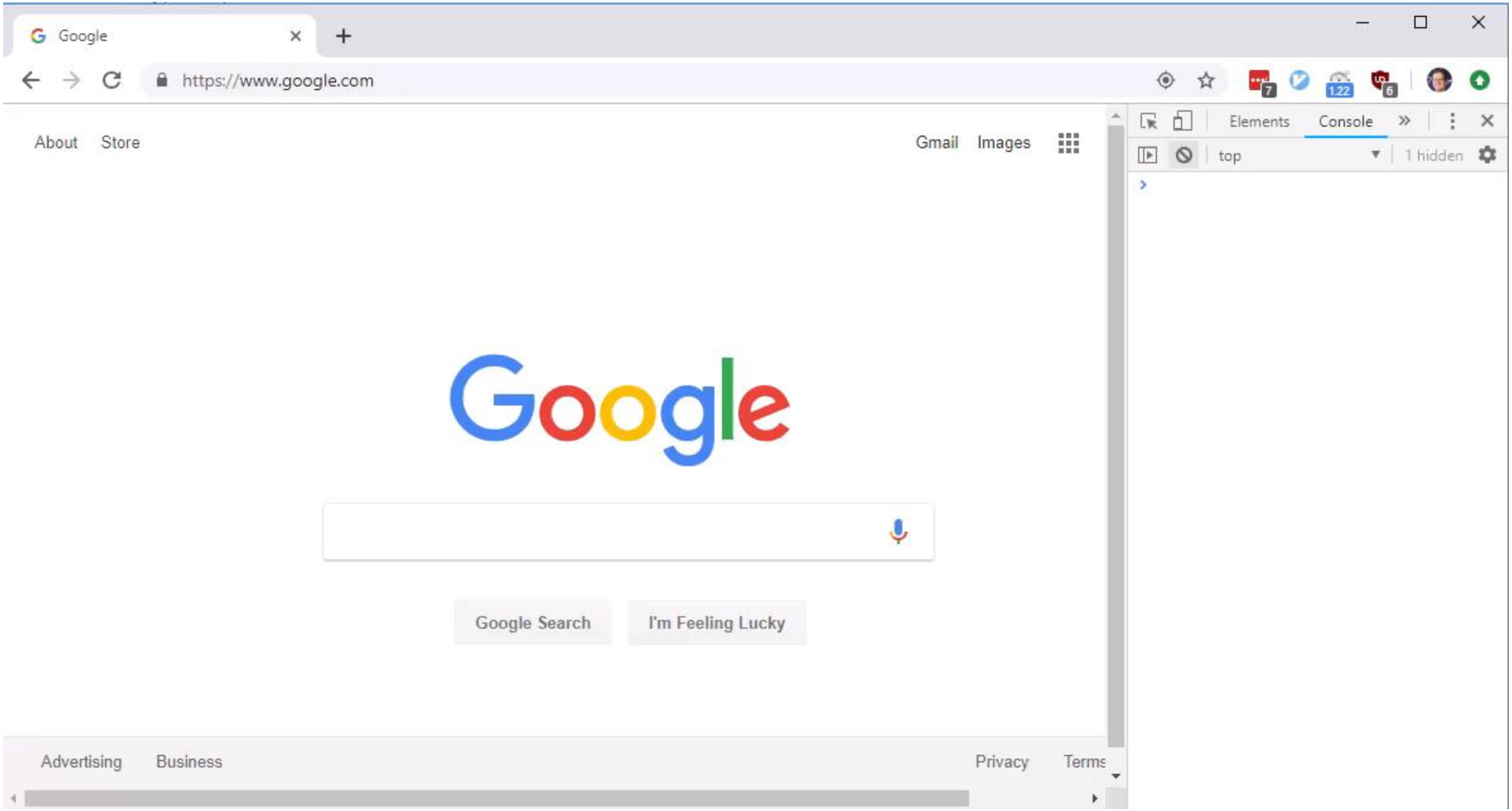
- *Hyper-Text Markup Language* (HTML): static, structured representation of content
  - Not interactive, not dynamic
- *Document Object Model* (DOM): dynamic representation
  - Presents JavaScript *application programming interface* (API)

HTML

```
<div id = "main">
  <h1>Hello!</h1>
</div>
```

DOM (via JavaScript)

```
var div = document.createElement("div");
var h1 = document.createElement("h1");
div.id = "main";
h1.appendChild(document.createTextNode("Hello!"));
div.appendChild(h1);
```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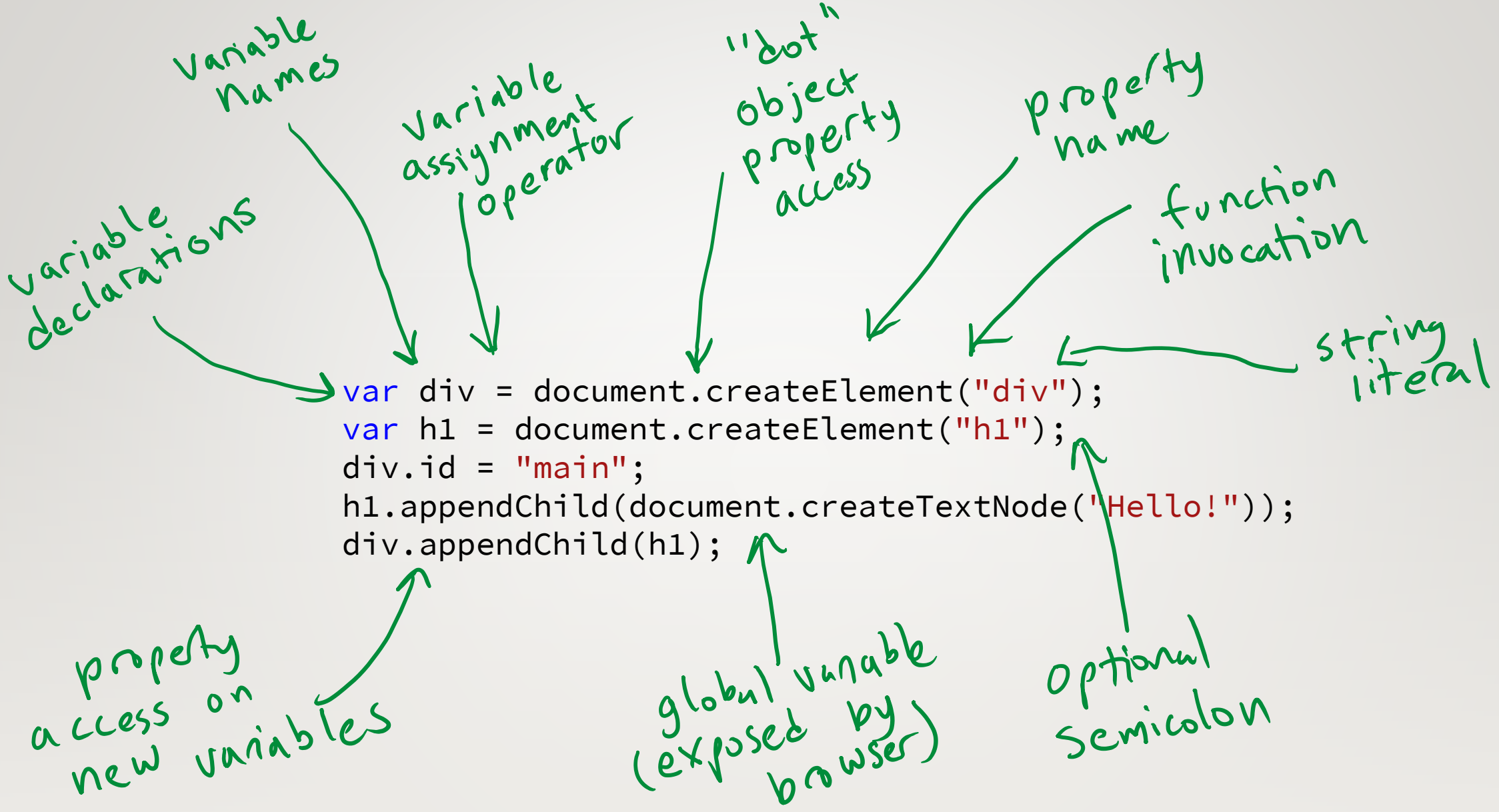
variable names
variable assignment operator
"dot" object property access
property name
function invocation
variable declarations
string literal
var div = document.createElement("div");
var h1 = document.createElement("h1");
div.id = "main";
h1.appendChild(document.createTextNode("Hello!"));
div.appendChild(h1);
property access on new variables
global variable (exposed by browser)
optional semicolon

JavaScript

```
var div = document.createElement("div");
var h1 = document.createElement("h1");
div.id = "main";
h1.appendChild(document.createTextNode("Hello!"));
div.appendChild(h1);
```

Pseudo-R with R6 (“Extract-style”)

```
div <- document$createElement("div")
h1 <- document$createElement("h1")
div$id <- "main"
h1$appendChild(document$createTextNode("Hello!"))
div$appendChild(h1)
```

Key Similarities

- Garbage-collected: Memory is managed automatically
- Dynamically/strongly typed: Type errors at runtime
- Multi-paradigm: imperative, functional, object-oriented (OO)
  - R has many OO systems: S3, S4, R6…
  - JavaScript has “prototypal inheritance” as introduced by the Self language
- First-class functions
- Similar scoping rules

Key Differences

- Security
- Purpose
  - JavaScript: end-user applications: n developers < n users
  - R: statistical computing, data science: n users = n developers
- Data types
  - Not everything in JavaScript is an object
  - JavaScript primitives are not vectors
- Meta-programming
  - R has non-standard evaluation

JavaScript Tools

- Modern web browser (Edge, Safari, Firefox, Chrome)
  - Try things in the JS console
  - Explore DOM
  - Debug with breakpoints
- npm: analogous to CRAN
- yarn: analogous to Packrat
- webpack: Reduces size of JS files so they load faster, among many other things
  - No real analog in the R world
- VS Code: trending IDE, analogous to RStudio

Demo

Learning More

- **JavaScript: The Good Parts** by Douglas Crockford
- MDN web docs
  - https://developer.mozilla.org/en-US/docs/Web/JavaScript
- "Build custom input objects" in Shiny Dev Center
  - https://shiny.rstudio.com/articles/building-inputs.html
- "Creating a widget"
  - http://www.htmlwidgets.org/develop_intro.html
- reactR (and Slack community)
  - https://github.com/react-R/reactR

Thank you!

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