



Introduction. How browsers work

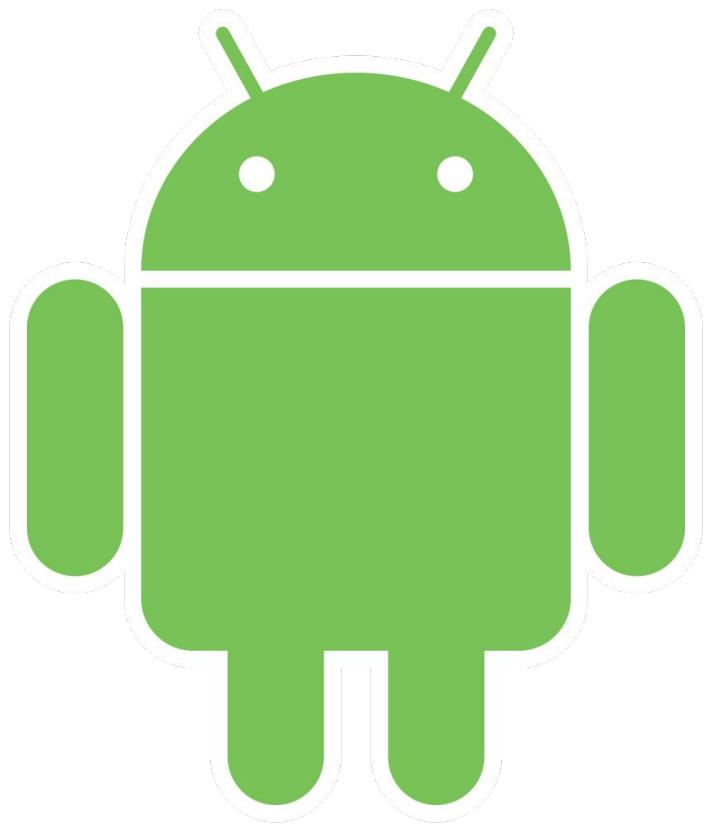
Brest 2018

Introduction



<https://it-shark.pro/>





IT Shark links



1. <https://www.facebook.com/itsharkpro>
2. <https://vk.com/itsharkpro>
3. https://twitter.com/IT_Shark_PRO
4. <https://www.instagram.com/itsharkpro>
5. <https://github.com/it-shark-pro>
6. <https://t.me/itsharkpro>
7. <https://goo.gl/zbm4NG> (slack)

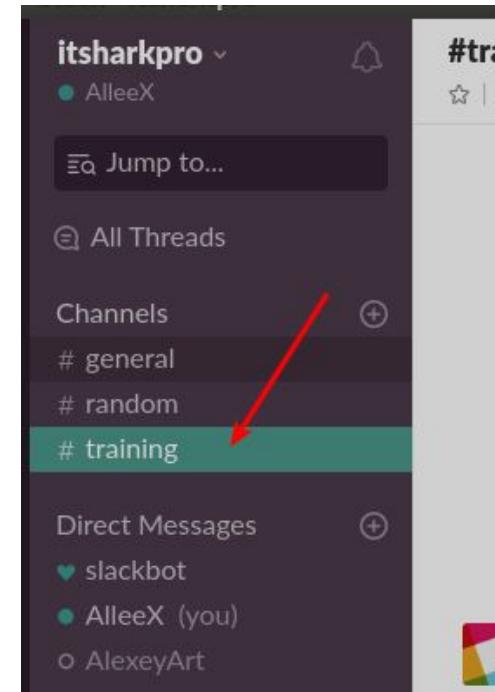
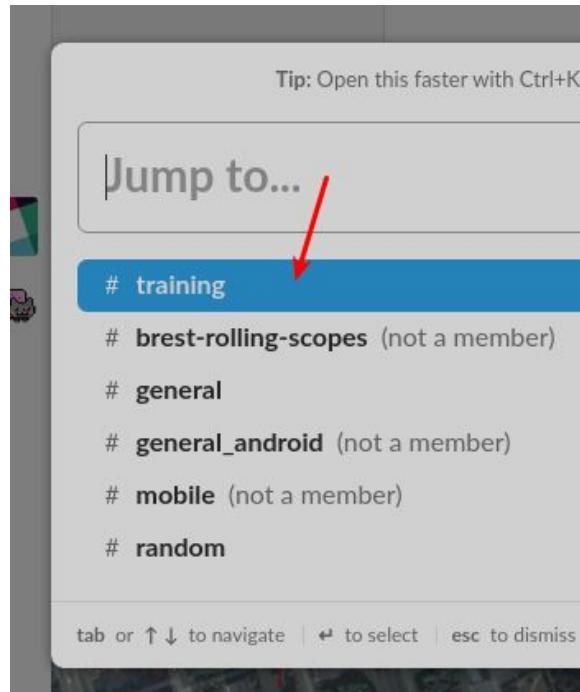
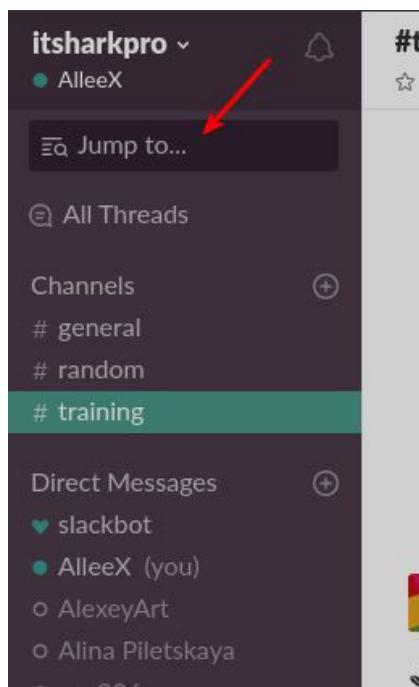


Homeworks & Project





slack



<https://goo.gl/zbm4NG>



Contacts



- AlleeX - Саша
- Eduard Trutsyk - Эдик
- udzi - Вова
- DraX - Виталий
- Vasili Brutsky - Вася



Plan

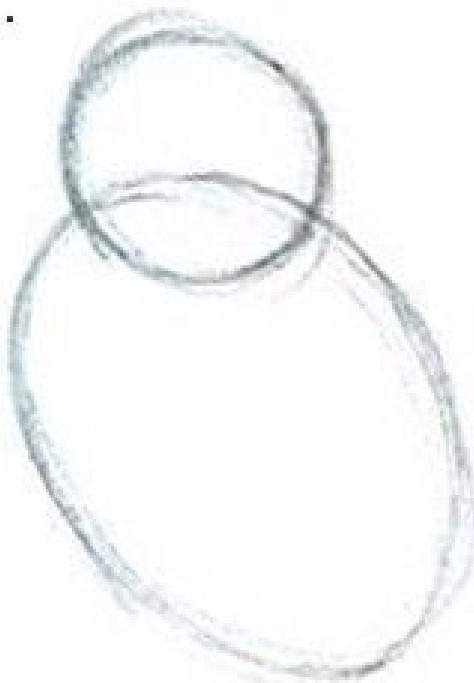
- Introduction. How browsers work
- HTTP
- Introduction to HTML5 / CSS3
- Introduction to Javascript 2015
- Introduction to REST
- Nodejs, Express
- Web apps architecture
- Introduction to JS Frameworks (React)
- Developers Tools



WEB development

How to draw an owl

1.



2.



1. Draw some circles

2. Draw the rest of the fucking owl

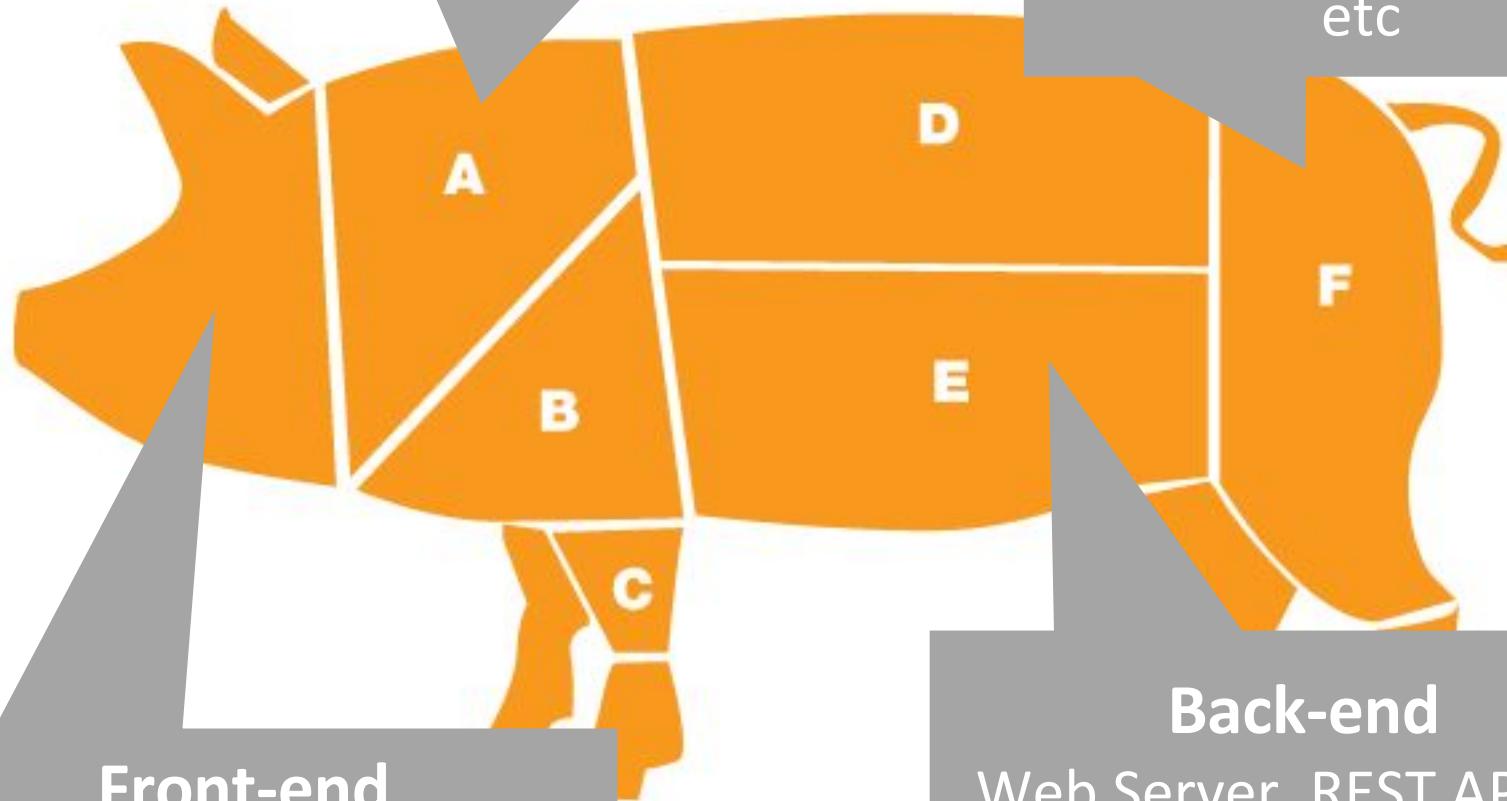


Web app infrastructure

Proxies, Caches, Load Balancers

Back-end Services

Data Server, Services
etc



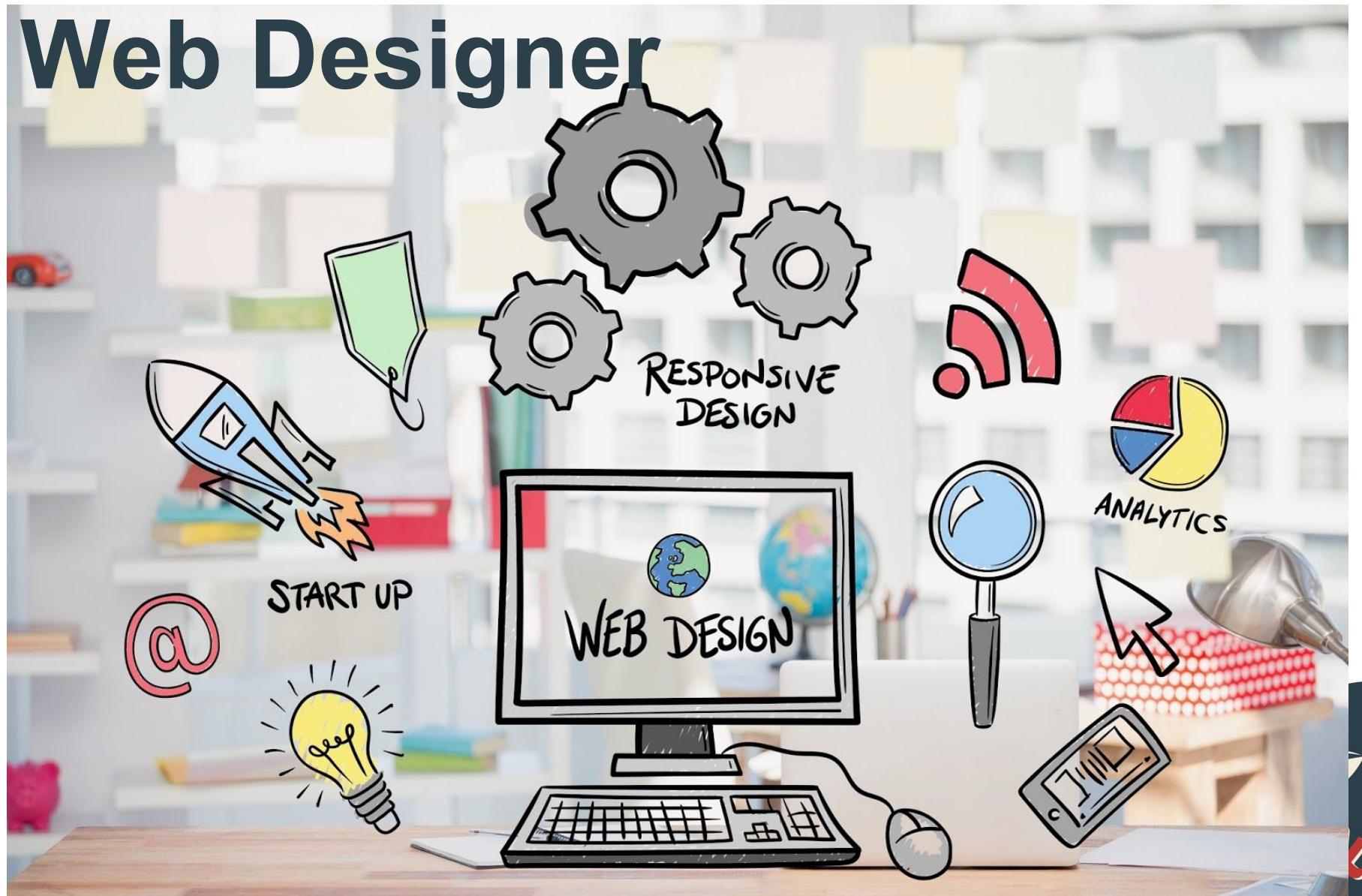
Front-end
HTML,CSS,JavaScript

Back-end

Web Server, REST API etc

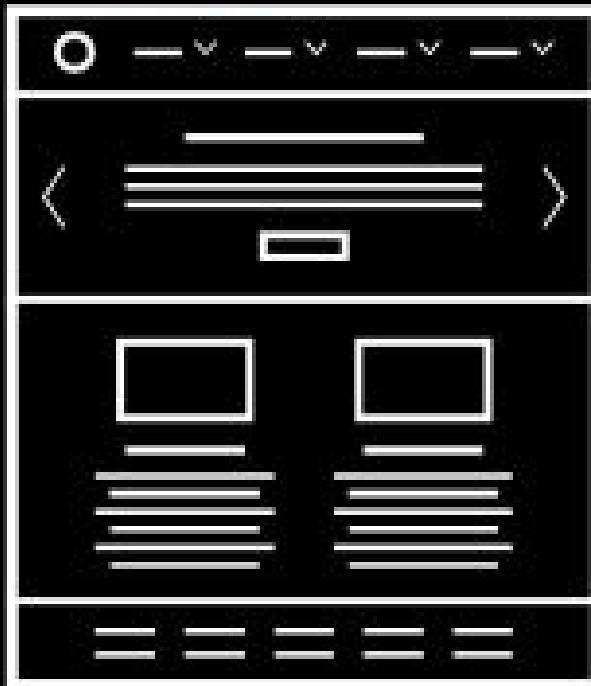
Frontend Specialization:

Web Designer

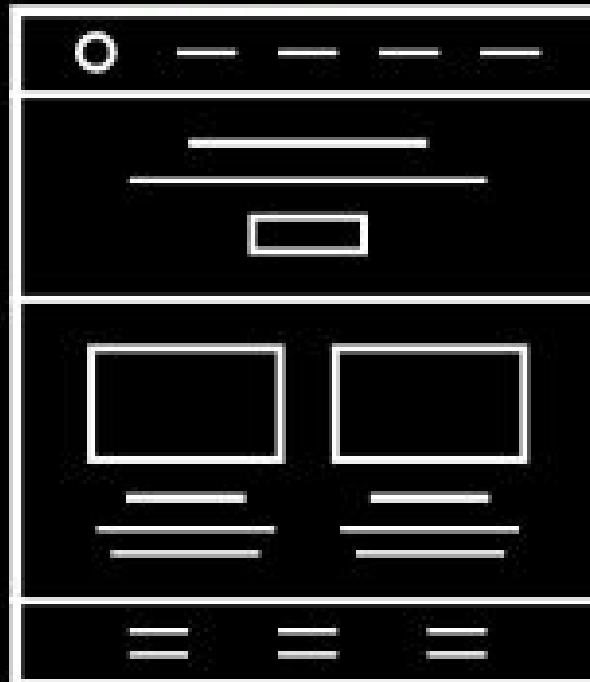


Frontend Specialization: UX Designer

Bad UX



Good UX



Frontend Specialization: Web Developer



What is Frontend

REST AJAX XSS
CORS HTTP JSON
WebComponents
WebSockets Cookie
Battery Status API
Navigation API
Local Storage CSS DOM
User Experience Typography Media Queries
IT Shark



Frontend tools

CSS



Sass



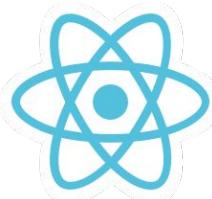
HTML



#Alloy



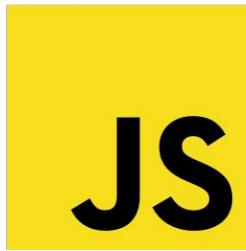
BABEL



npm



Github



METE



Underscore.js

#Sammy.js

browserify

BACKBONE.JS

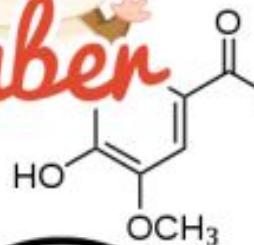
Breeze ANGULARJS

express
REQUISITES

G



ember



DERBY



10



TypeScript

 mongoDB



The Front-End Web Developer Spectrum



Since there is a huge chance that, while I am writing this presentation, there are 100325 new front-end tools being released, it's possible that this image is already not completely up to date.





libuv



User agent (desktop)

59%



12%



12%



3.8%



3.4%



1.7%



1.6%



1.4%



User agent (mobile + tablet)

56%



31%



4%



3%



2.6%



Mdot vs adaptive vs RWD

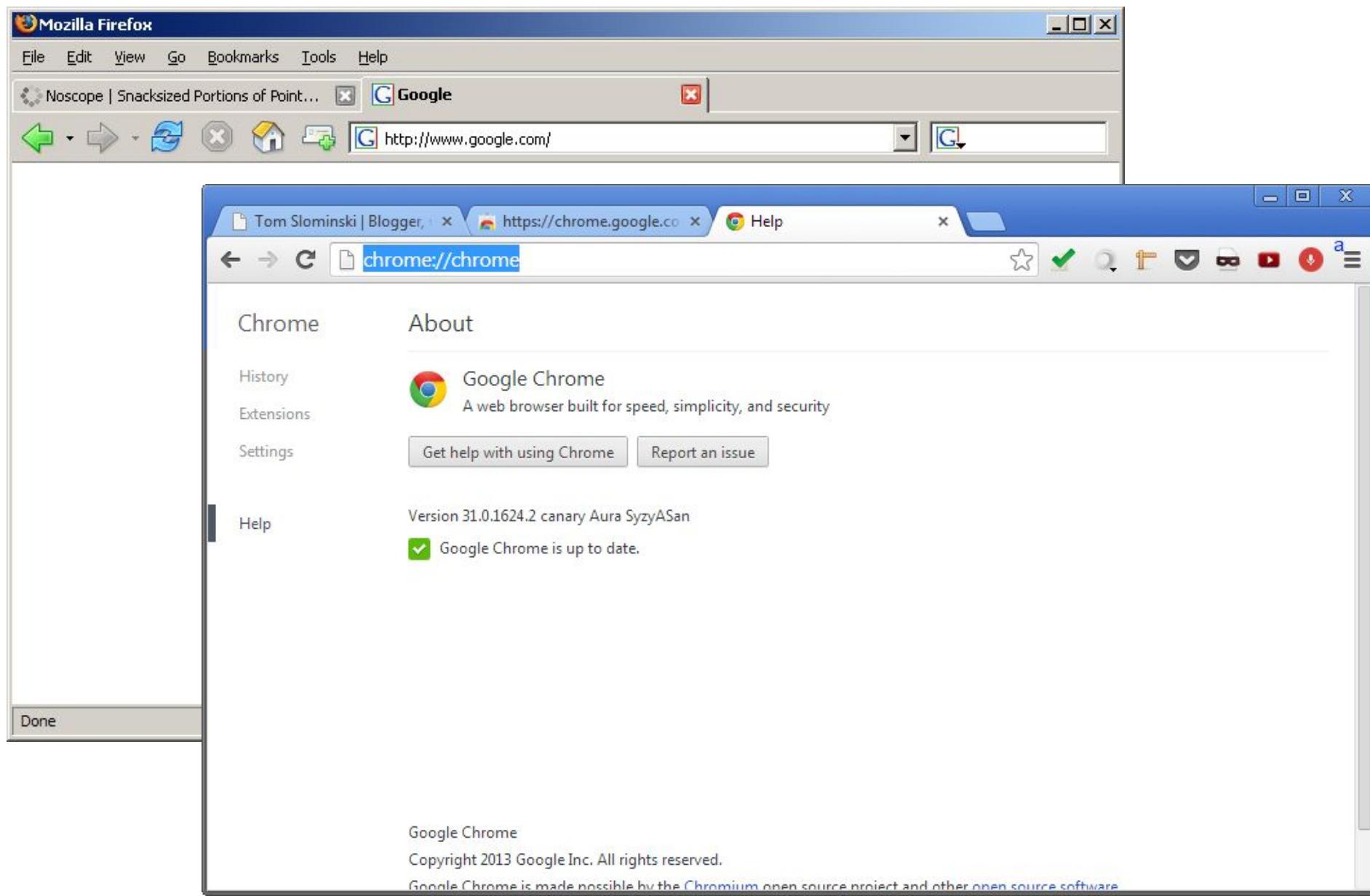


Mdot vs adaptive vs RWD

Metric (Defaults)	Adaptive	Responsive
Response	568 ms	1,202 ms
Document Complete	1,536 ms	4,086 ms
Webpage Response	2,889 ms	4,860 ms
Bytes Downloaded	2,474,326 kb	4,229,362 kb
Objects Downloaded	20	61



Browser interface



URI

Uniform Resource Identifier



URI

URN



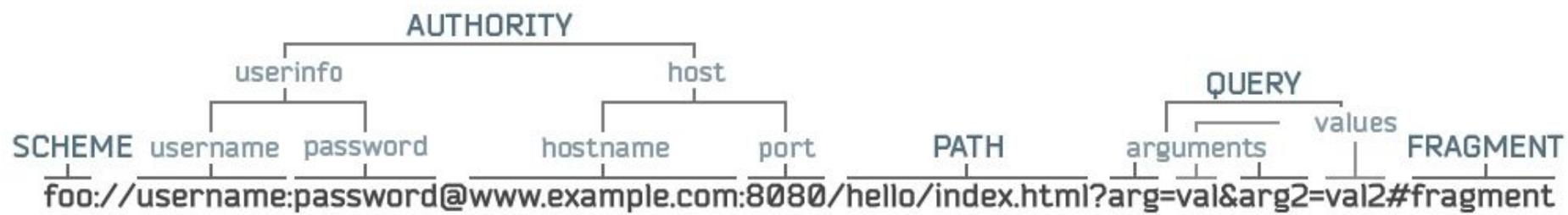
URL



URI



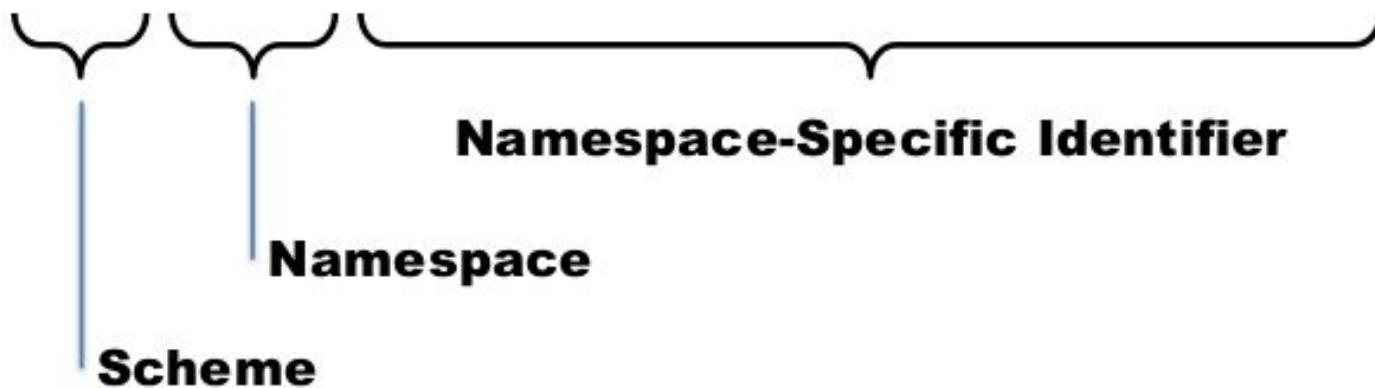
URL



URN

URN Syntax (RFC 8141)

`urn:uuid:ae84-d5c2-9fb785ea-72cd34`



```
<URN> ::= "urn:" <NID> ":" <NSS>
```



;))



Response Times: The 3 Important Limits

■ 100ms

1s

10sec



Network latency

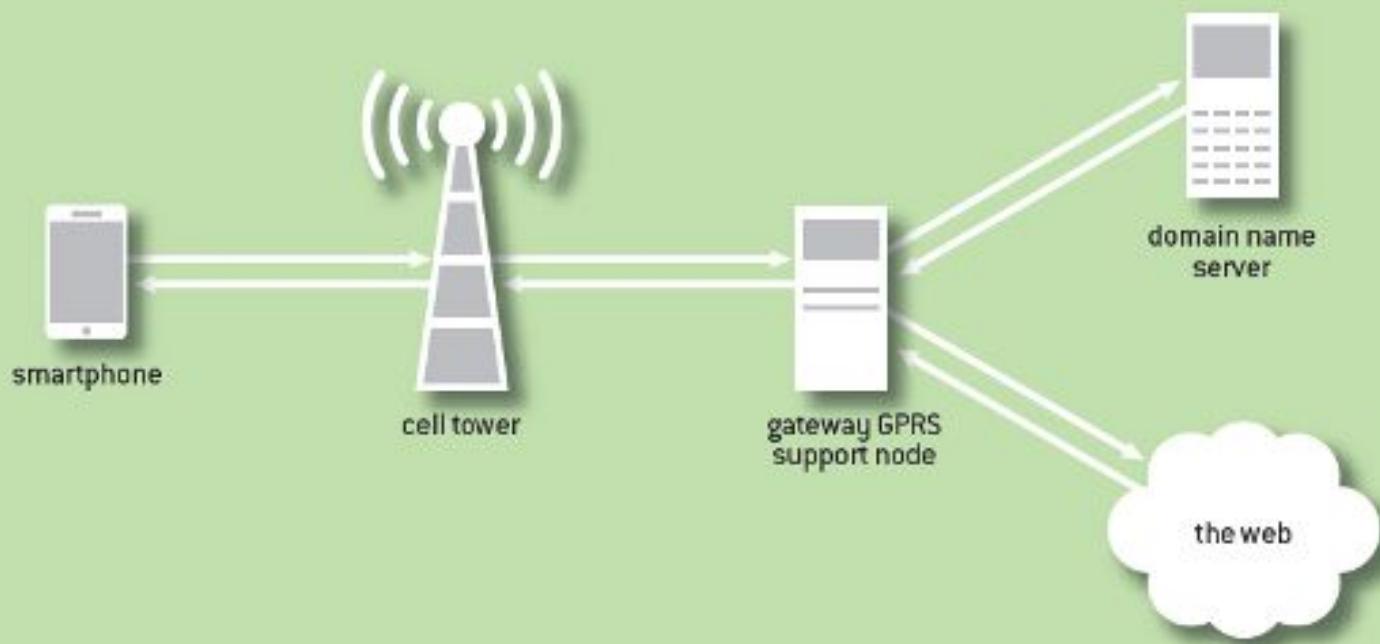
Route	Distance, km	Light in Vacuum, ms	Light in Fiber, ms	RTT in Fiber, ms
MINSK – LONDON	2,162	7	11	22
MINSK – NEW YORK	7,118	24	36	72
MINSK – SYDNEY	15,131	51	76	152
EQUATORIAL CIRCUMFERENCE	40,075	133.7	200	200



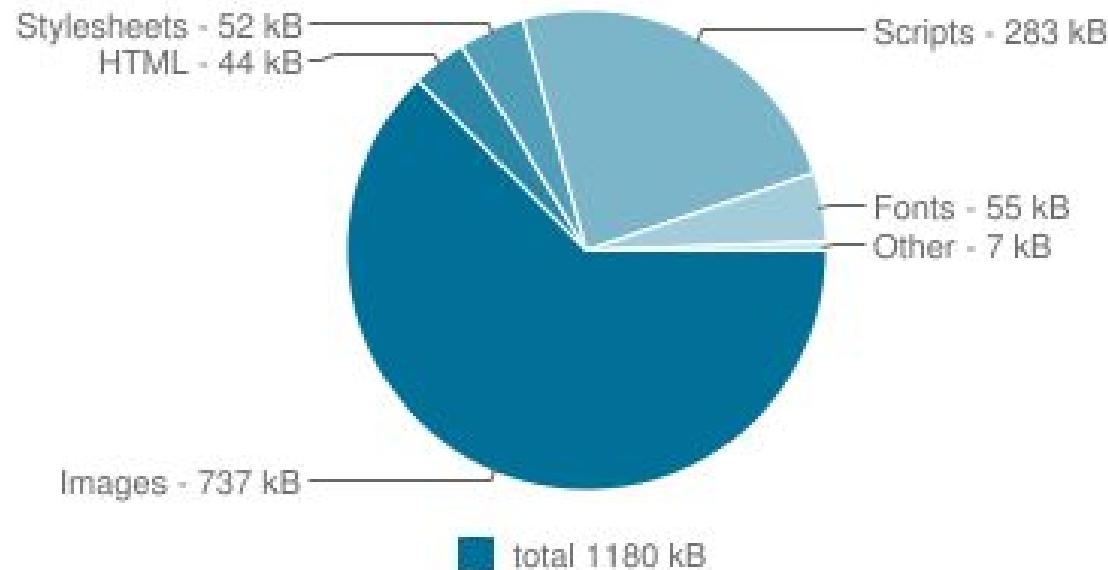
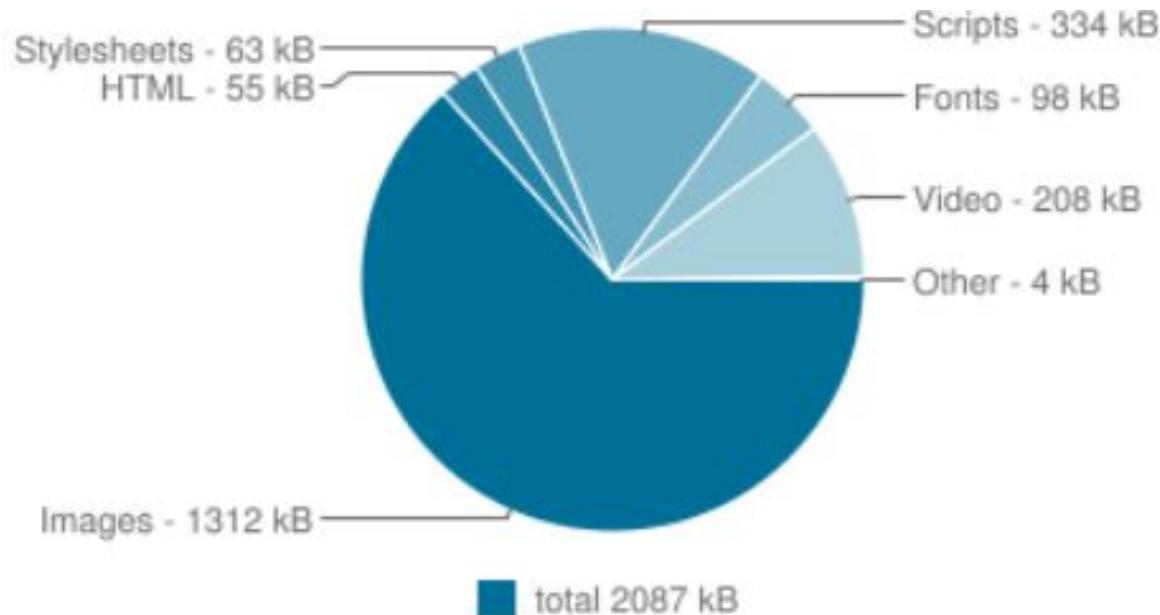
Mobile Network

FIGURE
1

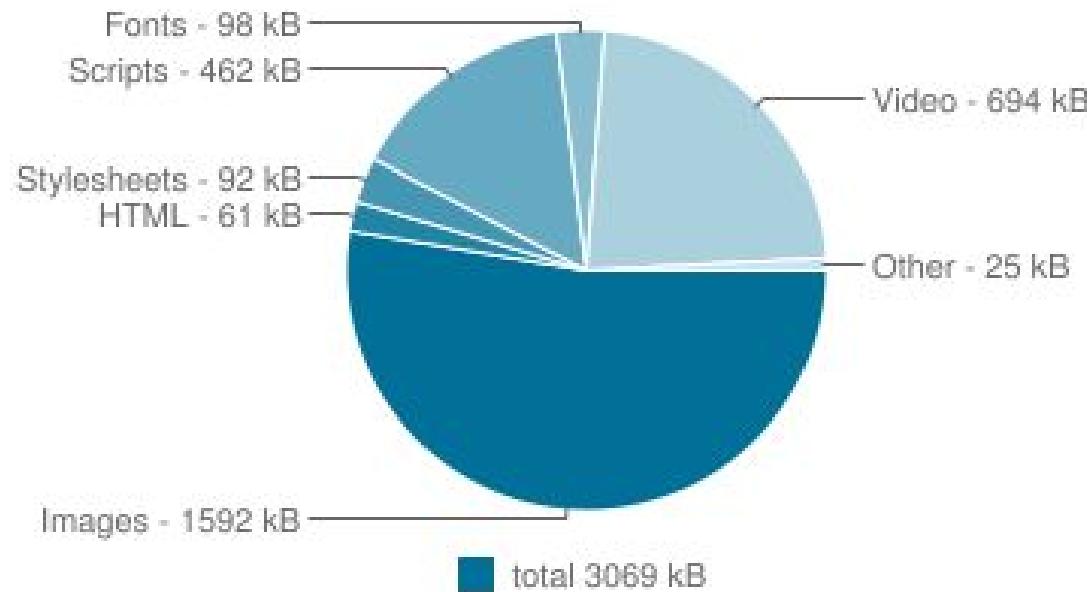
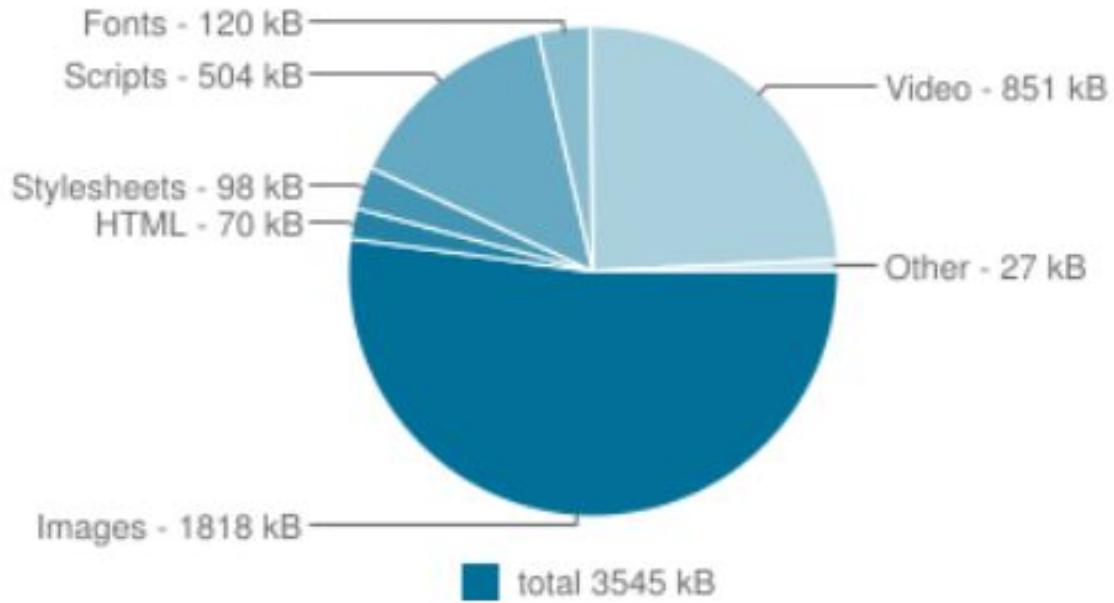
An HTTP Request from a Smartphone



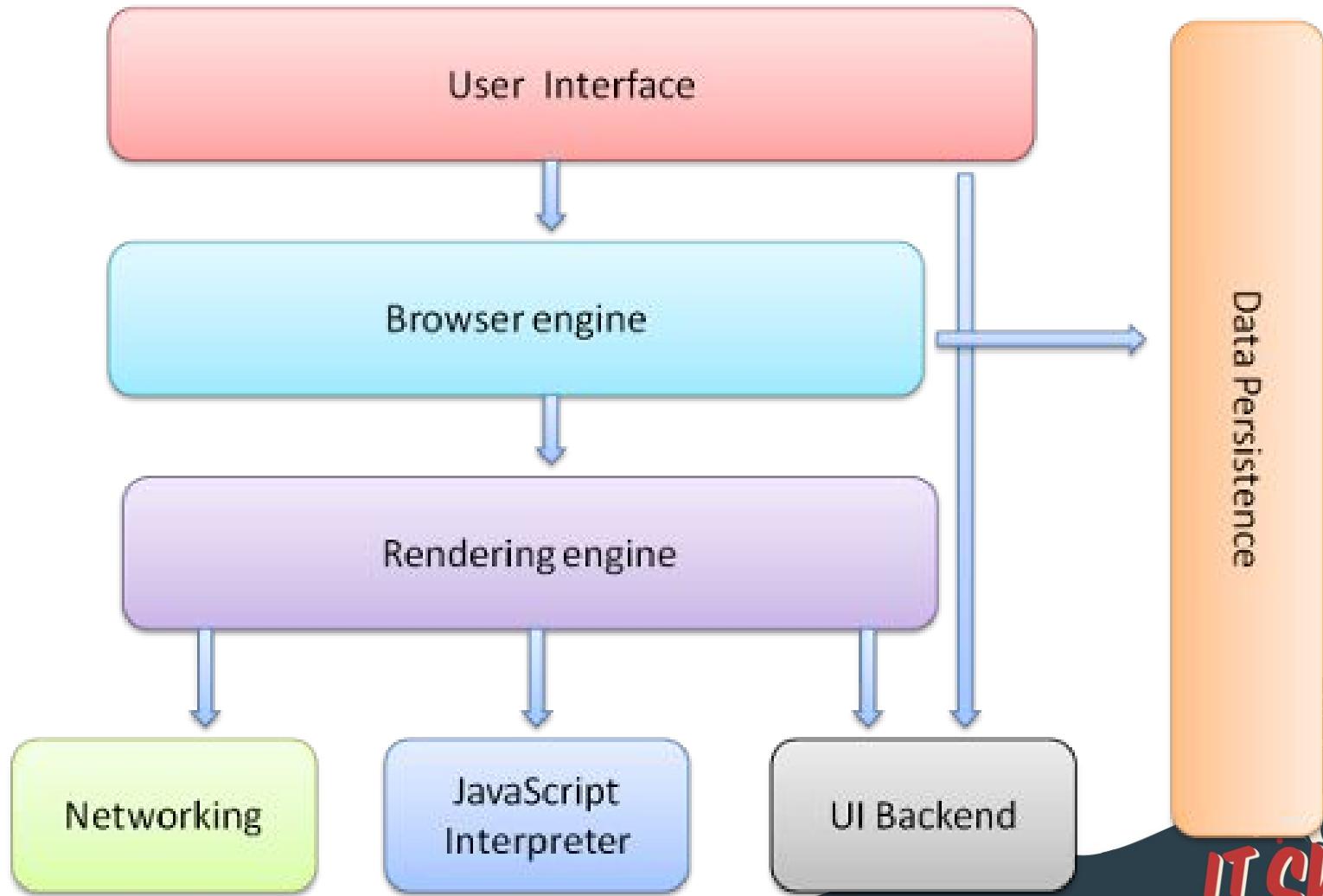
Statistics 2015



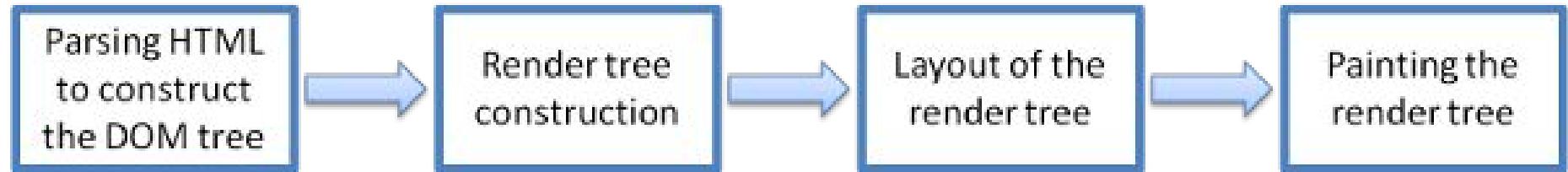
Statistics 2018



The browser's high level structure



Rendering engine basic flow



WebKit



WebKit

Open Source Web Browser Engine

Product based on WebKit and Blink



Safari Browser



Android Browser



Chrome



Tizen Browser/WebRuntime



Amazon Silk Browser

Open webOS

webOS Browser



Konqueror Browser



UC Browser



Opera Browser



Netfront Browser

 BlackBerry

Blackberry Browser



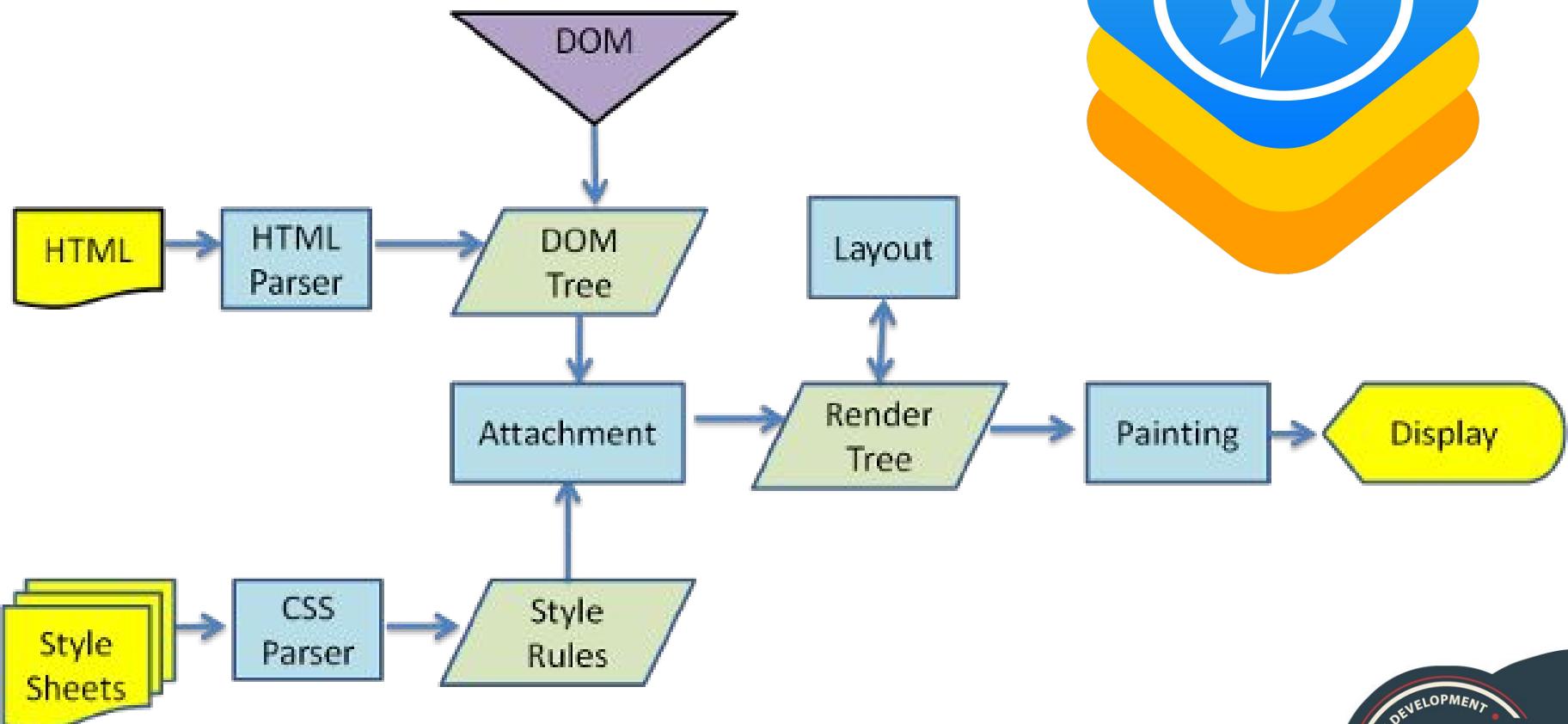
Dolphin Browser

Swing browser

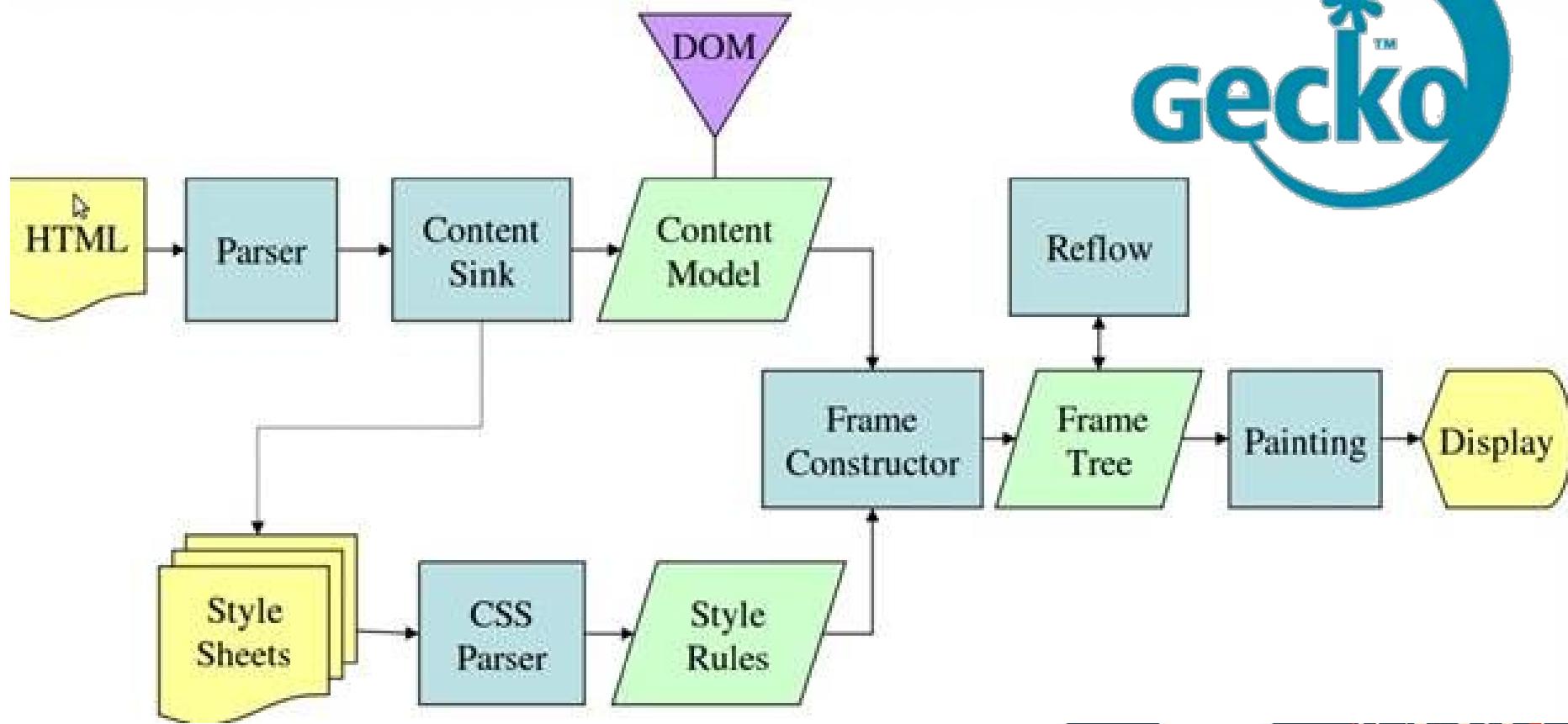
Swing Browser



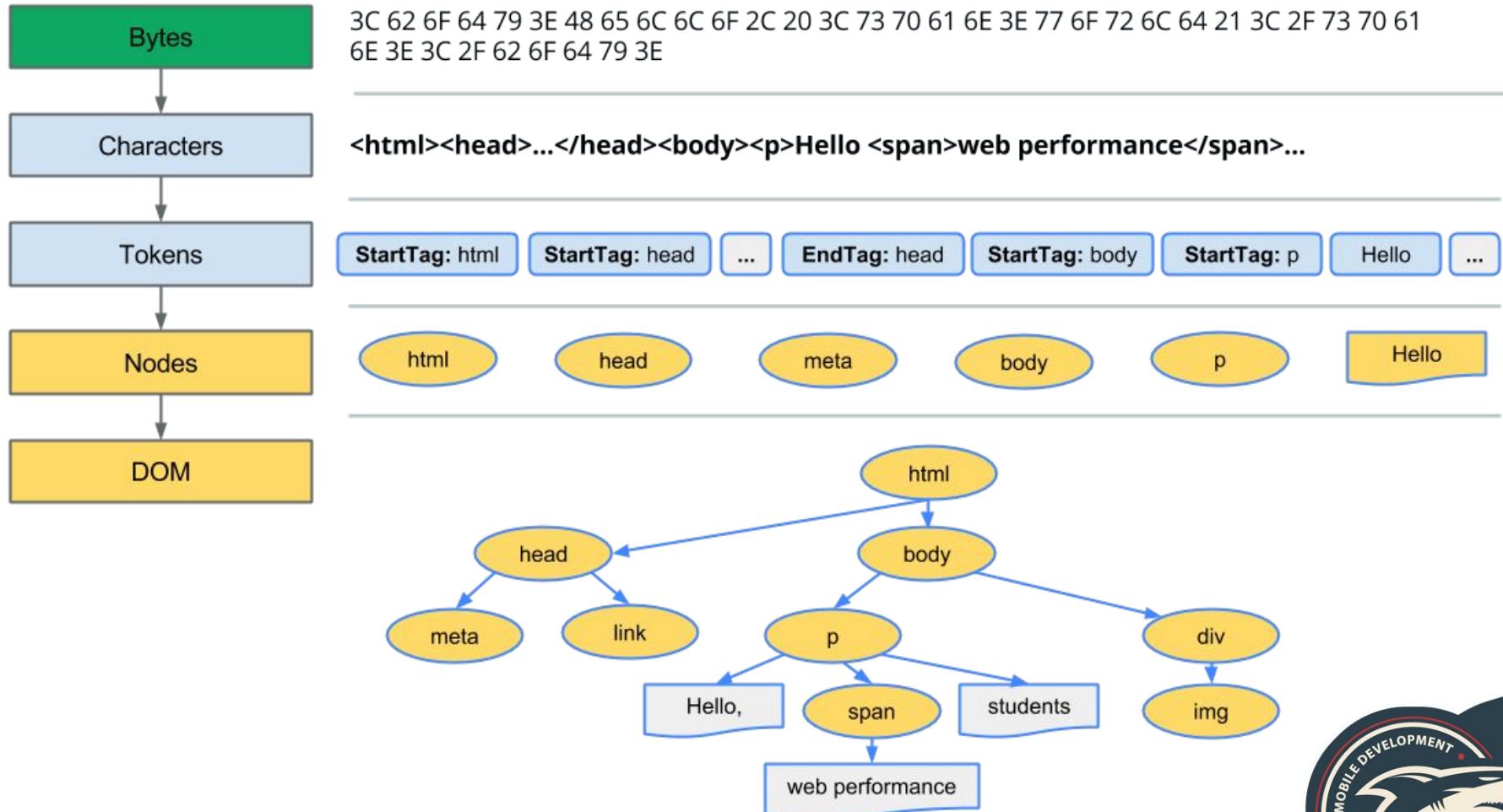
WebKit main flow



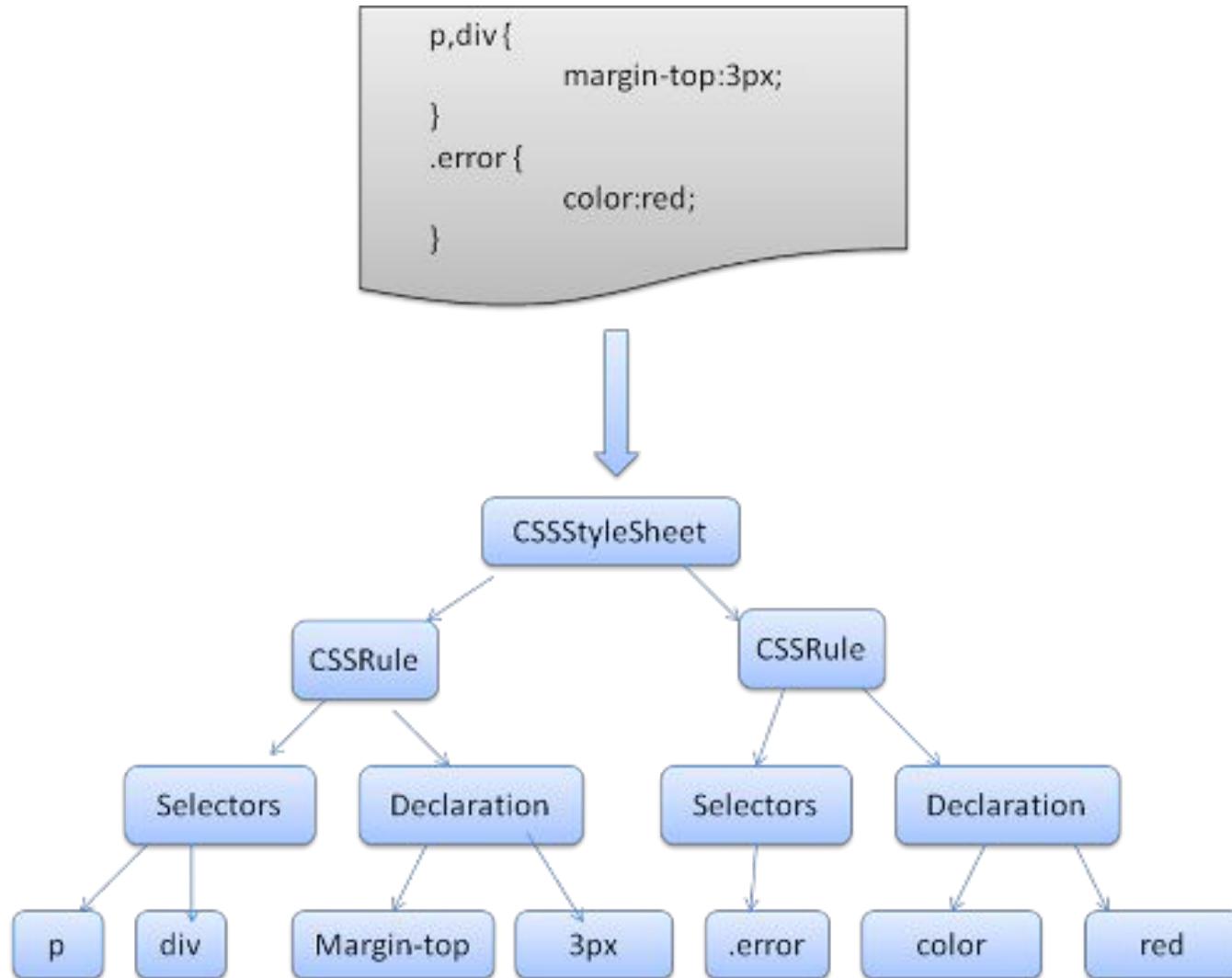
Mozilla's Gecko rendering engine main flow



HTML parsing - DOM

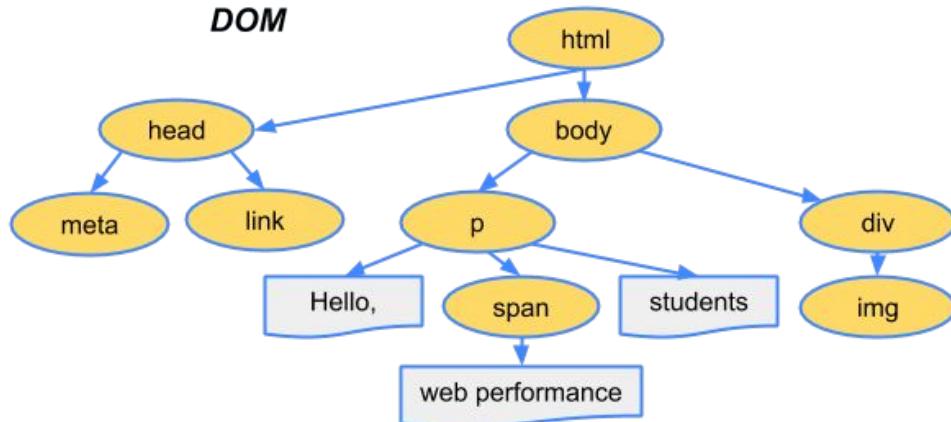


CSS Parsing - CSSOM

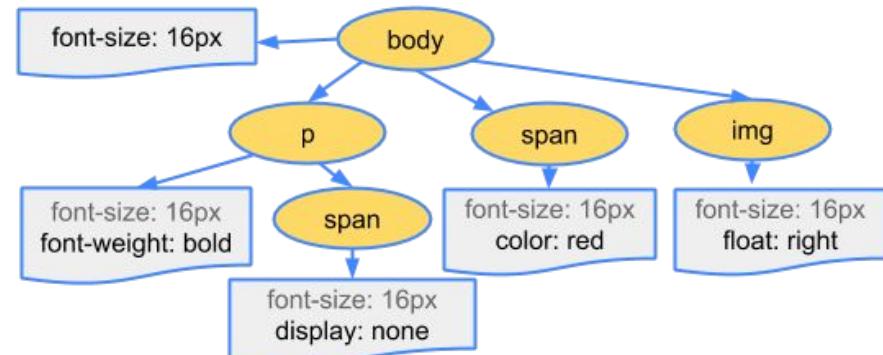


Render tree

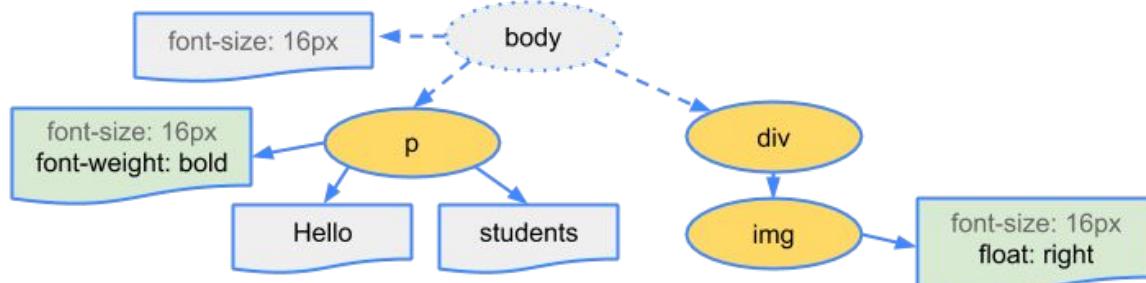
DOM



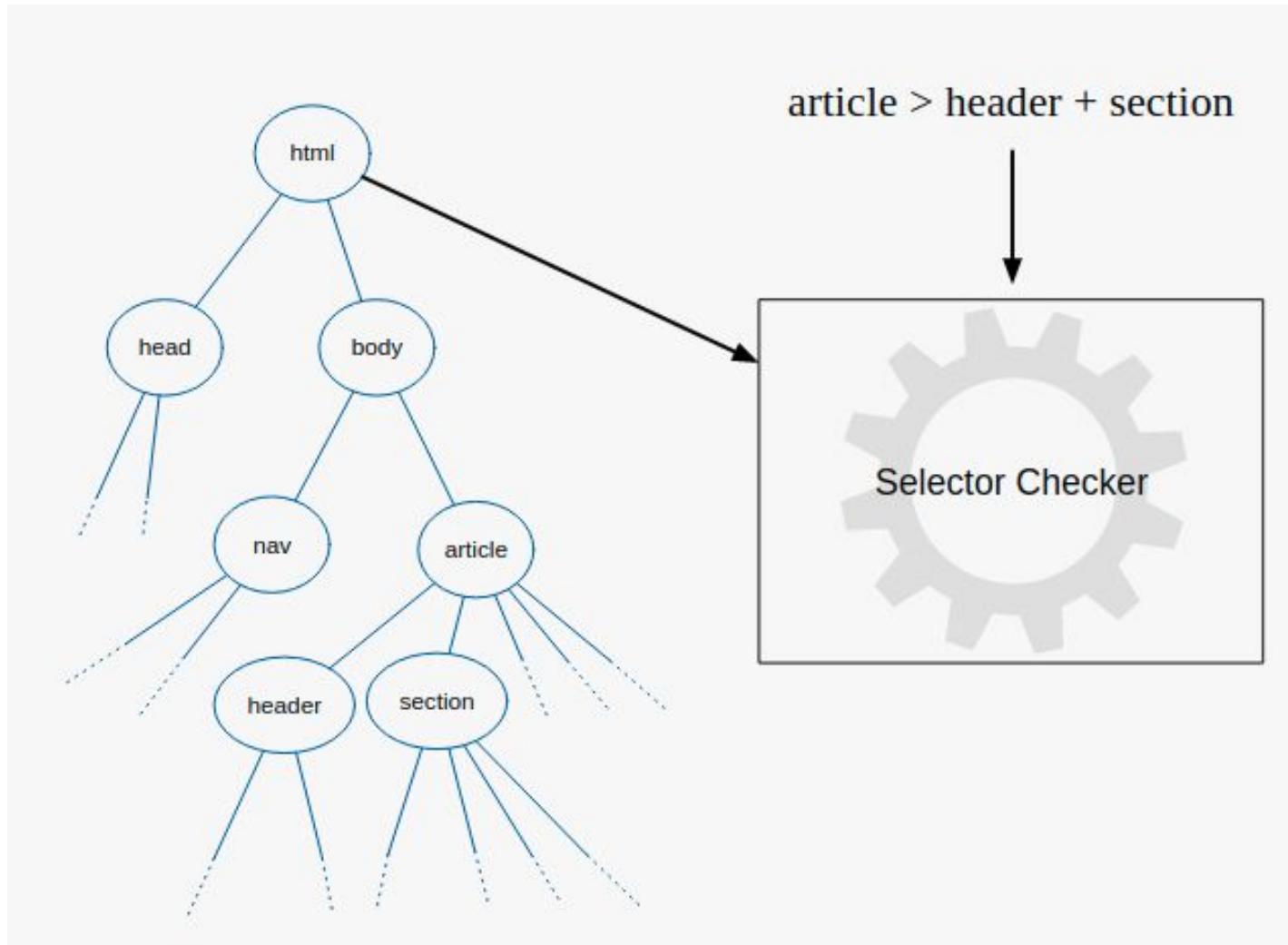
CSSOM



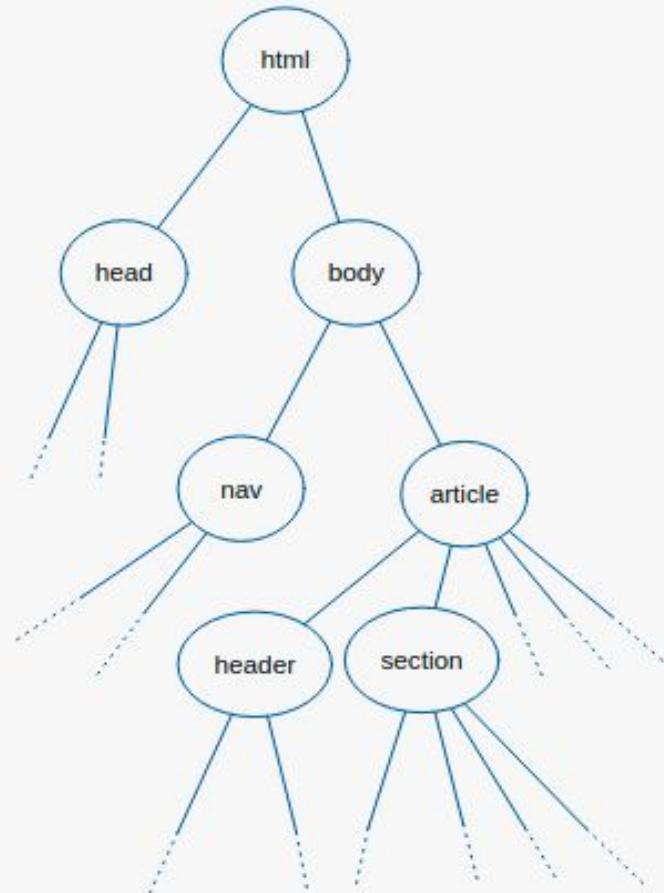
Render Tree



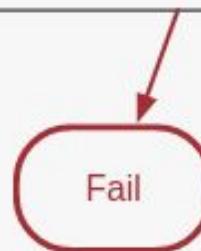
Selector Checker



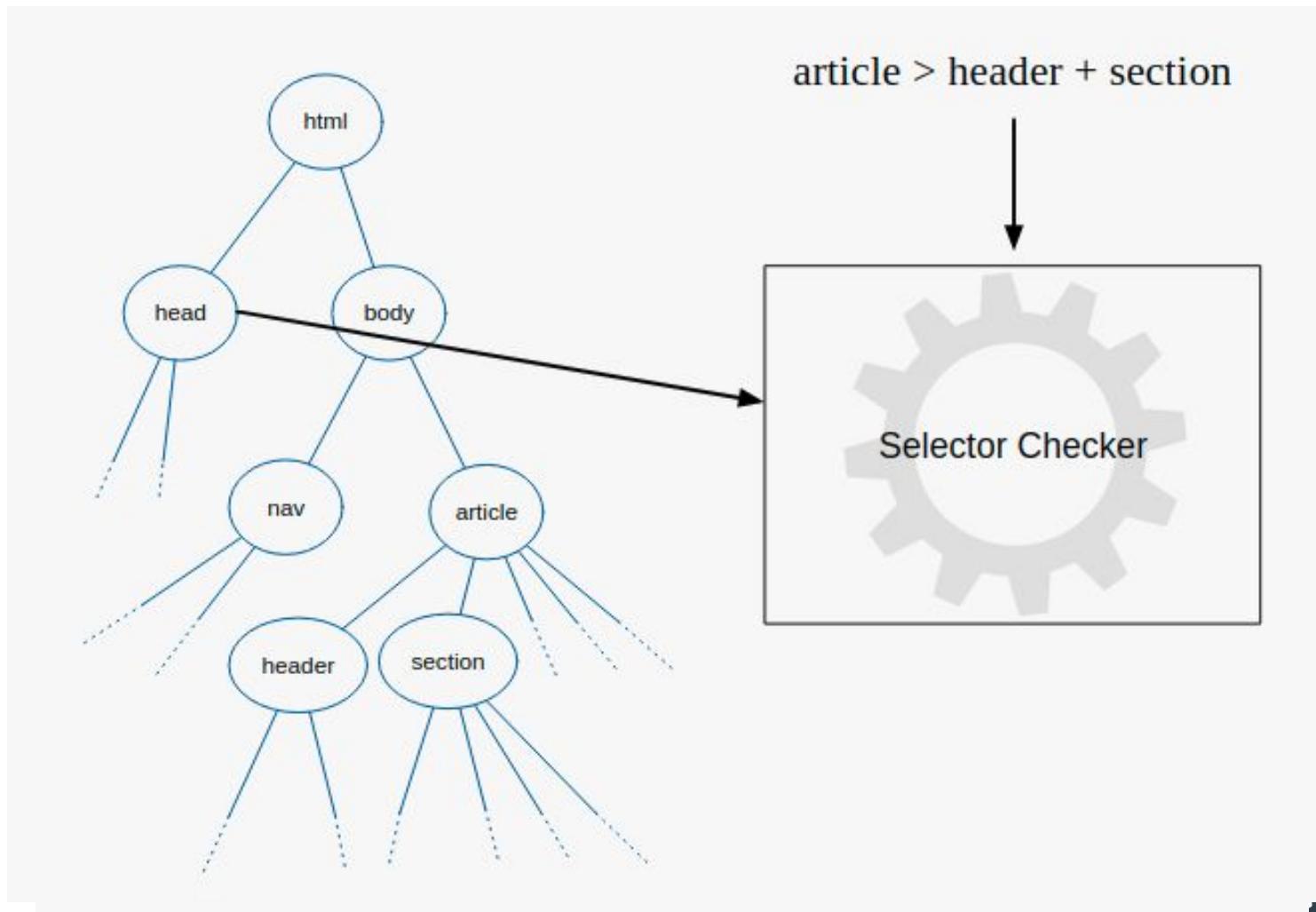
Selector Checker



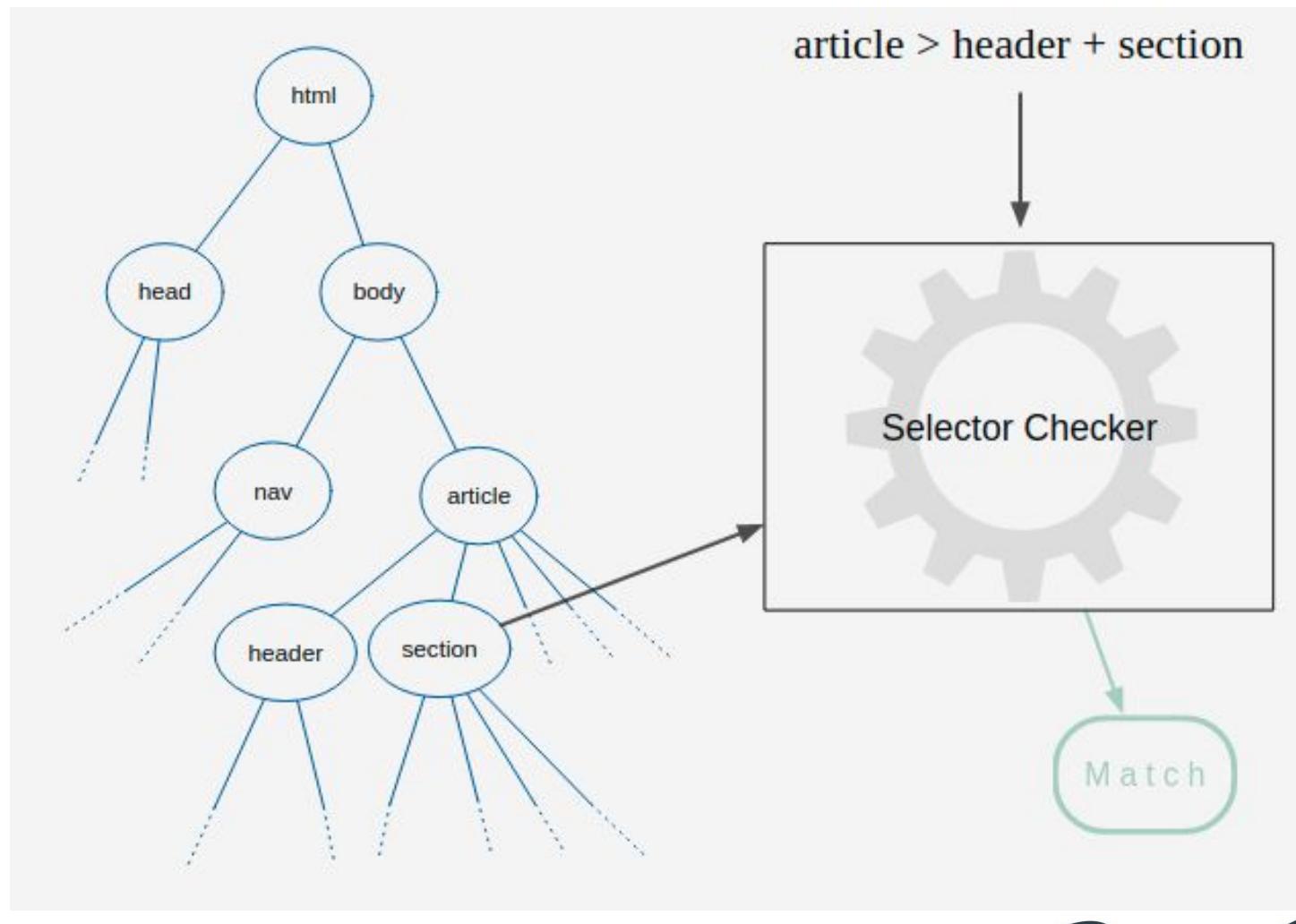
article > header + section



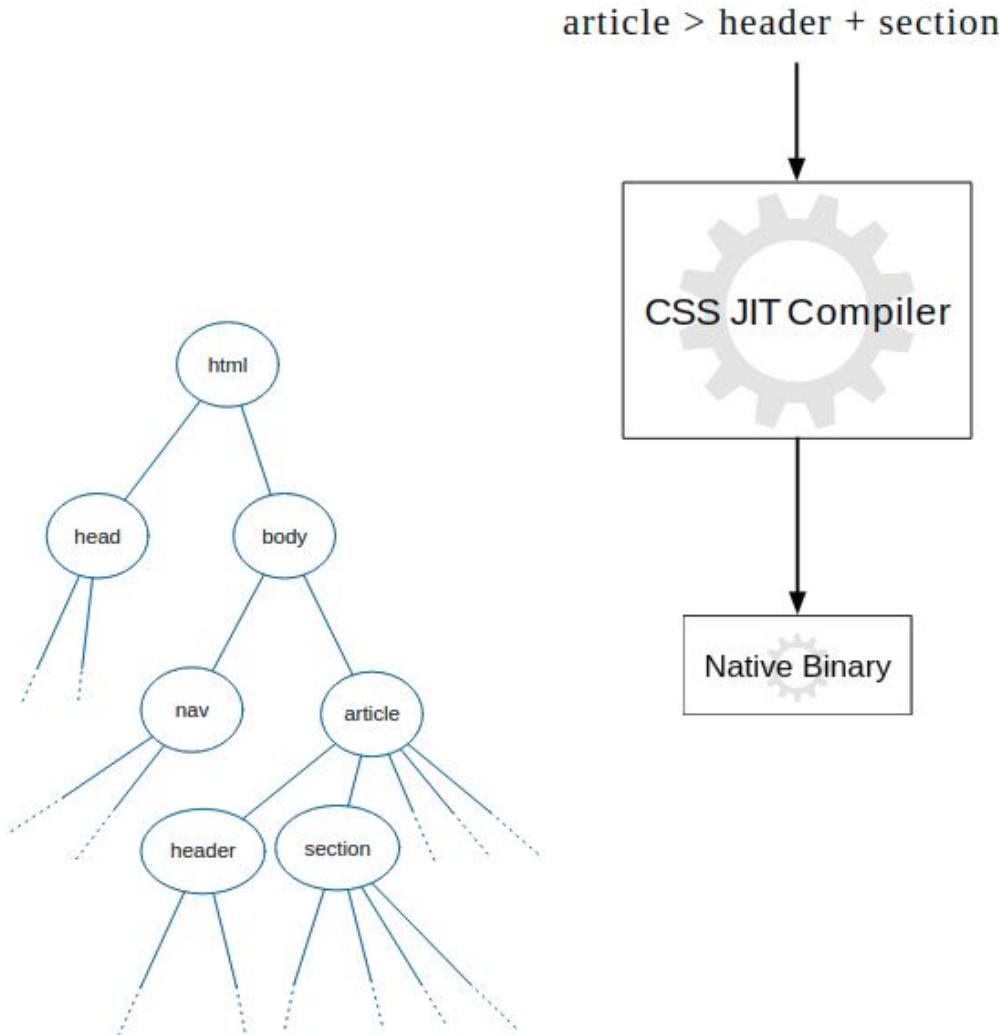
Selector Checker



Selector Checker

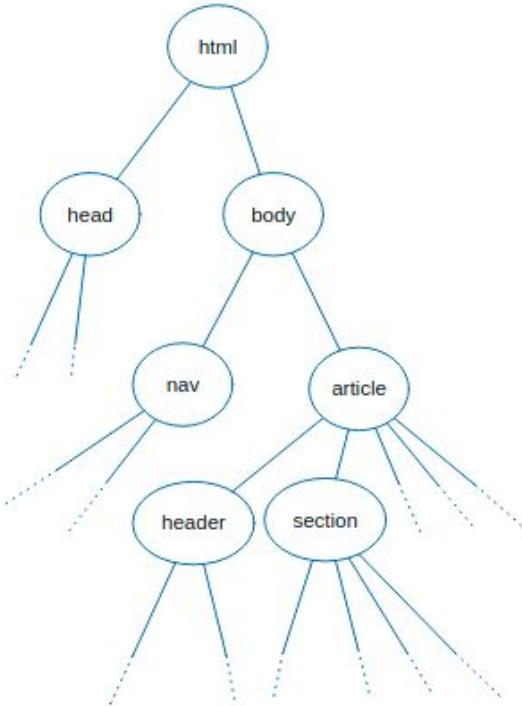


The Selector JIT Compiler



The Selector JIT Compiler

article > header + section

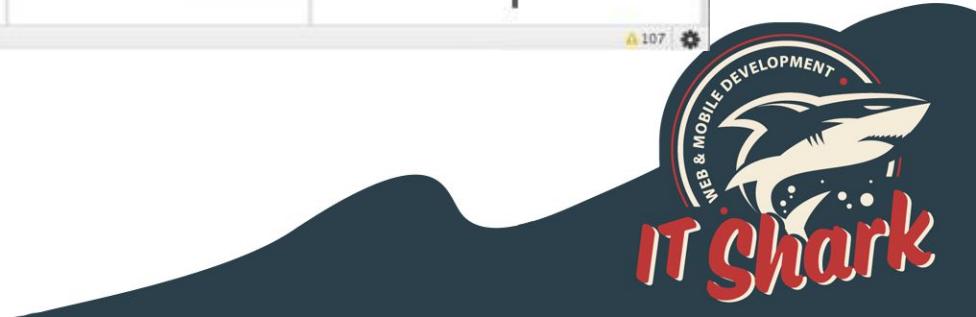
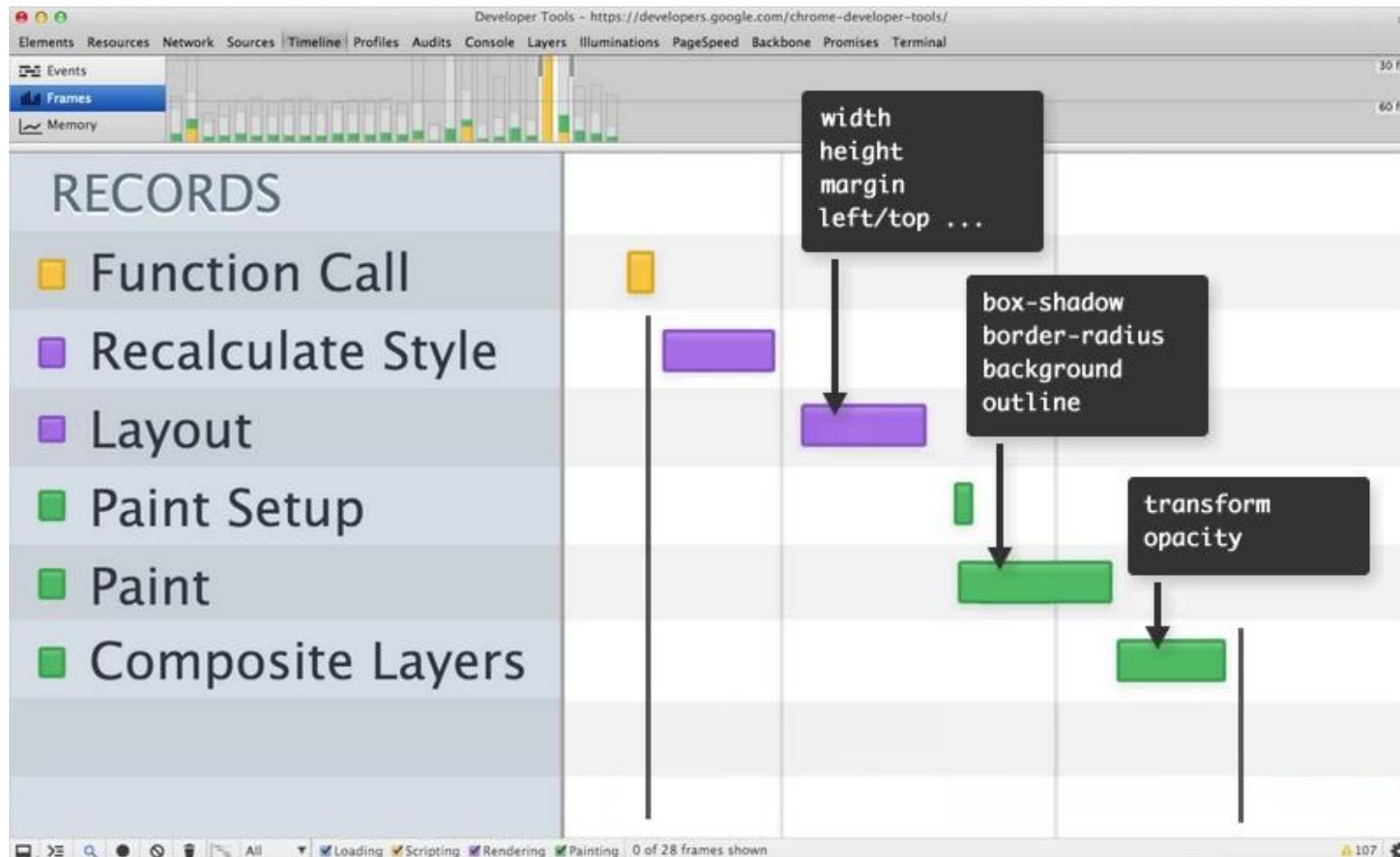


CSS Performance Test

Selector	Chrome
1. id	271.9ms
2. tag	267.2ms
2. classname (same)	355.8ms
3. classname (diff)	263.8ms
4. attributes	1069.7ms
5. attribute with value	1062.9ms

Selector	Chrome
1. tag & id	277 ms
2. tag & classname (same)	363.6ms
3. tag & classname (diff)	281.6ms
4. tag & attributes	1192.3ms
5. tag & attribute with value	1234.9ms

Reflow & Repaint

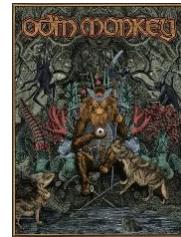


JS Engines



V8
Crankshaft

- [V8 JavaScript Engine](#)



Spider
Monkey

- [Mozilla SpiderMonkey](#)



Chakra

- [Architecture Overview](#)

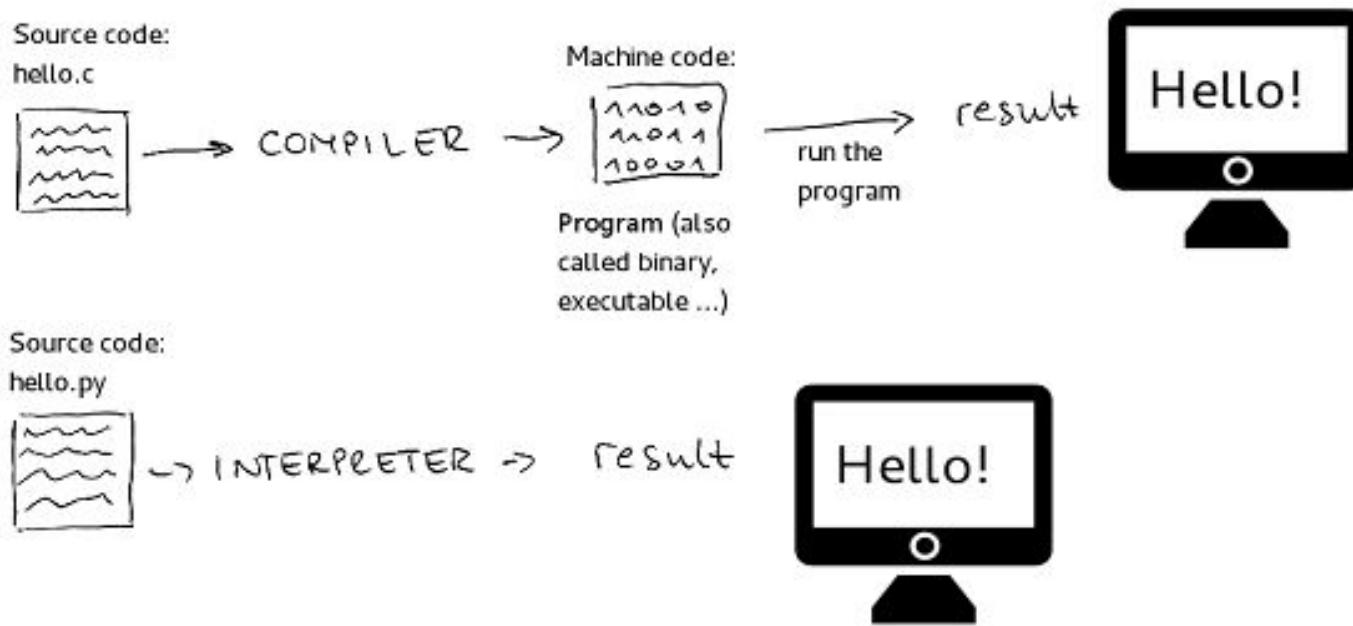


Nitro

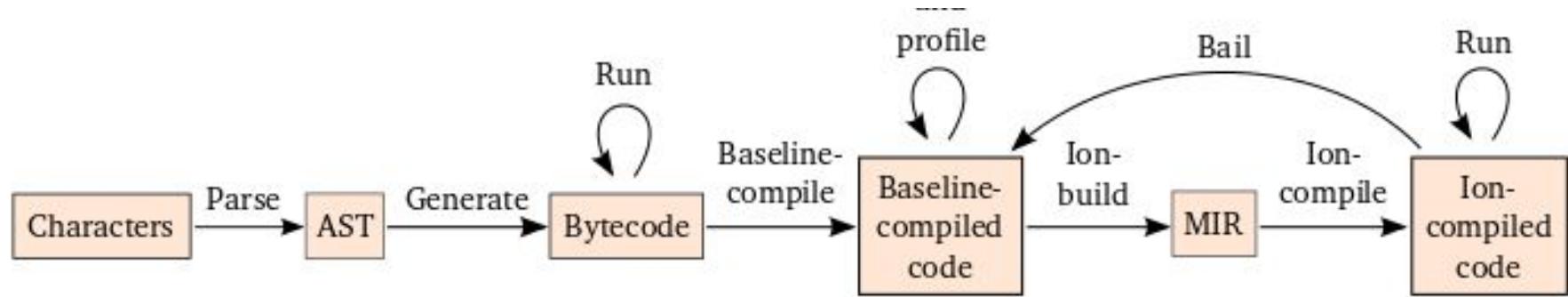
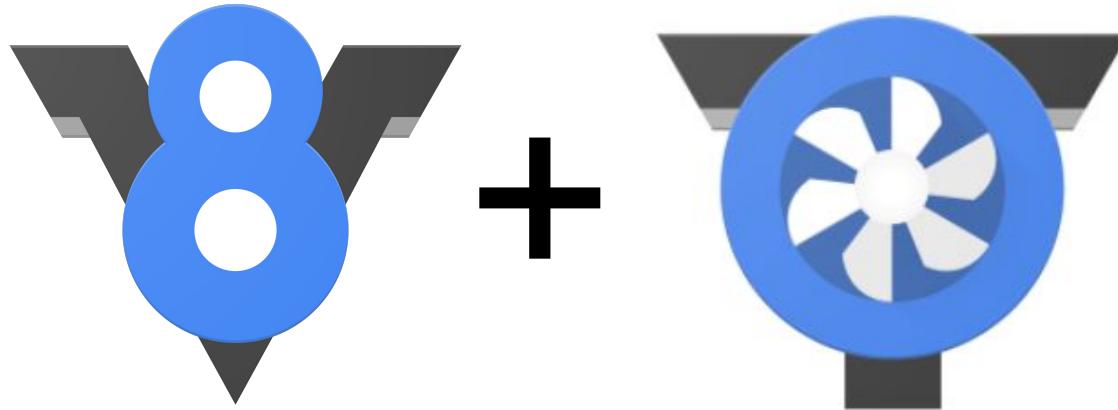
- [JavaScriptCore](#)

[Performance Comparison](#)

Compilation & Interpretation



JIT Compiler



<https://blog.mozilla.org/luke/2014/01/14/asm-js-aot-compilation-and-startup-performance/>

JIT Compiler

Statically typed languages

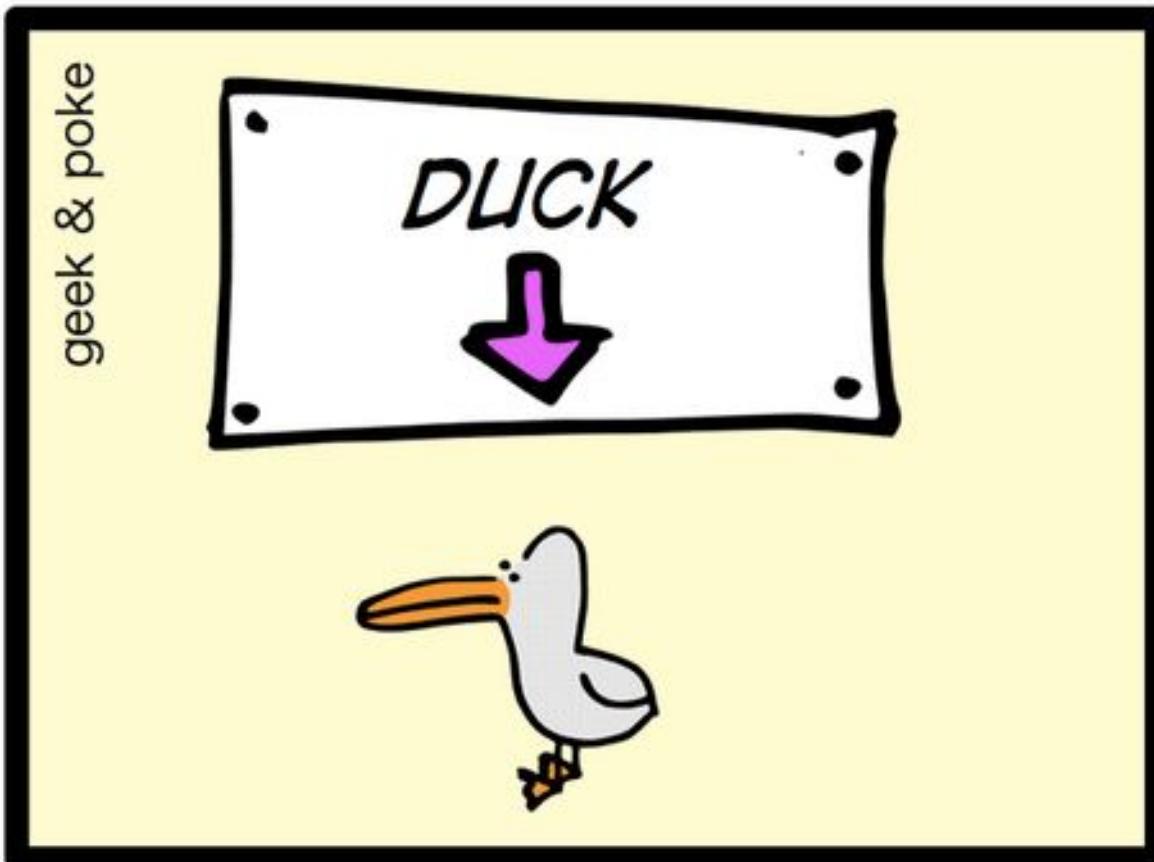
Java, C, C++

Dynamically typed languages

Javascript, Ruby, Python



Duck typing

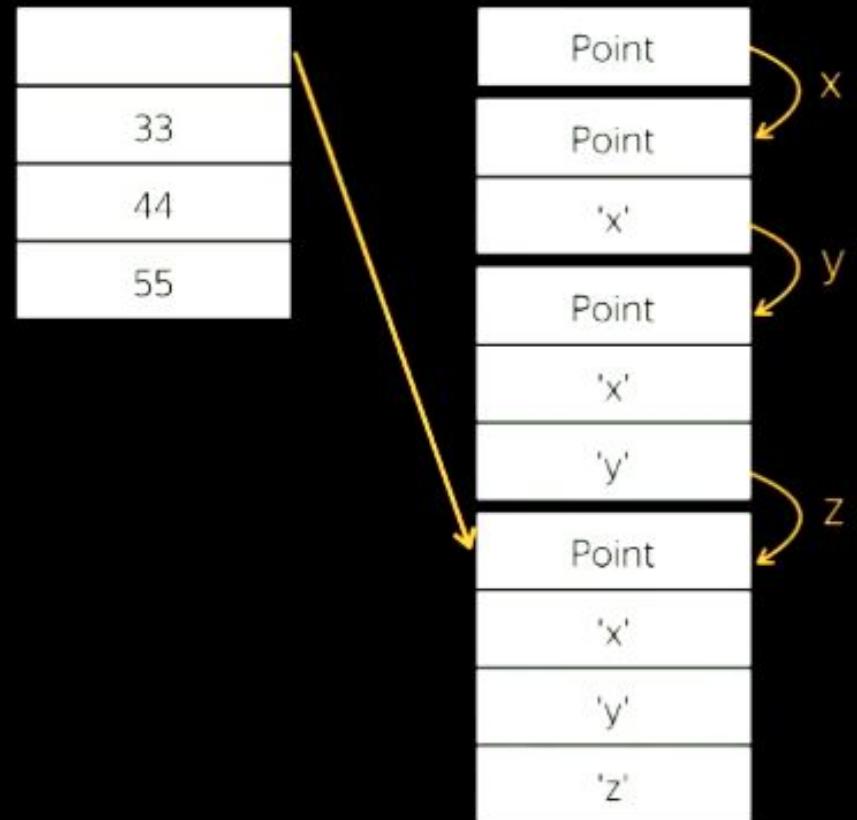


STATICALLY TYPED DUCK

Hidden classes

```
function Point(x, y) {  
    this.x = x;  
    this.y = y;  
}
```

```
var p1 = new Point(11, 22);  
var p2 = new Point(33, 44);  
p2.z = 55;  
// Теперь p1 и p2 имеют разные hidden  
classes
```



How to start learning frontend:

- <https://developer.mozilla.org/en-US/Learn>
- <https://developers.google.com/web/>
- How browsers work:
<http://www.html5rocks.com/en/tutorials/internals/howbrowserswork/>



*What Every Web Developer Should Know About
Networking and Browser Performance*



High Performance

Browser Networking

O'REILLY®

Ilya Grigorik

Ilya Grigorik

High Performance Browser Networking



"The Missing Manual series is simply the most intelligent and usable series of guidebooks..."

—KEVIN KELLY, CO-FOUNDER OF WIRED

HTML5

the missing manual®

The book that should have been in the box.

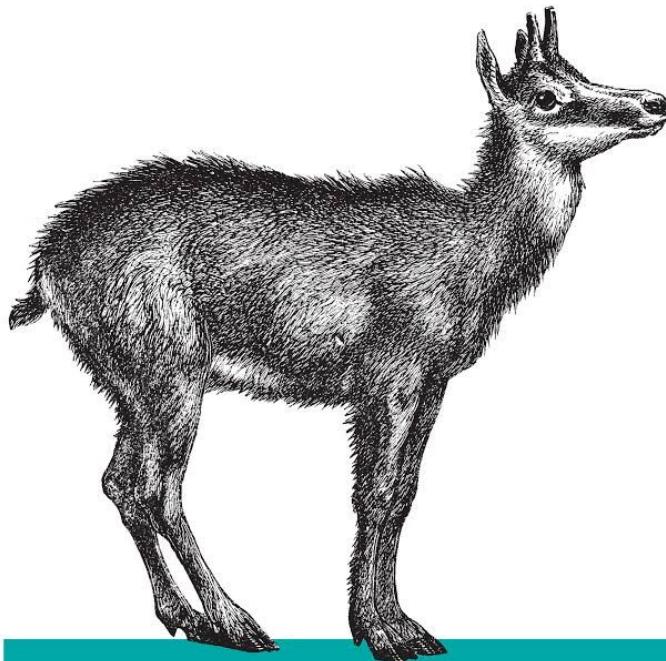
Second
Edition



O'REILLY®

Matthew MacDonald

Dive into the Future of Web Development



HTML5

Up and Running

O'REILLY® | Google™ PRESS

Mark Pilgrim



"The Missing Manual series is simply the most intelligent and usable series of guidebooks..."

—KEVIN KELLY, CO-FOUNDER OF WIRED

CSS3

the missing manual®

The book that should have been in the box®

Fully Revised
3rd Edition



O'REILLY®

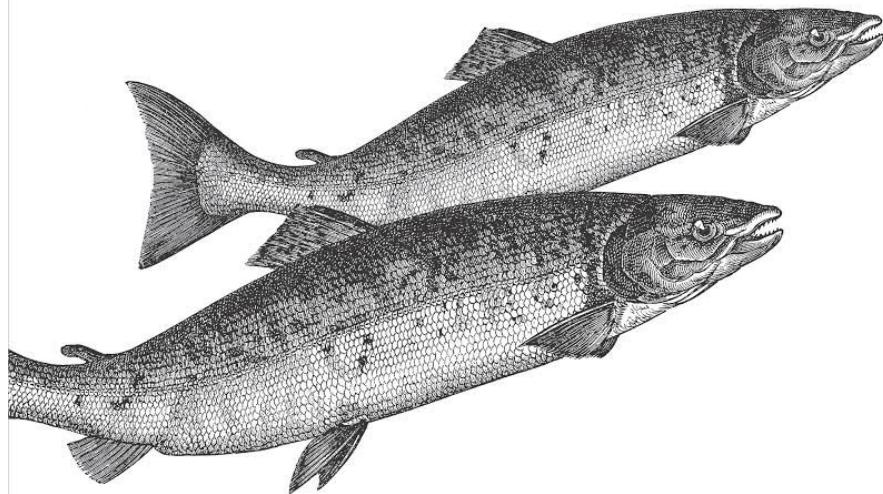
David Sawyer McFarland

Visual Presentation for the Web

3rd Edition

CSS

The Definitive Guide



O'REILLY®

Eric Meyer



O'REILLY
"With you there's no compromise and you can create better work and service better than you do. The code is great, it's clean, it's easy to read. It's just craft. This is why I'm so excited about O'REILLY's 'You Don't Know JS' series."

KYLE SIMPSON

UP &
GOING

JS
YOU DON'T KNOW

O'REILLY
"You are an unlikely hero and every day of my workshop you come up with any material and general questions." —CHRIS BOSCH, American Facebook website developer

KYLE SIMPSON

SCOPE &
CLOSURES

JS
YOU DON'T KNOW

O'REILLY
"The first functional and prototypes are practical because they are fundamental to doing real programming with JavaScript." —ANDREW BRAY, Senior JavaScript, API Engineer, GitHub

KYLE SIMPSON

this & OBJECT
PROTOTYPES

JS
YOU DON'T KNOW

O'REILLY
"An excellent book at the core, useful for programmers that want to understand how and why their code works and how to make it better." —JONATHAN WALKER, Senior Web Developer, Mozilla

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TYPES &
GRAMMAR

JS
YOU DON'T KNOW

O'REILLY
"Each chapter has a wonderful range of practical and useful exercises to help you learn in an applied and real-world context and perspective." —MARK DRABBLER, CEO & CTO, Devbridge, Freshcode, Reverb

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ASYNC &
PERFORMANCE

JS
YOU DON'T KNOW

O'REILLY
"I could have never imagined in my wildest dreams that a reference would be available." —ADRIEN BRÉARD, Author, Engineer, and Lead Frontend Developer at Mozilla France. Former Lead Software Engineer at Mozilla.

KYLE SIMPSON

ES6 &
BEYOND

JS
YOU DON'T KNOW

Kyle Simpson

You don't know JS

<https://github.com/getify/You-Dont-Know-JS>



Frontend video courses

- <https://academy.yandex.ru/events/shri/ekb-2013/>
- <https://academy.yandex.ru/events/shri>
- <https://park.mail.ru/materials/video/#9>
- <https://frontendmasters.com/> (commercial)
- <https://www.youtube.com/playlist?list=PLEzQf147-uEpvTa1bHDNlxUL2klHUMHJu> Douglas Crockford channel



QUESTIONS?