



INTRODUCTION TO WEB TECHNOLOGIES

Web Tech
SET08101

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TL/DR



- Before we can go anywhere, we should really know how we got here. So we'll:
 - Consider a potted history
 - Overview the Chrome DeveloperTools
 - Think about deployment
- Essentially: An overview of the basic things we need to know to understand how it all fits together

AIMS

- At the end of this (sub-section) of the topic you will be able to:
 - Understand the variety of technologies, tools, languages, and protocols that make up the web



OVERVIEW: THE WEB, COMMUNICATION, PROTOCOLS, SERVERS, & CLIENTS

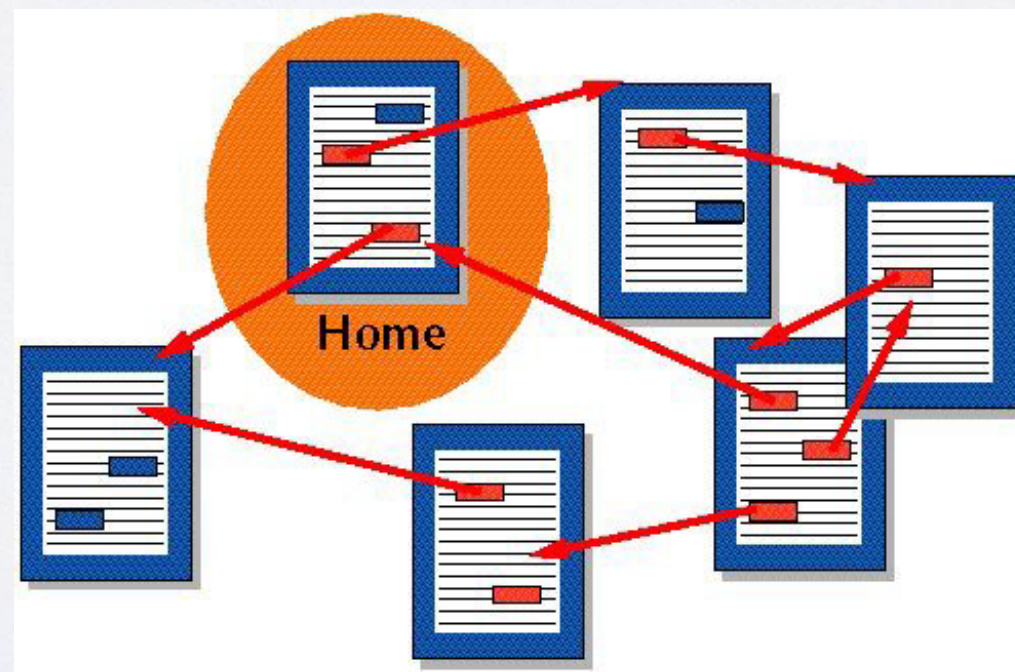


COMMUNICATION

- Protocols are agreements for how to communicate
- Computer protocols are agreements specified with enough clarity that a computer can follow them
- The Internet & web are really just communication methods
- Specifically, a **Hypermedia** system

HYPERTEXT/HYPERMEDIA

- Coined by Ted Nelson in ~1965
- Text displayed on an electronic device that incorporates references, called **Hyperlinks**, to other text.
- Text becomes *non-linear* as a result
- One implementation of the hypertext idea is in **HTML**



INVENTION OF THE WEB

- Invented in 1989 by Sir Tim Berners-Lee
- First web browser written in 1990
- Originally seen as a way to share scientific research
- Text formatted using HTML & communicated using HTTP
- Builds on existing protocols that underpin the **Internet**





THE INTERNET

- A global system of interconnected computer networks
- Built on shared & agreed protocols - the Internet Protocol suite (TCP/ IP)
- Dates back to research in the 1960's commissions by the US government



INTERNET PROTOCOLS

- **Application Layer:** DNS, HTTP, IMAP, POP
- **Transport Layer:** TCP
- **Internet Layer:** IP
- **Link Layer:** Ethernet



HTTP

- An application layer protocol for distributed and collaborative **hypermedia/hypertext** systems.
- Request-response protocol that uses the client-server model.
- Client (browser) makes a request. HTTP server (software running on an Internet connected computer) listens and responds according to the protocol.
- HTTP Session - a sequence of request-response transaction transmitted over TCP.
- Request Methods: HTTP verbs, e.g. GET, HEAD, POST, PUT, DELETE, OPTIONS, PATCH



HTML

- **HyperText Markup Language**
- A **language** for turning **text** into **hypertext** using **markup**
 - **Text** - strings (sequences of characters) encoded using an agreed format (Generally UTF8)
 - **Language** - Means for communication.
 - **Hypertext** - Links between text
 - **Markup** - HTML uses Tags, generally placed around the element being tagged, e.g.

<h1>Hello</h1>

- Explore the [Mozilla Developer Docs](#) to find out more



SERVERS

- A piece of software that runs on a computer
- Listens for messages & calculates the right response to make
- A server is a piece of software that uses a particular protocol
 - A web server listens for messages that are sent using web protocols (HTTP)
- *If a server is listening then what is doing the speaking?*



WEB CLIENTS

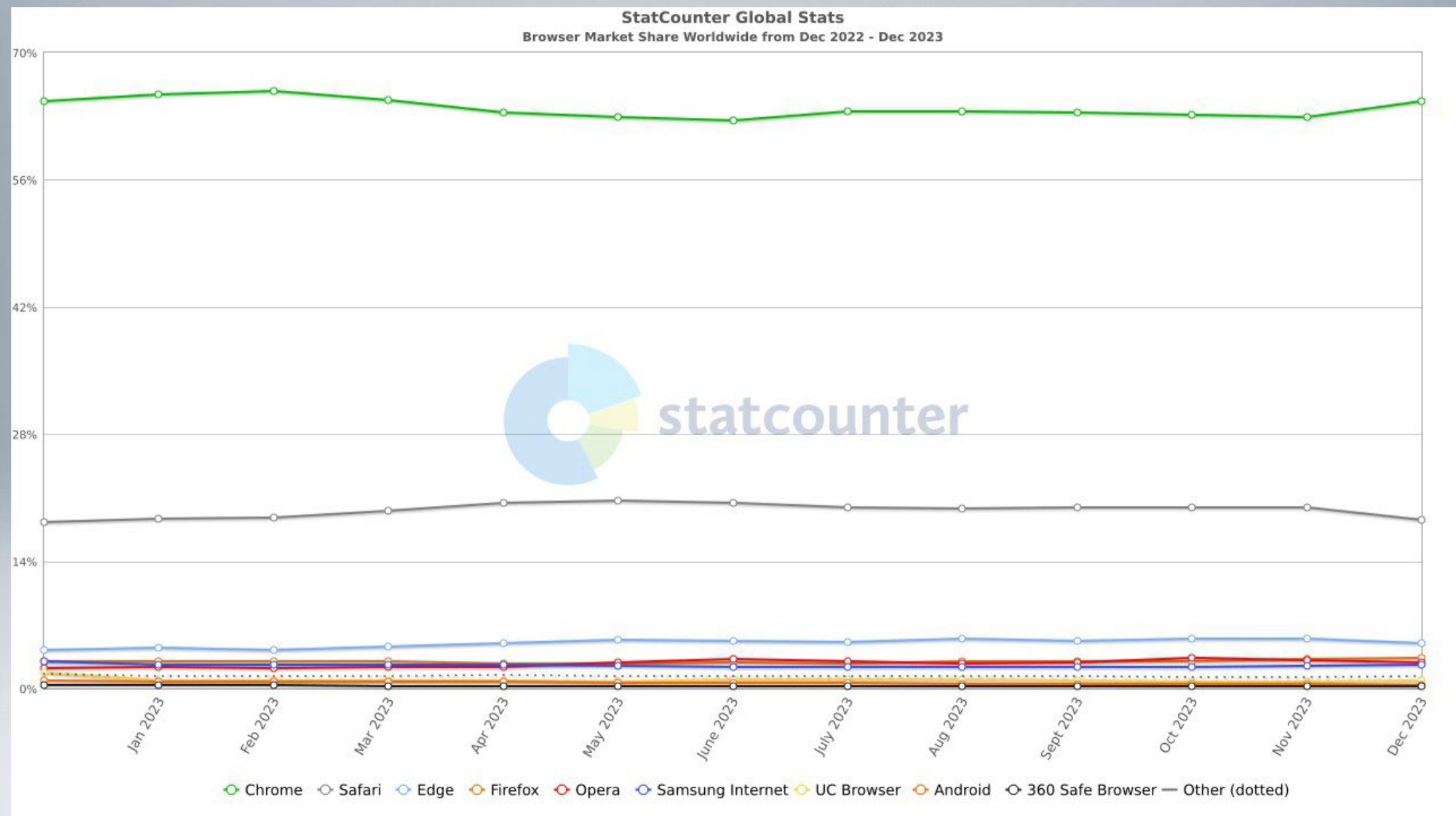
- Another piece of software (nothing particularly special)
- Known as a user agent
- Sends messages from an Internet connected machine (host) to a server that listens, interprets the request & generates an appropriate response:
 - e.g. a **web browser** making a **request** to a **web server** using **HTTP**



WEB BROWSERS

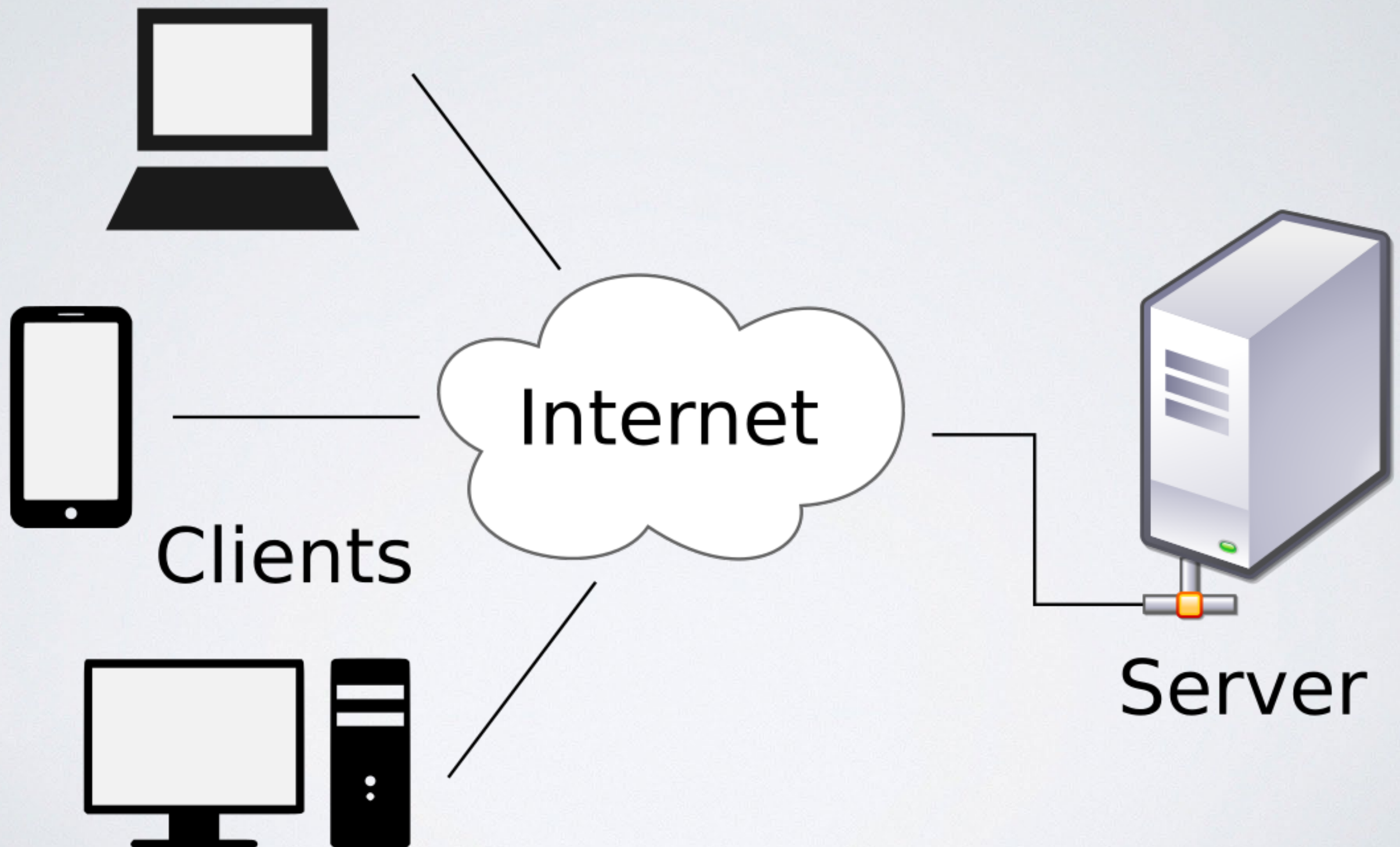
- Software containing a layout engine that *renders* web pages (HTML)
- Used to navigate the web but also private networks, IoT interfaces, local file systems.
- Have become a default cross-platform environment so also now used for desktop GUIs

BROWSER MARKET SHARE



<https://gs.statcounter.com/>

CLIENT-SERVER MODEL





HTML INSIDE THE BROWSER

- HTML represented within the browser using the **DOM**
- **Document Object Model**
- HTML is parsed into a tree data structure to construct the DOM (for that document)
 - Each node is an object representing part of the document
 - Objects can be manipulated programmatically
- HTML displayed in developer tools is a representation of the DOM



DEVELOPER TOOLS

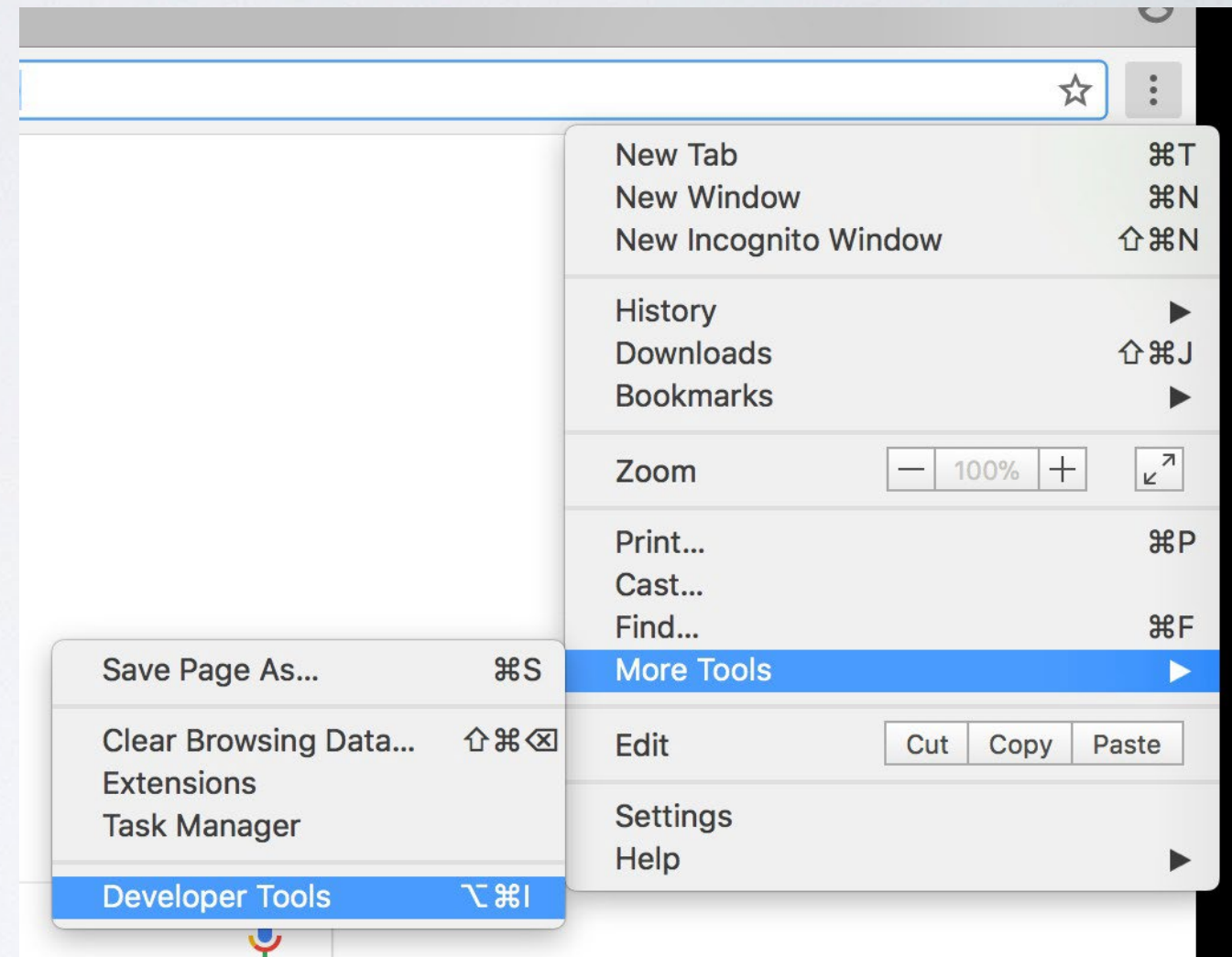


BROWSER DEVELOPER TOOLS

- Browser: Chrome, Chromium, Firefox, Safari, Opera, IE/Edge
- Common Features of Developer Tools:
 - HTML & DOM viewers & editors
 - Web page assets, resources, network information
 - Profiling & Auditing
 - JavaScript Debugging & Console
- Text Editors: Sublime, Notepad++, Atom, Brackets, Vim

CHROME DEVELOPER TOOLS

- (Currently) Very popular - also pioneers new ideas & directions for the future of the web
- Fast. Stable, Feature Rich. Many tools to support developers



Google

Secure

https://www.google.eo.uk/webhp?hl=en&sa=X&ved=0ahUKEwiekpObqoLZAhUDbRQKH...aY0AhIQPAgD

Elements

Console

Sources

Network

Performance

Memory

Application

Security

Audits

<!DOCTYPE html>

<html itemscope itemtype="http://schema.org/WebPage" lang="en-GB">

<head>...</head>

<body class="hp vasq" onload="document.f&&document.f.q.focus(); document.gbqf&&document.gbqf.q.focus(); if (document.images) new Image().src="/images/nav_logo242.png" id="gsr">= \$0

<div class="ctr-p" id="viewport">...</div>

<script src="/xis/ /is/k=xis,s.en GB.w-UfDns3csq.O/ m=d3l.udlgaa.abdasync.dvl.foot..csi/rt=i/d=l/ed=l/t=zcms/ rs=ACT90oHipyPPnMAGCgesBmDPlcimXUiWw?xis=sl" async gapi_processed;::"true"></script>

<iframe src "https://clients5.google.com/pagead/drt/dn/" aria hidden;::"true" style;::"display: none;">...</iframe>

</body>

</html>

Styles

Computed

Event Listeners

>>

Filter

:hov .els +...

element.style {

}

body, html { webhp?hl=en&sa=...aY0AhIQPAgD: 11

font-size: small;

}

body { webhp?hl=en&sa=...aY0AhIQPAgD: 11

background: #fff;

color: #222;

}

body, td, a, p, .h { webhp?hl=en&sa=...aY0AhIQPAgD: 11

font-family: arial,sans-serif;

}

html, body { webhp?hl=en&sa=...aY0AhIQPAgD: 11

height: 100%;

margin: 0;

}

body { user agent stylesheet

display: block;

margin: 0;

}

Inherited from html

body, html { webhp?hl=en&sa=...aY0AhIQPAgD: 11

font-size: small;

}

margin

border

padding

533 x 801

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Advertising

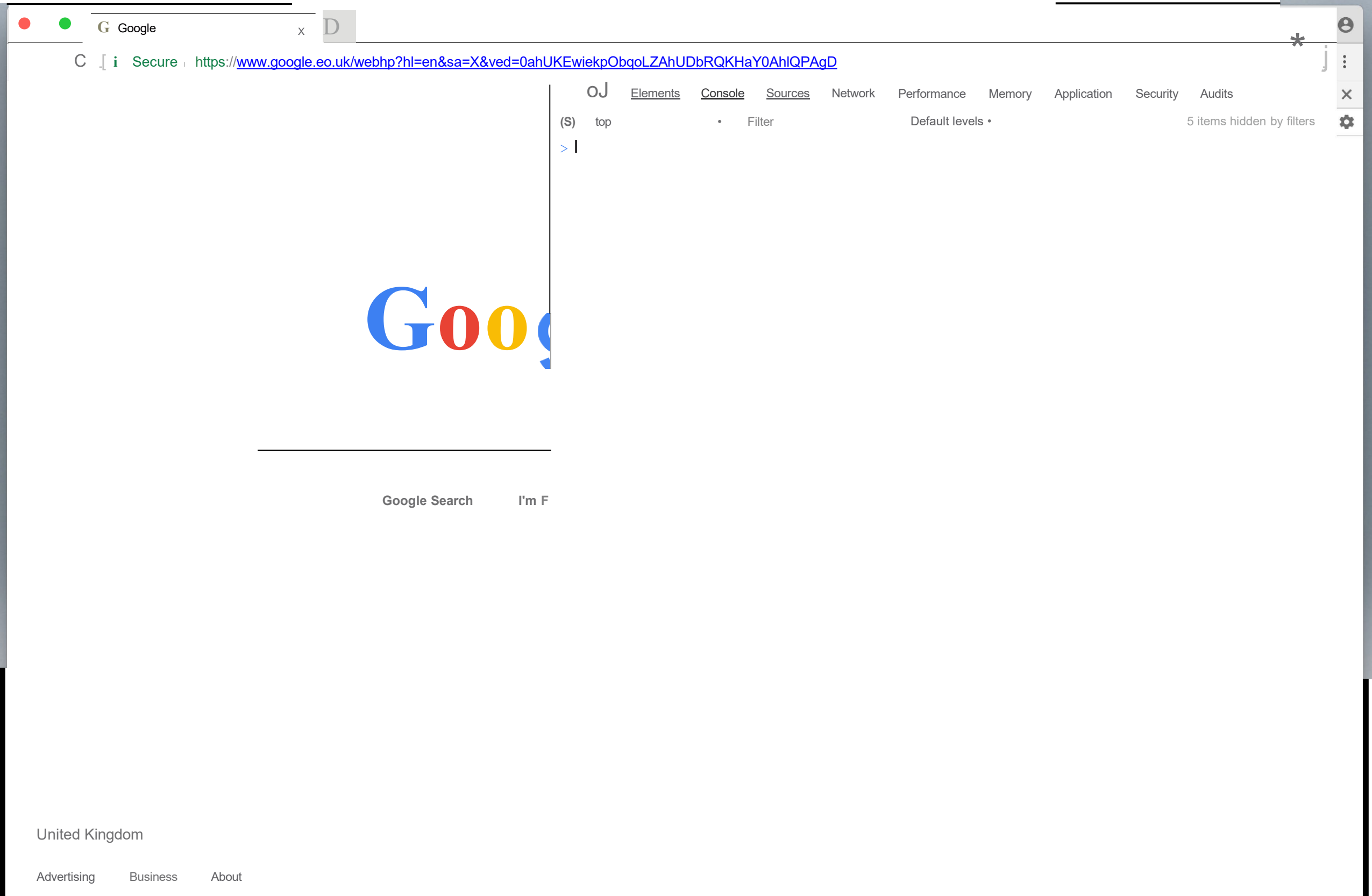
Business

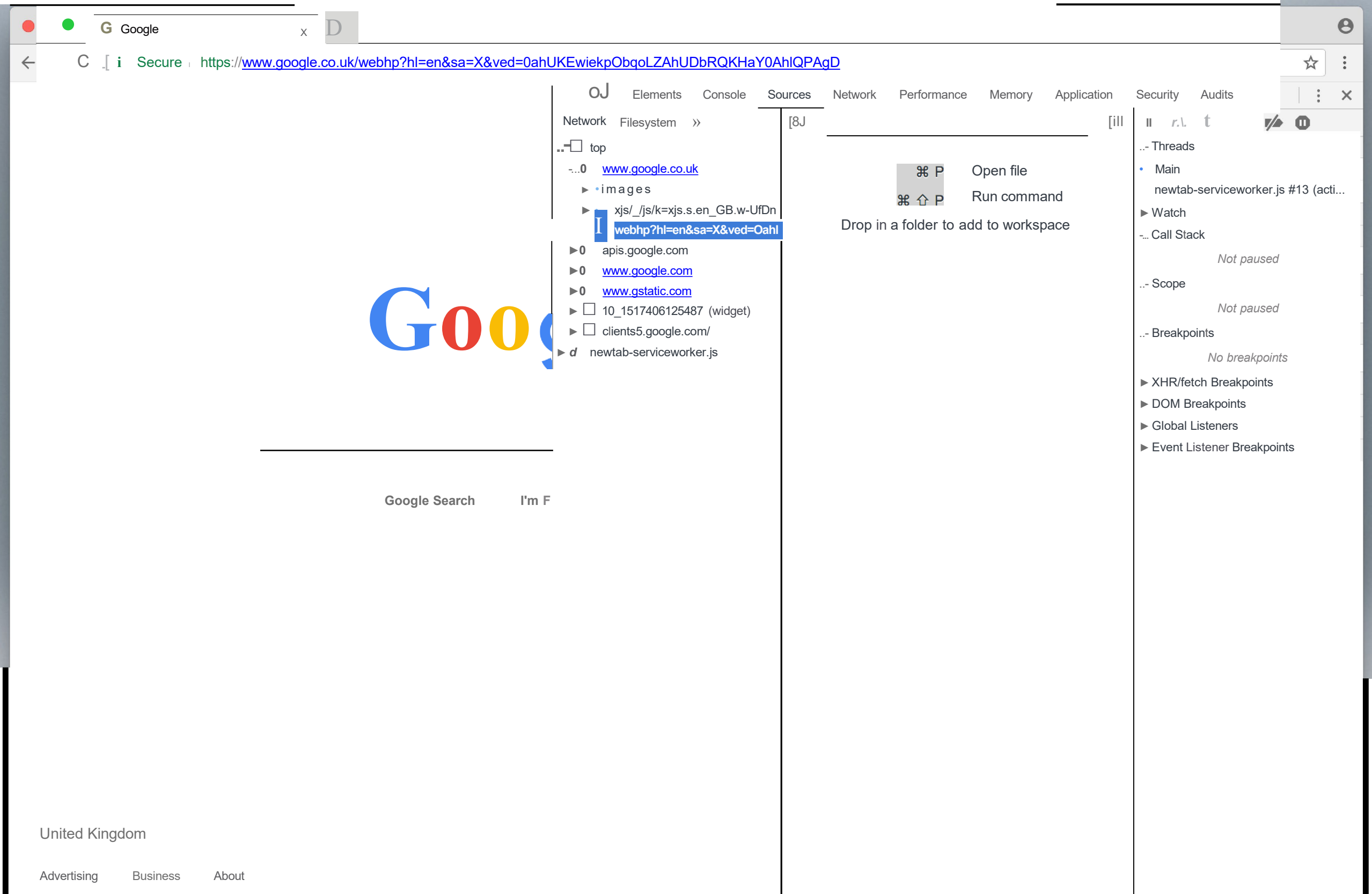
About

html

body#gsr.hp.vasq

Google Search I'm F





Google

Secure

https://www.google.eo.uk/webhp?hl=en&sa=X&ved=0ahUKEwiekpObqoLZAhUDbRQKH...Y0AhIQPAgD

Elements

Console

Sources

Network

Performance

Memory

Application

Security

Audits

Filter

Hide data URLs

XHR

JS

CSS

1mg

Media

Font

Doc

WS

Manifest

Other

10ms

20ms

30ms

40ms

50ms

60ms

?Oms

80ms

90ms

100ms

110ms

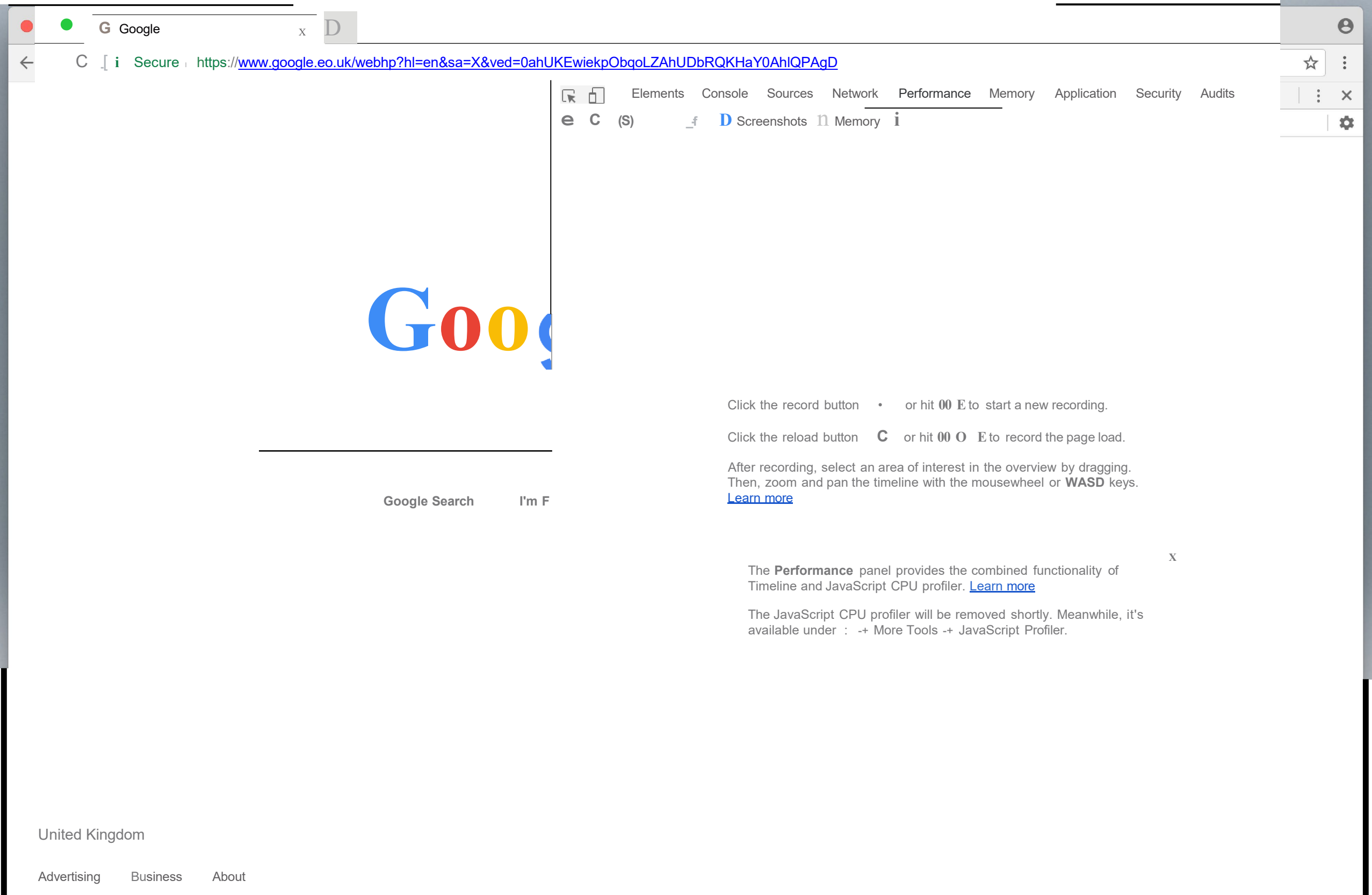
Name	Status	Type	Initiator	Size	Time	Waterfall
googlelogo_color_272x92dp.png	200	png	webhi;i?hl=en&s...	(from di...	30 ms	
data:image/gif;base...	200	gif	webhi;i?hl=en&s...	(from m...	Oms	
gen_204?s=webaft&atyp=csi&ei=...	204	text/html	webhi;i?hl=en&s...	40 B	51 ms	
nav_logo242.png	200	png	webhi;i?hl=en&s...	(from m...	Oms	
rs=ACT90oHlpyPPnMAgCgesBm...	200	script	webhi;i?hl=en&s...	(from di...	9ms	
tia.png	200	png	rs=ACT90oH lpj'....	(from m...	Oms	
data:image/png;base...	200	png	rs=ACT90oH lpj'....	(from m...	Oms	
data:image/gif;base...	200	gif	rs=ACT90oH li;j'....	(from m...	Oms	
rs=ACT90oHlpyPPnMAgCgesBm...	200	script	rs=ACT90oH lpj'....	31.5 KB	110 ms	
search?client=psy-ab&hl=en-GB...	200	xhr	rs=ACT90oH lpj'....	221 B	147 ms	
rs=AA2YrTuYBNXi2WfsWOZ7Bw...	200	script	webhi;i?hl=en&s...	(from di...	6ms	
dn/	200	document	rs=AA2YrTuYBN ...	140 B	73 ms	
cb=gapi.loaded_0	200	script	rs=AA2YrTuYBN ...	(from di...	50 ms	
count	200	xhr	rs=AA2YrTuYBN ...	535 B	239 ms	
gen_204?atyp=csi&ei=pBdxWvXy...	204	text/html	rs=ACT90oH lpj'....	38 B	96 ms	
ui	204	text/html	rs=ACT90oH lpj'....	43 B	92 ms	
dn.js	200	script	(index)	(from di...	66 ms	
widget?sourceid=1&hl=en&origin ...	200	document	cb=gai;ii.loaded...	229 KB	8ms	
rs=AGLTcCNZF80mC5Rwal4mvp...	200	xhr	/ /scs/social-sta...	(from di...	7 ms	
rs=AGLTcCNZF80mC5Rwal4mvp...	200	xhr	/ /scs/social-sta...	(from di...	11 ms	
oMMgfZMQthOryQo9n22dcuwDi...	200	font	Other	(from di...	7 ms	
rs=AGLTcCNZF80mC5Rwal4mvp...	200	xhr	/ /scs/social-sta...	(from di...	4ms	
api.js	200	script	/ /scs/social-sta...	(from di...	48 ms	
log?format=json	200	xhr	/ /scs/social-sta...	372 B	65 ms	
rs=AGLTcCNZF80mC5Rwal4mvp...	200	xhr	/ /scs/social-sta...	(from di...	22 ms	
rs=AGLTcCNZF80mC5Rwal4mvp...	200	xhr	/ /scs/social-sta...	(from di...	28 ms	
rs=AGLTcCNZF80mC5Rwal4mvp...	200	xhr	/ /scs/social-sta...	(from di...	20 ms	
cb=gapi.loaded_0	200	script	api.is:7	(from di...	8ms	

30 requests | 477 KB transferred | Finish: 5.86 s

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https://www.google.eo.uk/webhp?hl=en&sa=X&ved=0ahUKEwiekpObqoLZAhUDbRQKH...AhIQPAgD

ElementsConsoleSourcesNetworkPerformanceMemoryApplicationSecurityAudits

Profiles

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Select profiling type

@ Take heap snapshot

Heap snapshot profiles show memory distribution among your page's JavaScript objects and related DOM nodes.

Q Record allocation profile

Allocation profiles show memory allocations from your JavaScript functions.

Q Record allocation timeline

Allocation timelines show memory allocations from your heap over time. Use this profile type to isolate memory leaks.

Take snapshot

L Load

G Google

x

D

←

C

i

Secure

https://www.google.eo.uk/webhp?hl=en&sa=X&ved=0ahUKEwiekpObqoLZAhUDbRQKHaY0AhIQPAgD

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Elements

Console

Sources

Network

Performance

Memory

Application

Security

Audits

Application

Manifest

Service Workers

Clear storage

Storage

Local Storage

Session Storage

IndexedDB

WebSQL

Cache

Cookies

Cache Storage

Application Cache

Frames

top

Google

Google Search

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No manifest detected

A web manifest allows you to control how your app behaves when launched and displayed to the user.
[Read more about the web manifest](#)

Google

x

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Secure

https://www.google.eo.uk/webhp?hl=en&sa=X&ved=0ahUKEwiekpObqoLZAhUDbRQKHsY0AhIQPAgD

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Overview

Main origin

Reload to view details

Security overview

🔒

This page is secure (valid HTTPS).

Valid certificate

The connection to this site is using a valid, trusted server certificate issued by Google Internet Authority G2.

View certificate

Secure connection

The connection to this site is encrypted and authenticated using QUIC (a strong protocol), X25519 (a strong key exchange), and AES_128_GCM (a strong cipher).

Secure resources

All resources on this page are served securely.

Google

Google Search

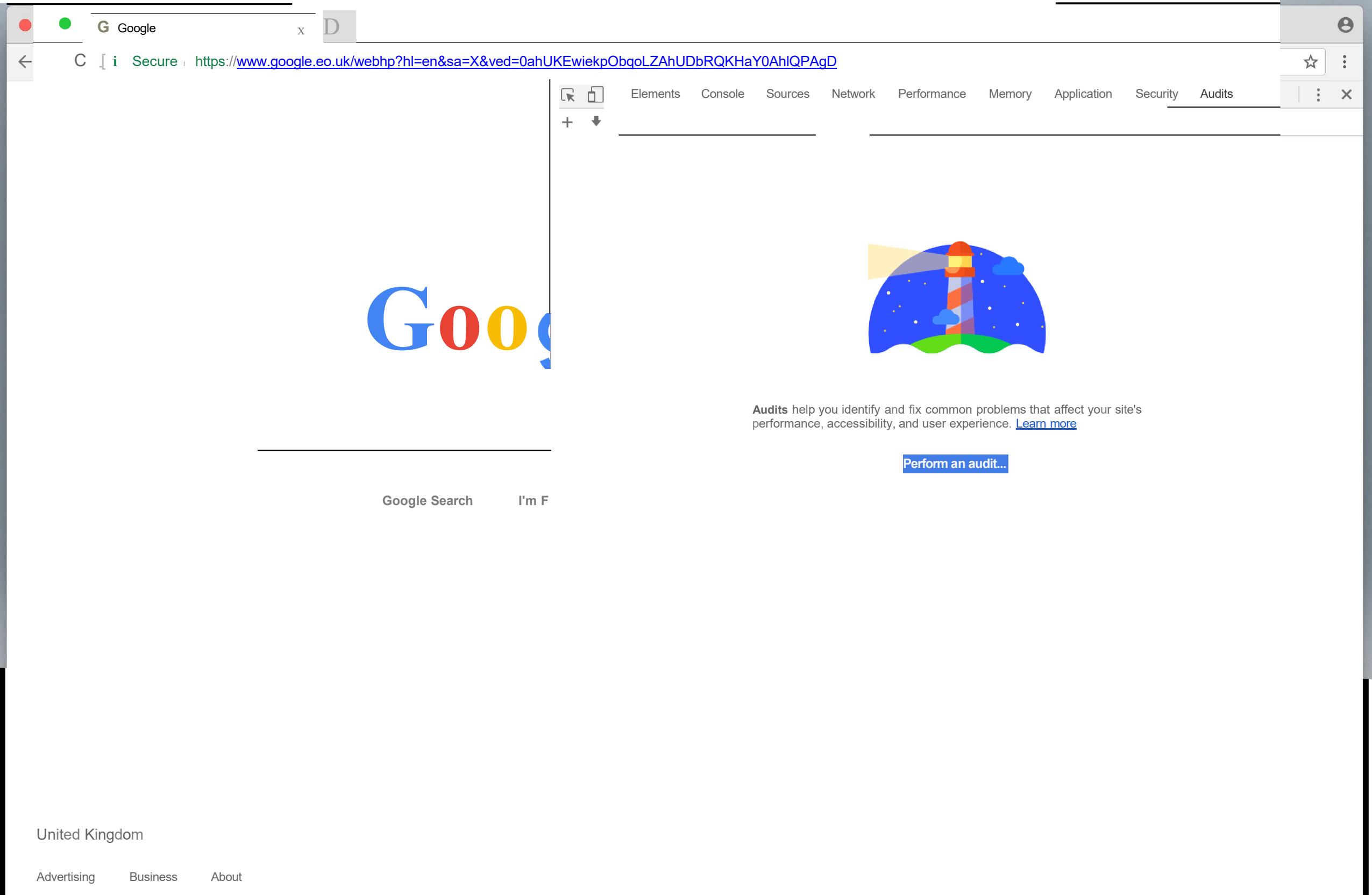
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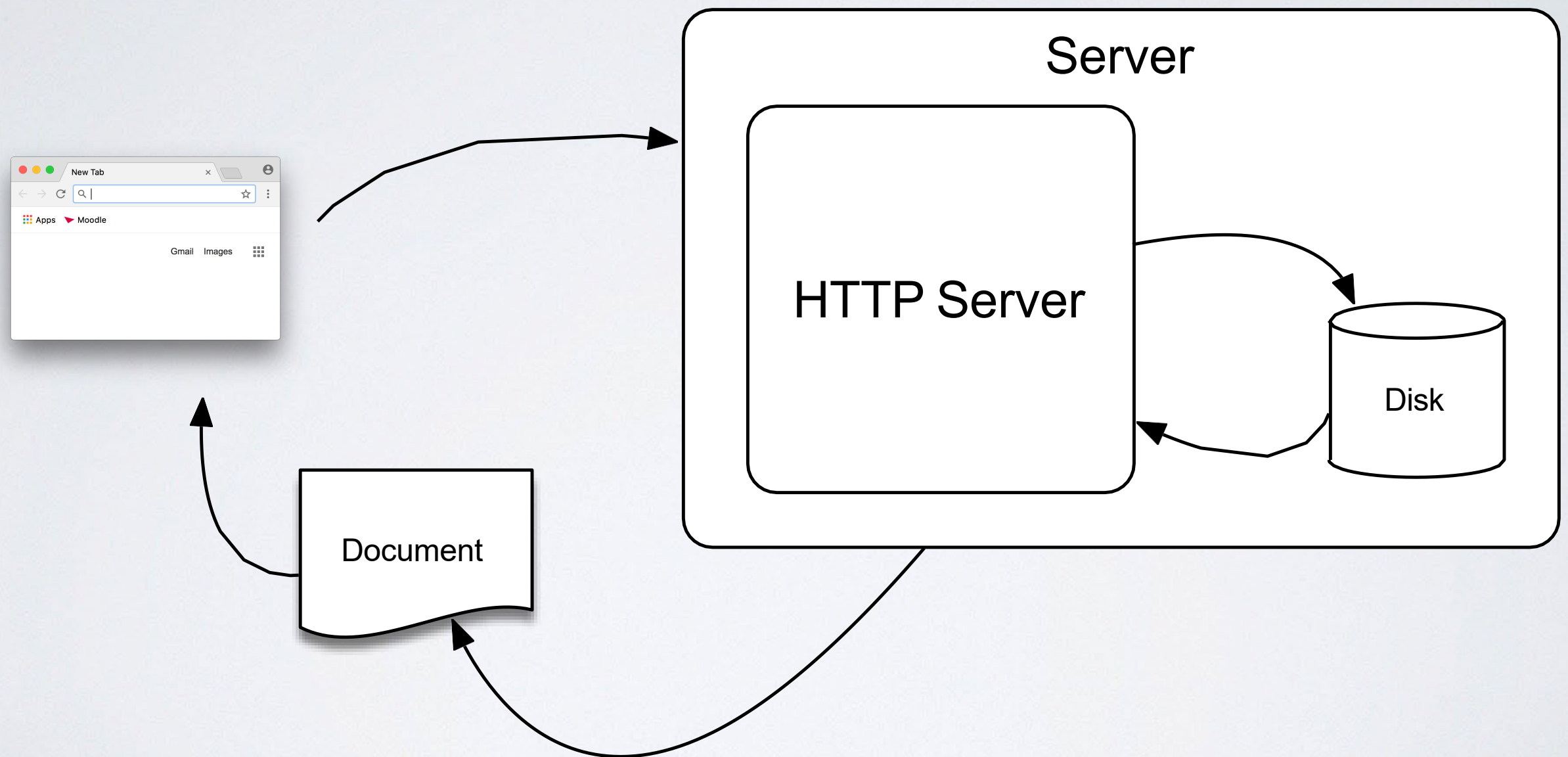
DEPLOYMENT



CLIENTS & SERVERS

- An established architecture for organising communication between devices & software
- Client makes a **request**
- Server **listens** for requests then makes a **response**
 - Unless you're using the XWindow server
- Server is a **nexus**

CLIENT SERVER ARCHITECTURES





WEB SERVING

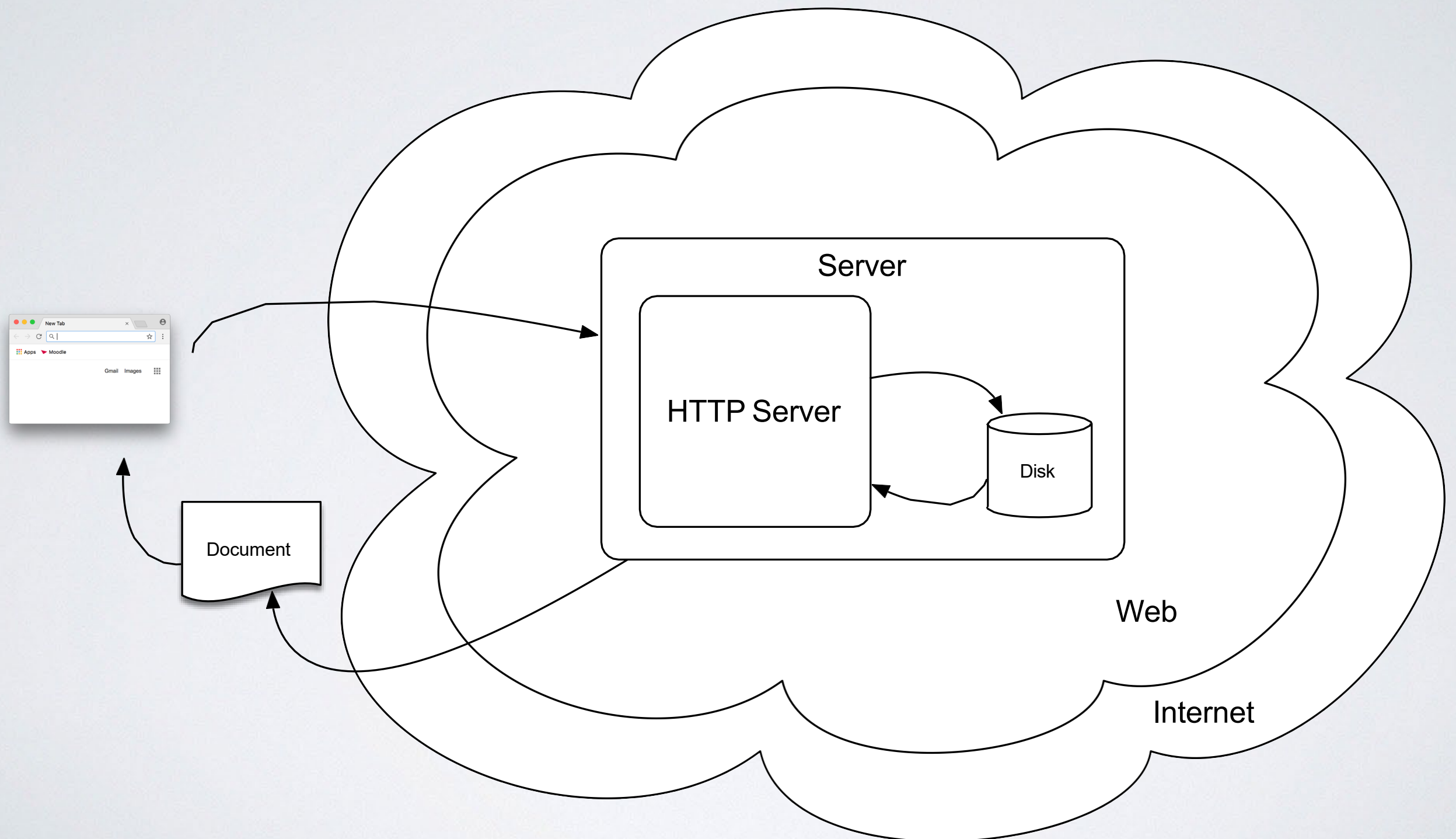
- Server needs to be on the Internet: IP Address
- Server needs to be an HTTP server: Listens for connections using the HTTP protocol (RFC 2616)



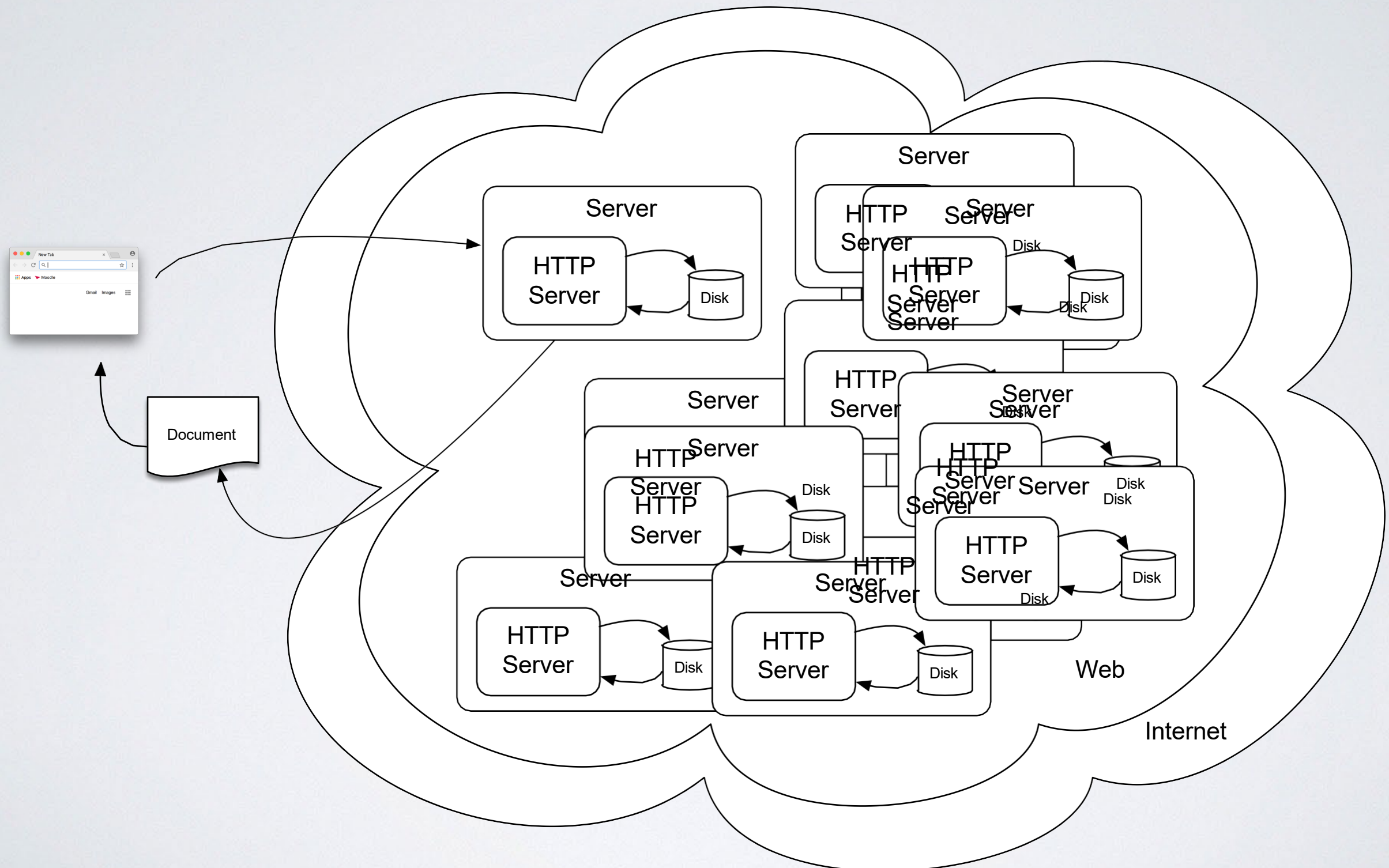
HTTP PROTOCOL

- Defines how (primarily text) messages for transferring HyperText should be:
 - formatted & transmitted
 - responded to by servers & clients
- Technically: a stateless, application layer protocol for communicating between distributed systems

WEB ARCHITECTURE



WEB SCALE





DEPLOYING OUR OWN SITES

- Local web server (not really deployment)
- Free static hosting service
- Dedicated Web hosting service
- Virtual Server
- Hardware Server
- Cloud Host



LOCAL WEB SERVER

- Run NGinX locally
 - Good for testing your site
 - Can be made available to other Internet users (but this gets complicated fast)



FREE STATIC HOSTING

- Neocities
 - Old School, free, static site hosting (in style of Geocities)
 - <https://neocities.org/>
- GitHub Pages
 - Static hosting direct from your GitHub repository:
 - <https://pages.github.com/>
 - Updates are pushed to your repo & automatically deployed
 - Available to all web users



DEDICATED WEB HOSTING

- Many sites provide web hosting
- Sign up for an account,
- Pay the fees (start small/sometimes free)
escalate rapidly depending upon bandwidth
- Limited control over web server software



VIRTUAL SERVER

- Gives you a virtual machine on someone else's server
- Connected to the Internet you will pay for CPU, RAM, Storage, & bandwidth - according to your needs
- Can start very cheap (some free many from £2.99/month) but price escalates rapidly
- Almost complete control over your machine
- Easy to backup and move your server to other places



HARDWARE SERVER

- Hardware that you build, buy or rent
- Must be connected to the Internet - needs reliable network & dedicated IP address.
- All administration must be done by you or others in your team
- Server can be located locally or in a hardware hosting facility (advantages & disadvantages to each)
- Must consider back-up, have a plan for expansion



CLOUD HOST

- Cloud Hosting
- Often incorporates the idea of “computing as a service”
- Scalable to the degree that you can afford
- Ultimately: someone else’s machine



GITHUB PAGES

- Normally, GitHub stores Git repositories
- We can set up a public Git repository, containing a website (HTML, CSS, & JS), and tell GitHub to serve that repository as a website
- This is essentially free Web hosting



SUMMARY

- Looked at a potted history of the Internet, Web, Hypertext, DOM, & Basic Web Architecture
- Looked at the developer tools available to us (Chrome)
- Considered deployment (Github Pages)
- Overview of the basic things we need to know to understand how it all fits together

NEXT

- The wonderful world of text markup, Hypertext, and HTML
- or

**“how to organise, structure, and
describe our data for presentation
on the Web”**