Web Security Overview

Cloud Computing and SaaS

Announcements

- Checkpoint 2 due Friday 10/23
  - Authorization Microservice
  - Dockerfile!
    - Will be using this to run your code in AG
  - Minor fixes, changes pushed to skeleton (make sure to pull!)
    - Latest update to skeleton at ~6:15pm
- AWS Educate
  - Do not create any services! We can't guarantee extra credits

Last Time

- Codebase Walkthrough
  - Different microservices
    - Authorization, Posts, etc.
- Microservices

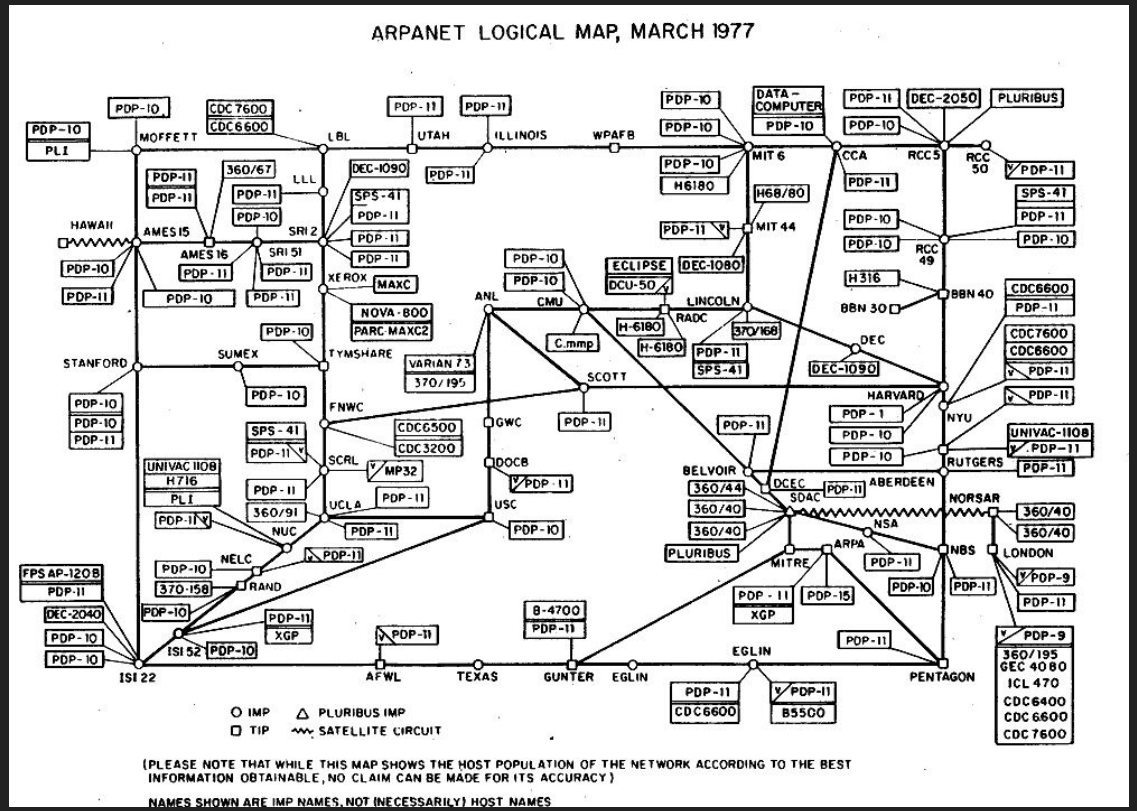
Today

- Introduction to Web Security
  - Beginning of the internet
    - Why it's actually a complete mess
  - Web Pages
    - HTML, CSS, Javascript(!)
  - Cookies
  - Frames
  - Same Origin Policy

Beginning of the Internet

- Problem: Need computers to communicate
- Solution: Create the concept of a “network”
- First workable prototype: ARPANET, funded by US DoD
  - Advanced Research Projects Agency Network
  - Allowed multiple computers to communicate on a single network
  - First message (“LOGIN”) sent from UCLA to Stanford, ended up crashing the network
  - Stanford received only the first two letters

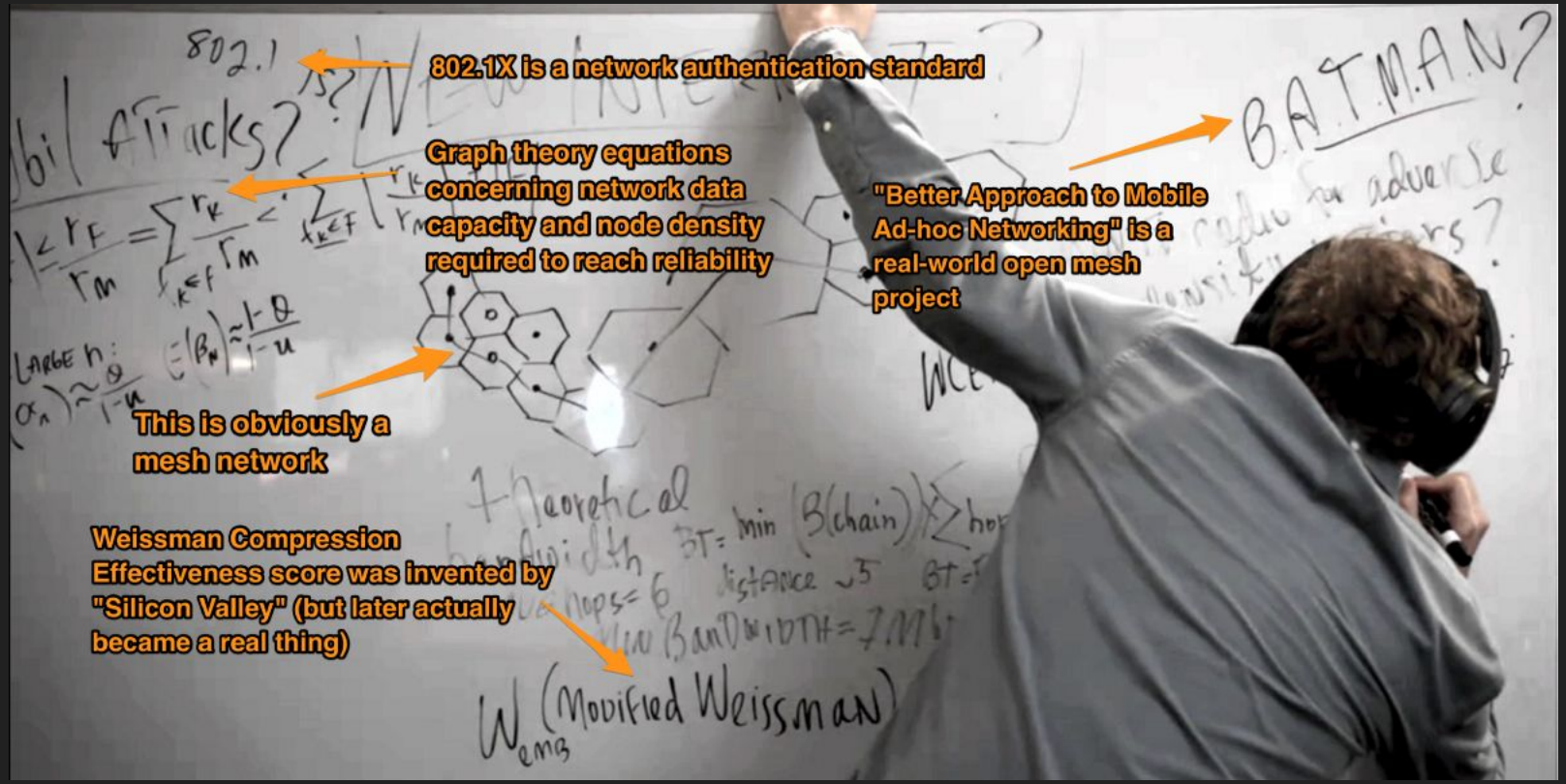
ARPANET Logical Map



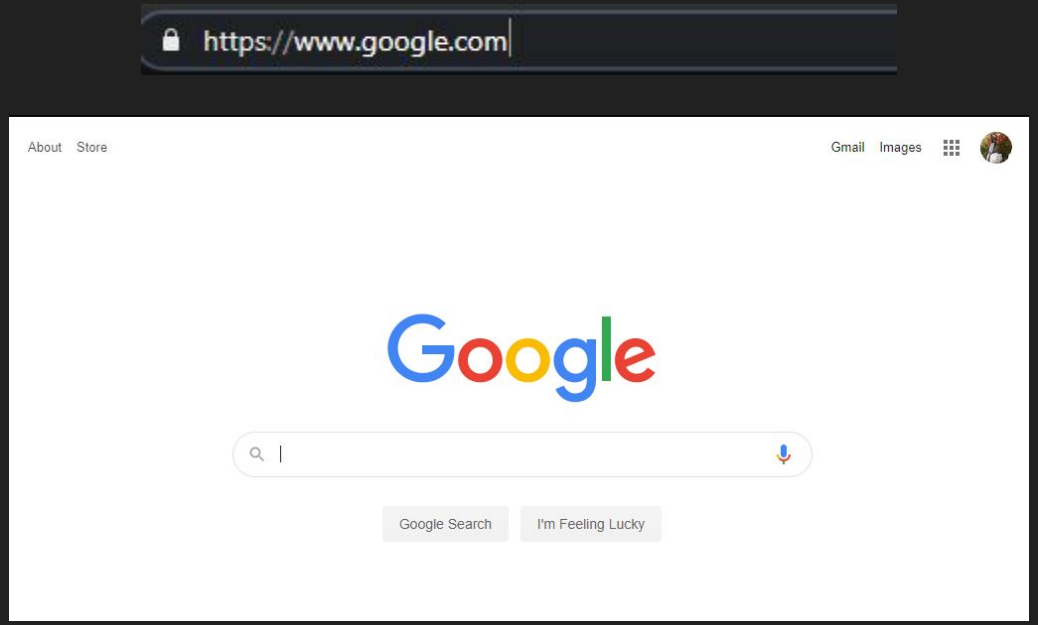
Why Internet Security is a Mess

- Most important principle of security: build security in from the start
- Problem: Internet was meant to only share research papers
  - Not many security concerns here
  - Very few people had access anyway
- Everything since then has been a hack/patch*
  - Maybe it's time for a new internet?

Why Internet Security is a Mess

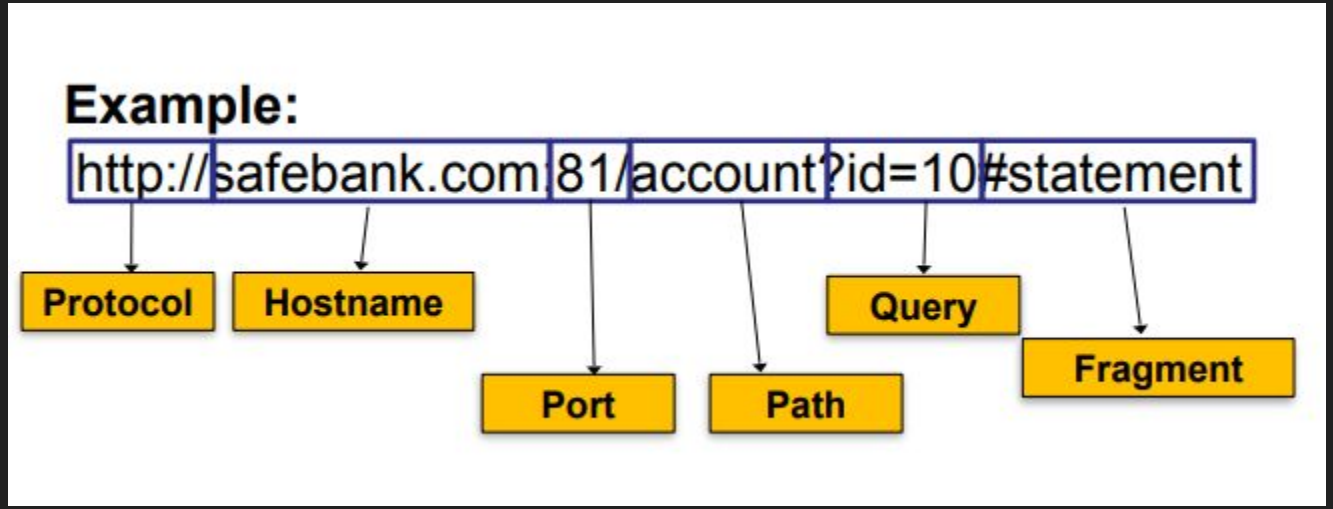


Web Pages

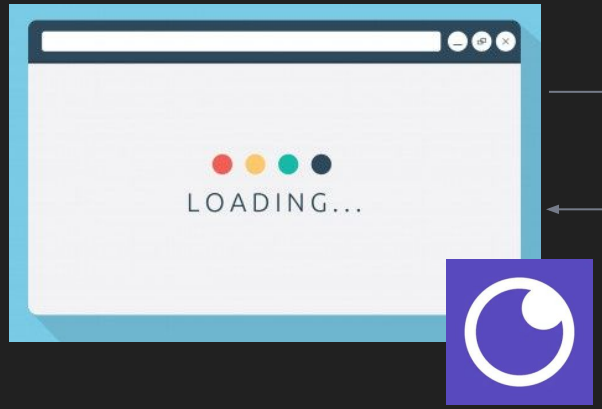

https://www.google.com
About
Store
Gmail
Images
Google
Google Search
I'm Feeling Lucky

Web Page URLs

- URL: Uniform Resource Locator



Recall: HTTP Requests



Frontend/Web Client

Backend/Web Server

Database

Web Page Components

- HTML
  - Hypertext Markup Language
  - “LaTeX for web pages”
- CSS
  - Cascading Style Sheets
  - Formats HTML content, Aesthetics
- Javascript
  - Scripting language that can read and modify a webpage and its elements

Web Pages: HTML

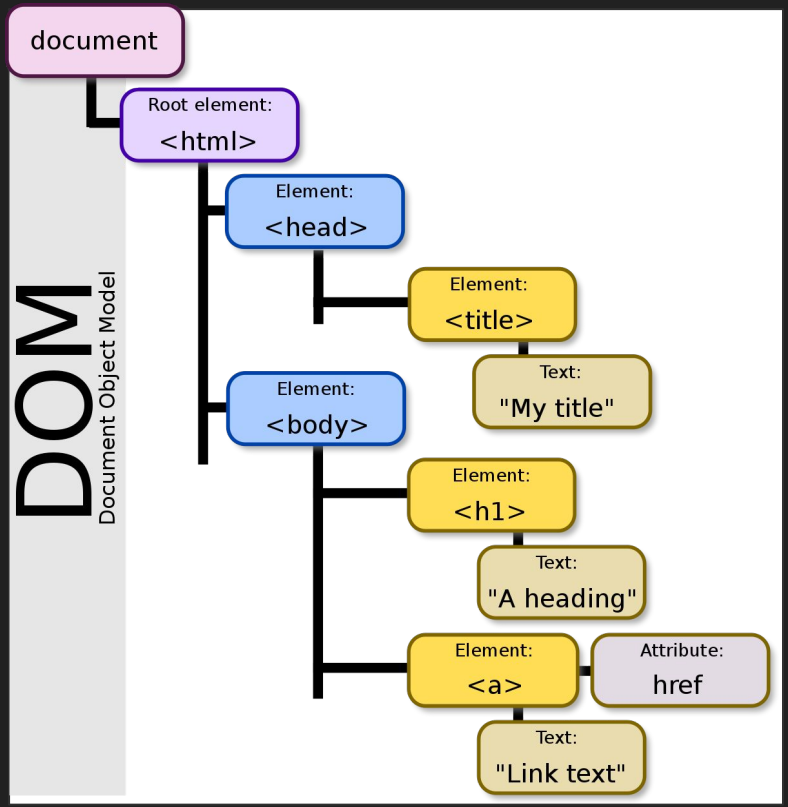
```html
<!DOCTYPE html>
<html>

    <head>
        <title>My First Webpage</title>
    </head>

    <body>
        <h1>
            My First Webpage
        </h1>
        <p>This is a paragraph...</p>
    </body>

</html>
```

Document Object Model (DOM)



Javascript

- Concerns:
  - Can change images, hide/unhide elements, change cursor
- Problem: Javascript can modify pretty much anything
- More Problems:
  - Cookies, can read and modify values
  - Javascript can make HTTP requests
    - What if they send your access_token to themselves and then delete it?

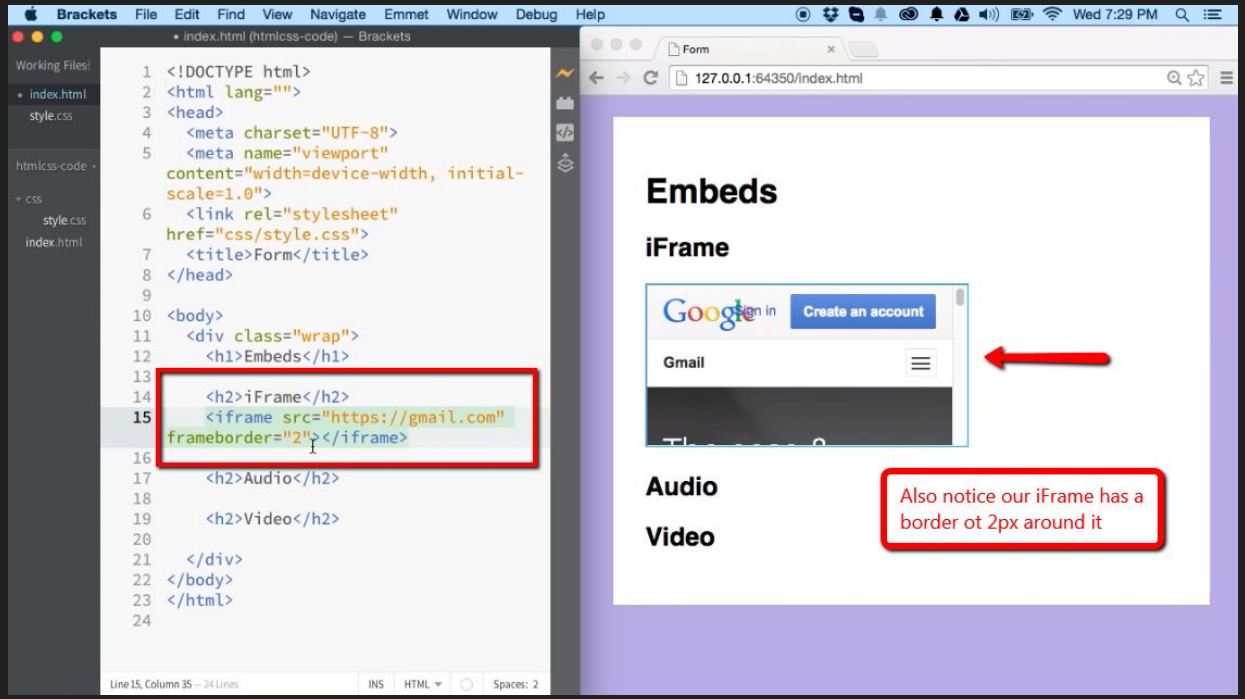
Javascript, Cookies

- Cookies
  - Reading
    - var x = document.cookie;
  - Writing
    - document.cookie = "username=DeCal; expires=Tue, 20 Oct 2020 12:00:00 UTC; path=/";

Javascript - Quick Demo

Frames

- Enable embedding web pages within web pages



Frames

- Problem: What if Javascript in one frame accesses the information of another?
- Solution: Browsers enforce frame isolation

Same-Origin Policy

- Big Idea: One origin shouldn't be able to read or modify the resources of another origin
- Different web pages are isolated from each other
- Different frames in a web page are isolated from each other
- What defines origin?
    - Protocol, Hostname, Port
    - String matching, nothing more

Same-Origin Policy Practice

- 1
  - http://calcloud.org/lec1
  - http://calcloud.org/lec2
- 2
  - http://calcloud.org:80/lec1
  - http://api.calcloud.org:80/lec2
- 3
  - https://calcloud.org:80/lec1
  - http://api.calcloud.org:81/lec2
- 4
  - https://calcloud.org:80/lec1
  - https://calcloud.org:80/lec2