BBM490

ENTERPRISE WEB ARCHITECTURE

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Hacettepe University Spring Semester ’15

Mert ÇALIŞKAN

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- 10+ Years of Enterprise Java Experience
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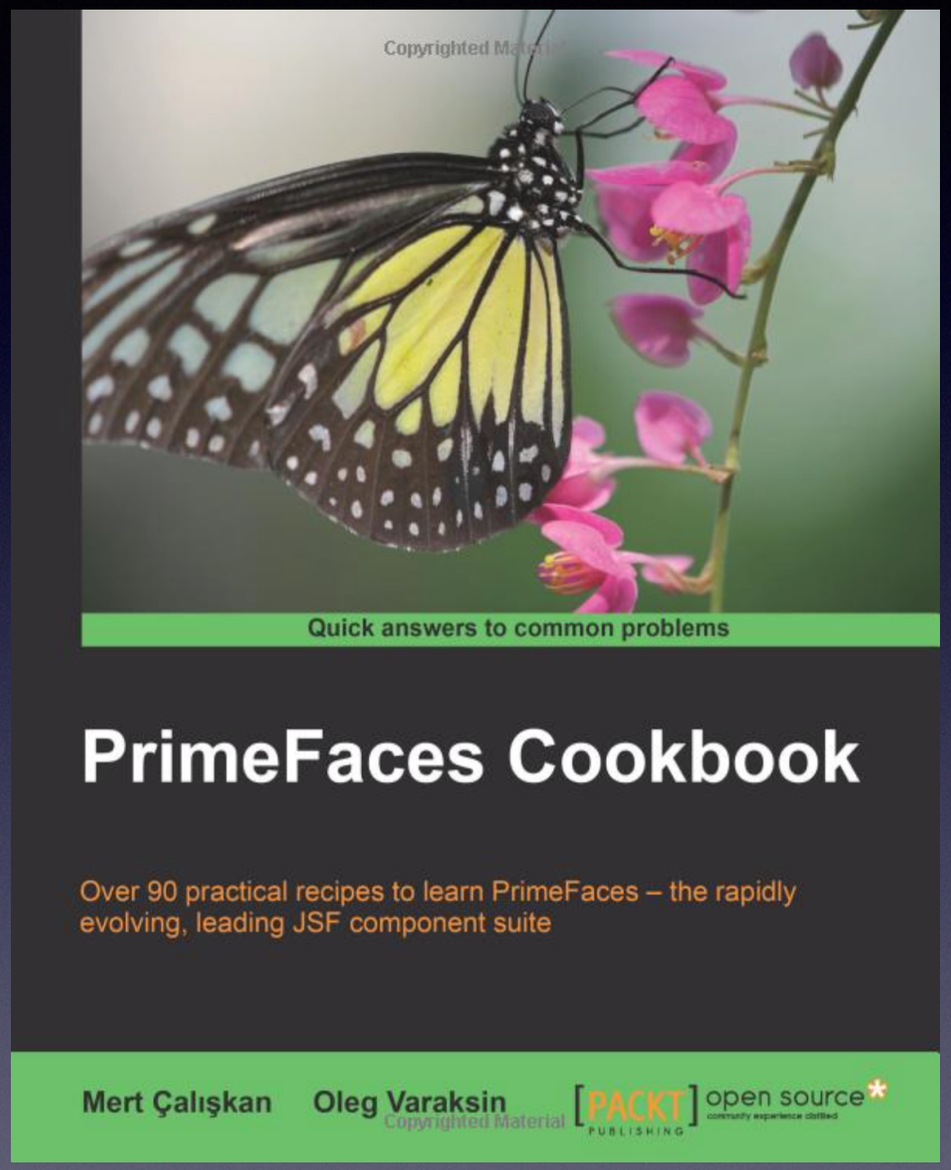
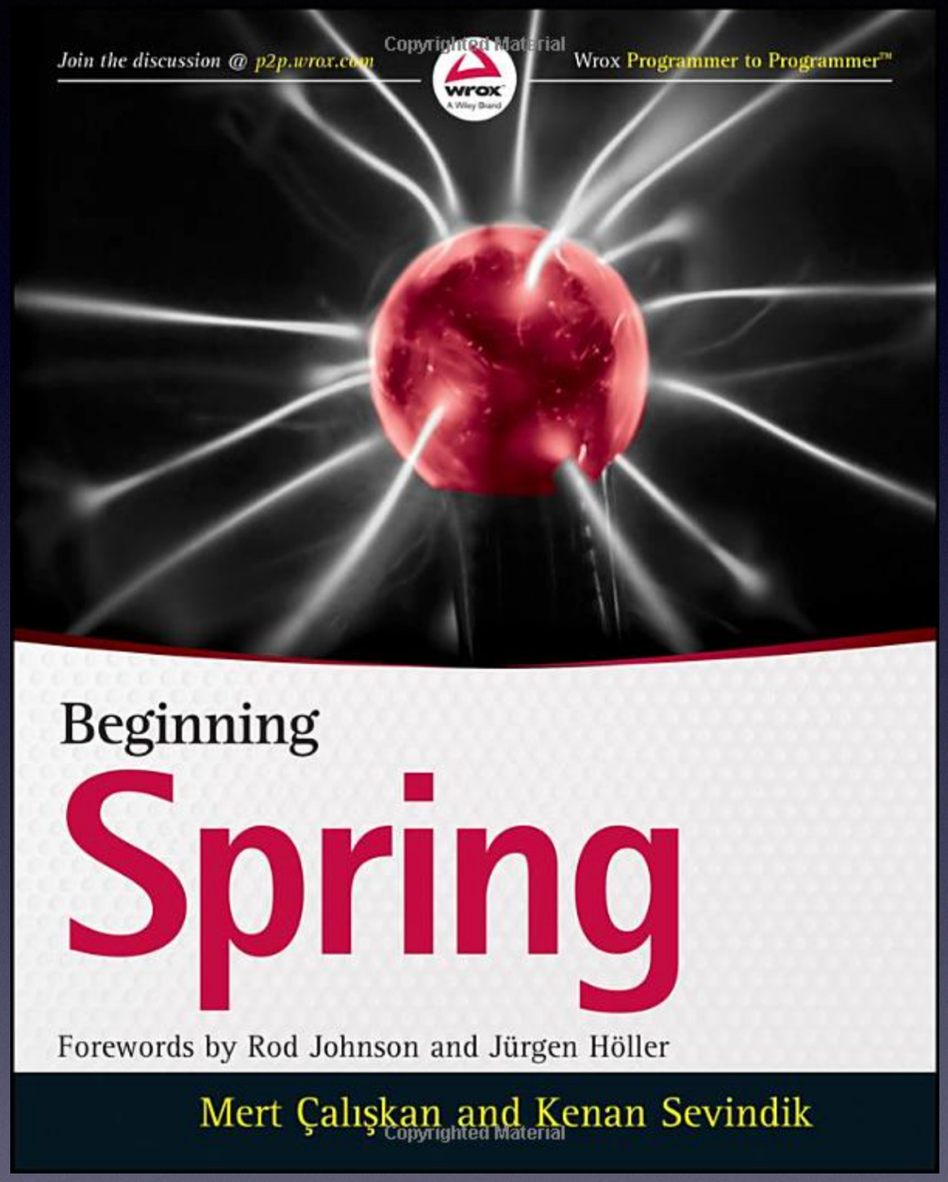
Books





Details available at http://amazon.com/author/mert

AnkaraJUG Leader

- Founded in November 2012 by 3 geeks.
- Official Java User Group registered by Oracle.
- 1 hour session of Java related topics.
- Register @
  http://bit.ly/ankarajugKAYIT
- Join US…! It's fun…

twitter.com/ankarajug

facebook.com/ankarajug

linkedin.com/groups/AnkaraJUG-4710658

BBM490 - Agenda

- History of WWW and JavaEE
- Anatomy of a WebApp
- Maven Project Management
- Spring Framework
- Cross Cutting Concerns w/ AOP, Caching, Security
- Development Environment Setup
- Facelets, Java Server Faces & PrimeFaces
- JPA and ORM Tools
- SOAP and REST based Web Services

BBM490 - Agenda

- Course will be fun and enlightening for you <u>if you are</u>,
  - into programming / coding,
  - into web development or want to learn it inside out,
  - like to code with new frameworks,
  - good at fill in the blanks, true/false, multiple choices and code execution questions.

Frameworks/Tools you will use

Eclipse

Spring

JSF

IntelliJ IDEA

Apache CXF

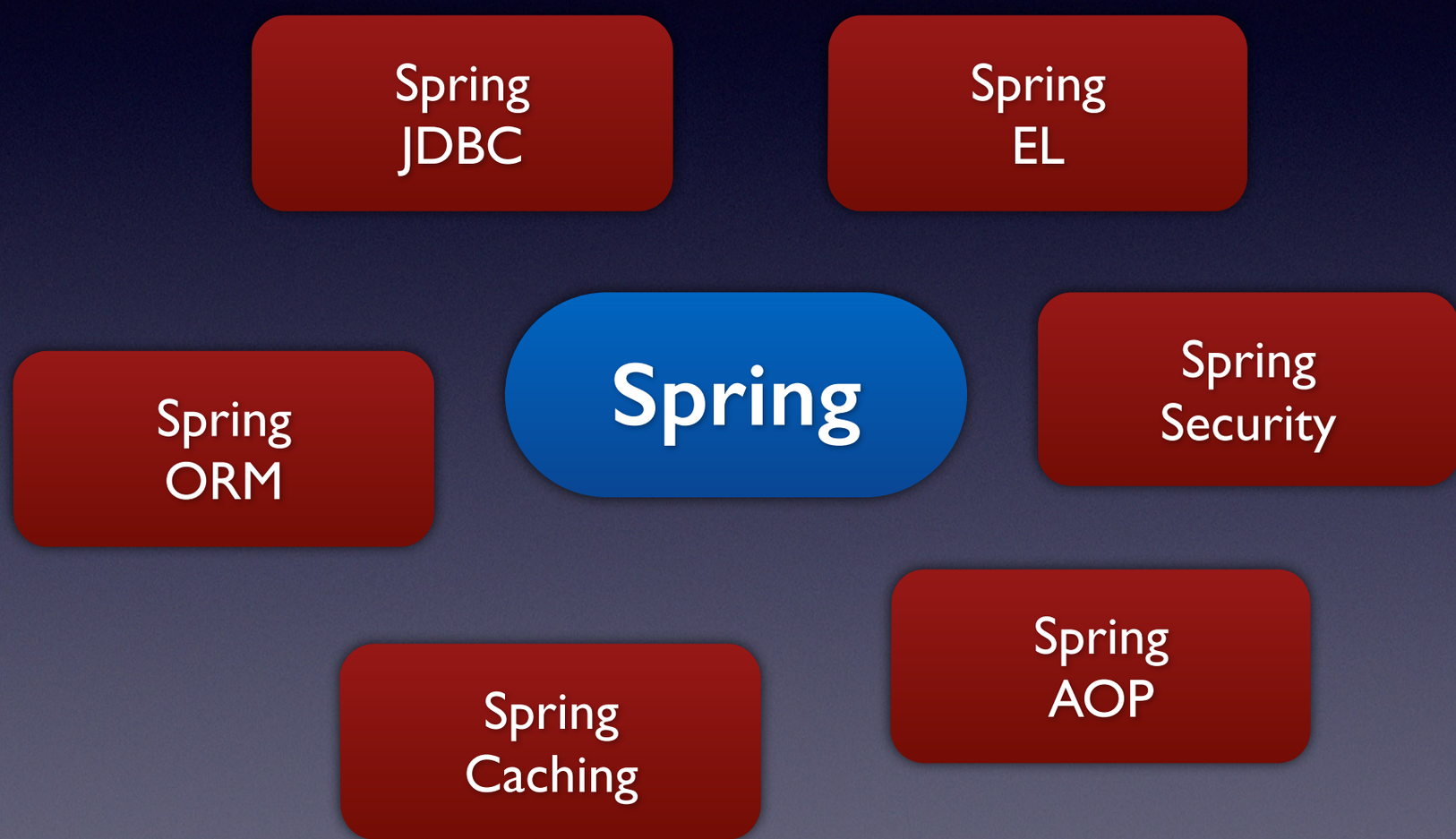
PrimeFaces

Validation API

JUnit

Mockito

Frameworks you will use



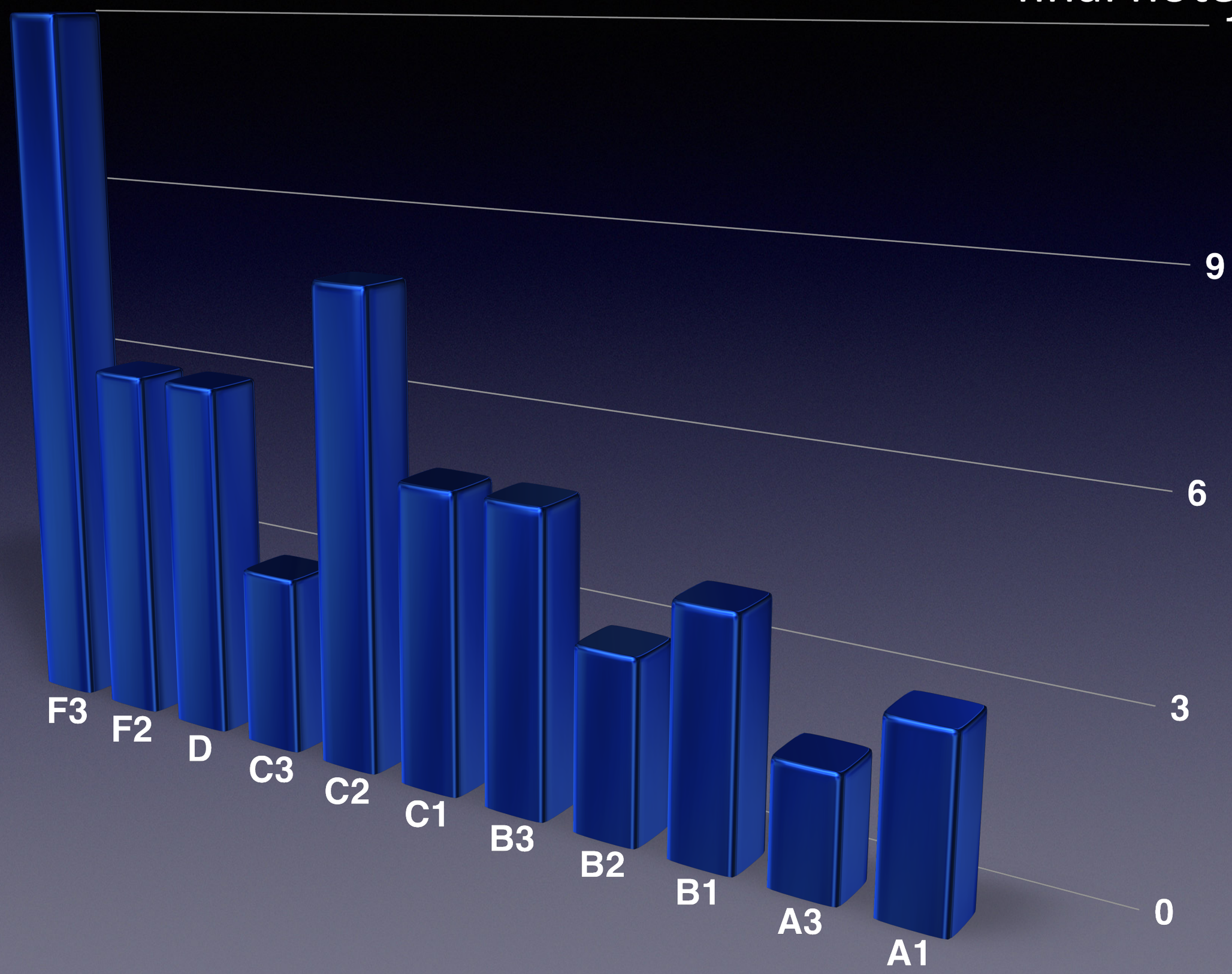
BBM490 - Plan/Communication

- We have 12 weeks.
- 1 quiz + 1 term + 1 final (like 15%, 35%, 50%)
- BBM488 will be the Lab for Web Services, there will be lots of coding.
- You can reach me through,
  mert.caliskan@hacettepe.edu.tr
  Any emails sent to any other address will be ignored.
- Slides and codes will be published via piazza/github.
- Do create yourself a github & linkedin account.

BBM490 - Plan/Communication

- Piazza
  - http://piazza.com/hacettepe.edu.tr/spring2015/bbm490/home
- Github
  - http://bit.ly/BBM490Notes

Last year's final notes...

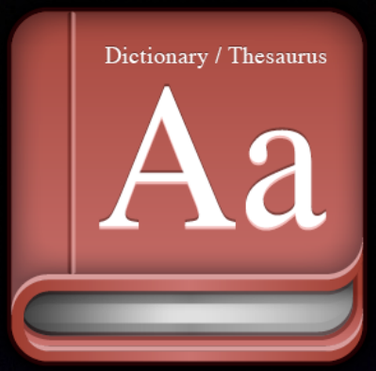


Week 01

We'll be going through the history of web and give some bits about the context.

So…

What’s Internet?

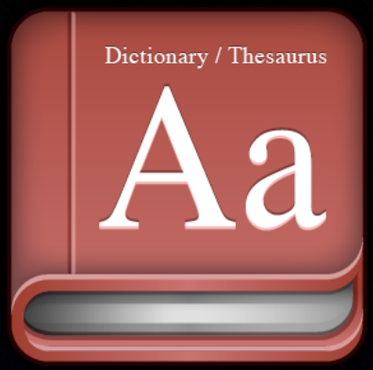


webster says that...

In·ter·net noun \ˈin-tər-ˌnet\

An electronic communications network that connects computer networks and organisational computer facilities around the world.

What's World Wide Web?



webster says that...

World Wide Web

An information system on the Internet which allows documents to be connected to other documents by hypertext links, enabling the user to search for information by moving from one document to another.

So question here is:

Can we call Internet as the World Wide Web ?

The Answer is:

World Wide Web != Internet

History of Internet

- Ever heard about :

  Advanced Research Projects Agency Network?

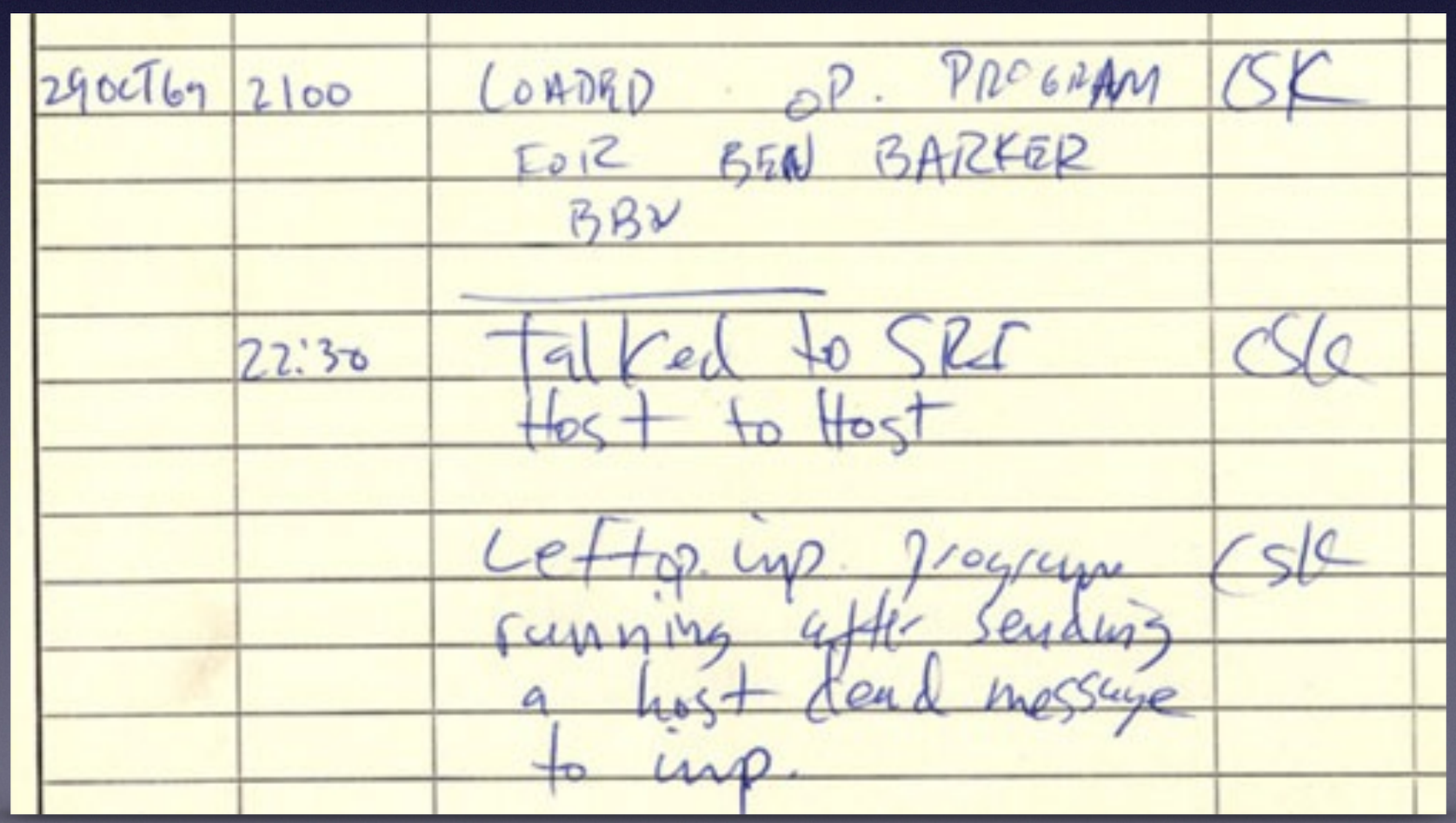
History of Internet

- ARPANET:

  Funded by the U.S. Department of Defence for use by its projects at universities and research laboratories in the US.
- First network to implement TCP/IP
- Got alive on 1969.

History of Internet

- First message sent via the ARPANET, 10:30 pm, 29 October 1969 between UCLA and Stanford Research Institute.



29OCT69	2100	LOADED OP. PROGRAM FOR BEN BARKER BBN	CSK
	22:30	Talked to SRI Host to Host	CSK
		Left op. imp. program running after sending a host dead message to imp.	CSK

History of Internet

- Content of the first message:

  The message text was the word login; the l and the o letters were transmitted, but the system then crashed. Hence, the literal first message over the ARPANET was lo.

History of Internet

- Then 2 more nodes added by the end of the year, was 4 in total.
- University of California Los Angeles
- University of California Santa Barbara
- University of Utah
- Stanford Research Institute

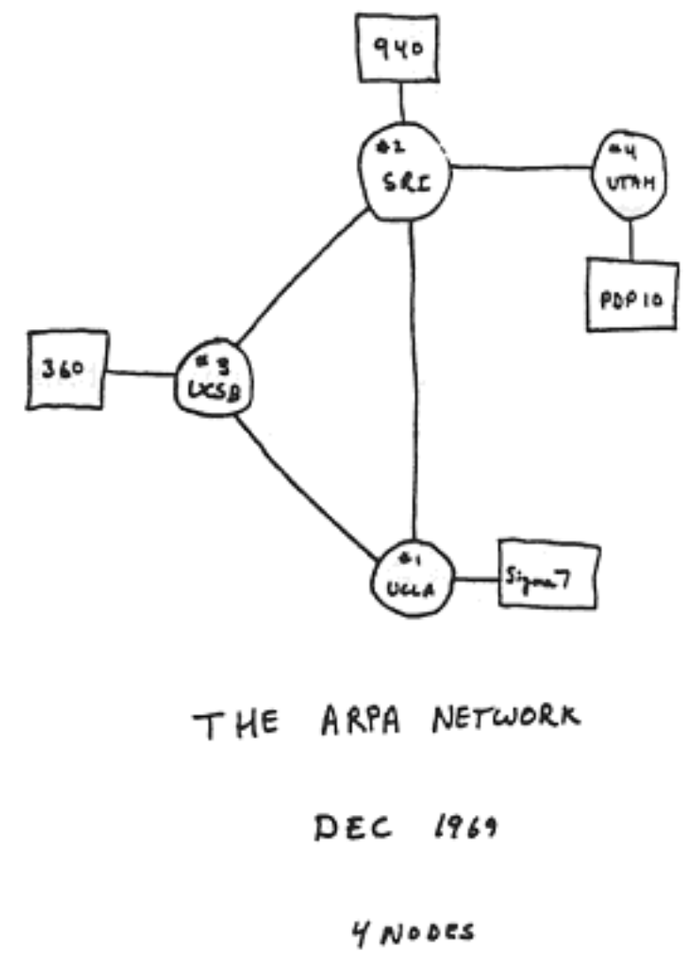
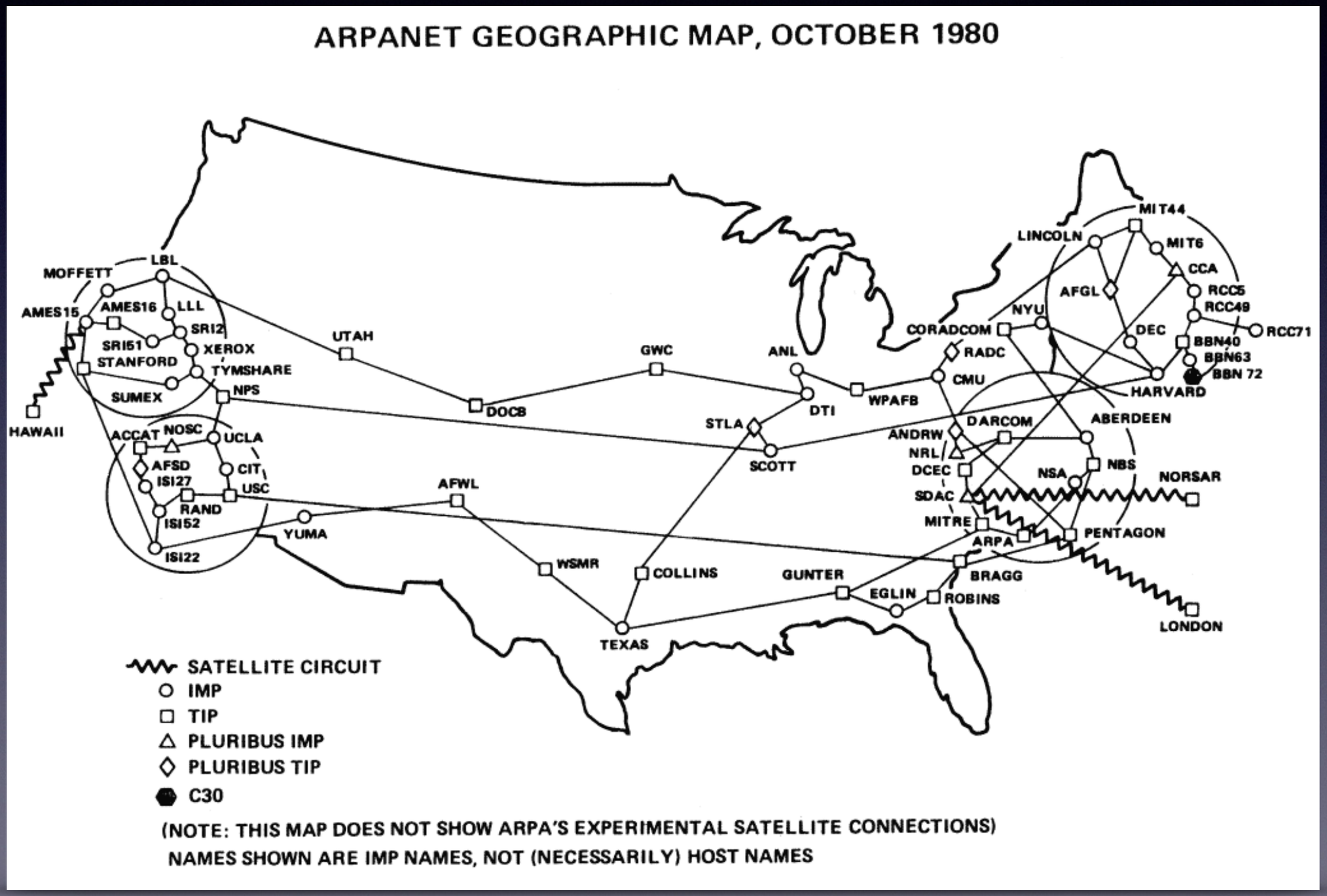


FIGURE 6.2 Drawing of 4 Node Network (Courtesy of Alex McKenzie)

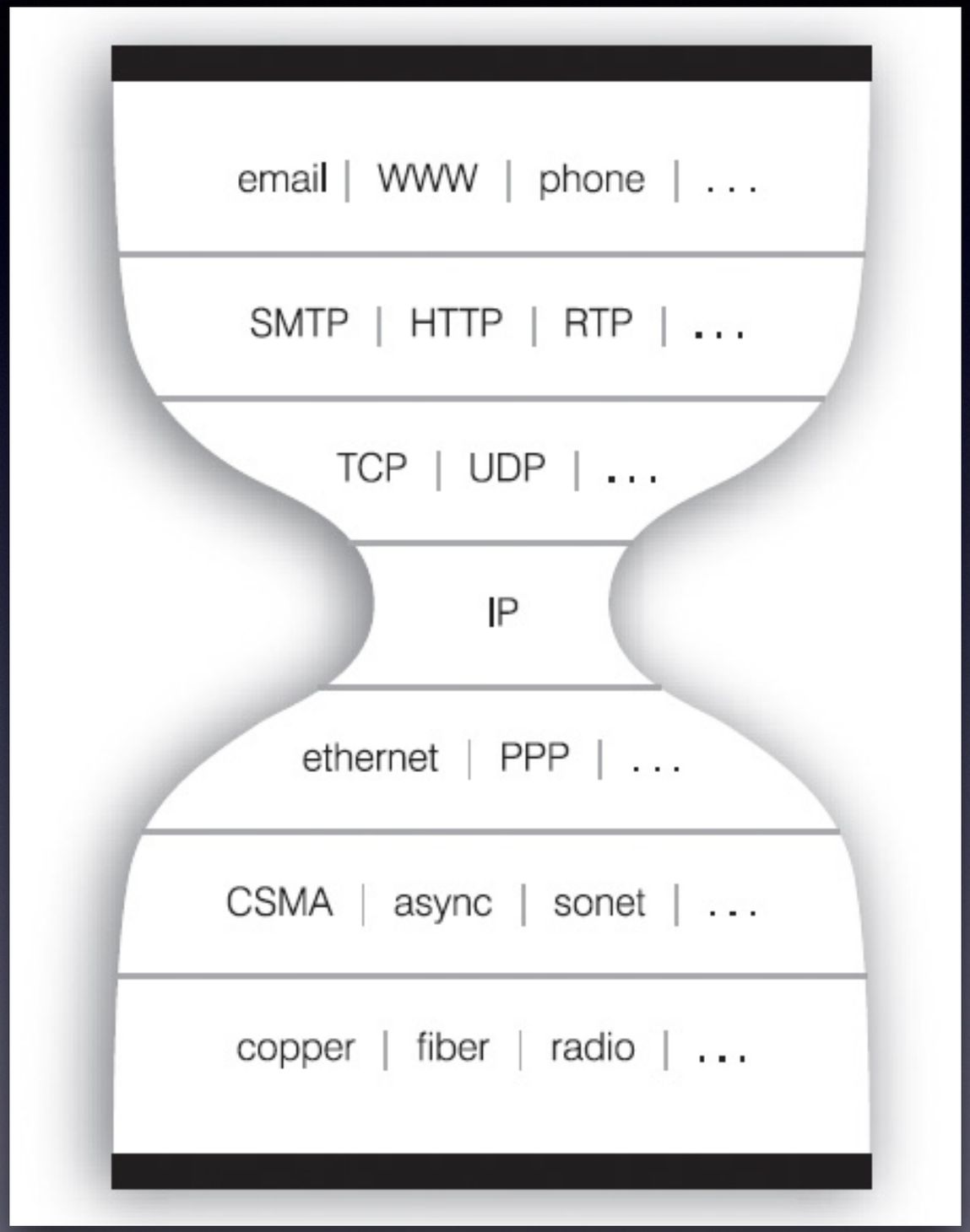
History of Internet

- In 1980…



Evolution of Internet's Architecture…

IP Hourglass



IP Hourglass

Specific Applications →

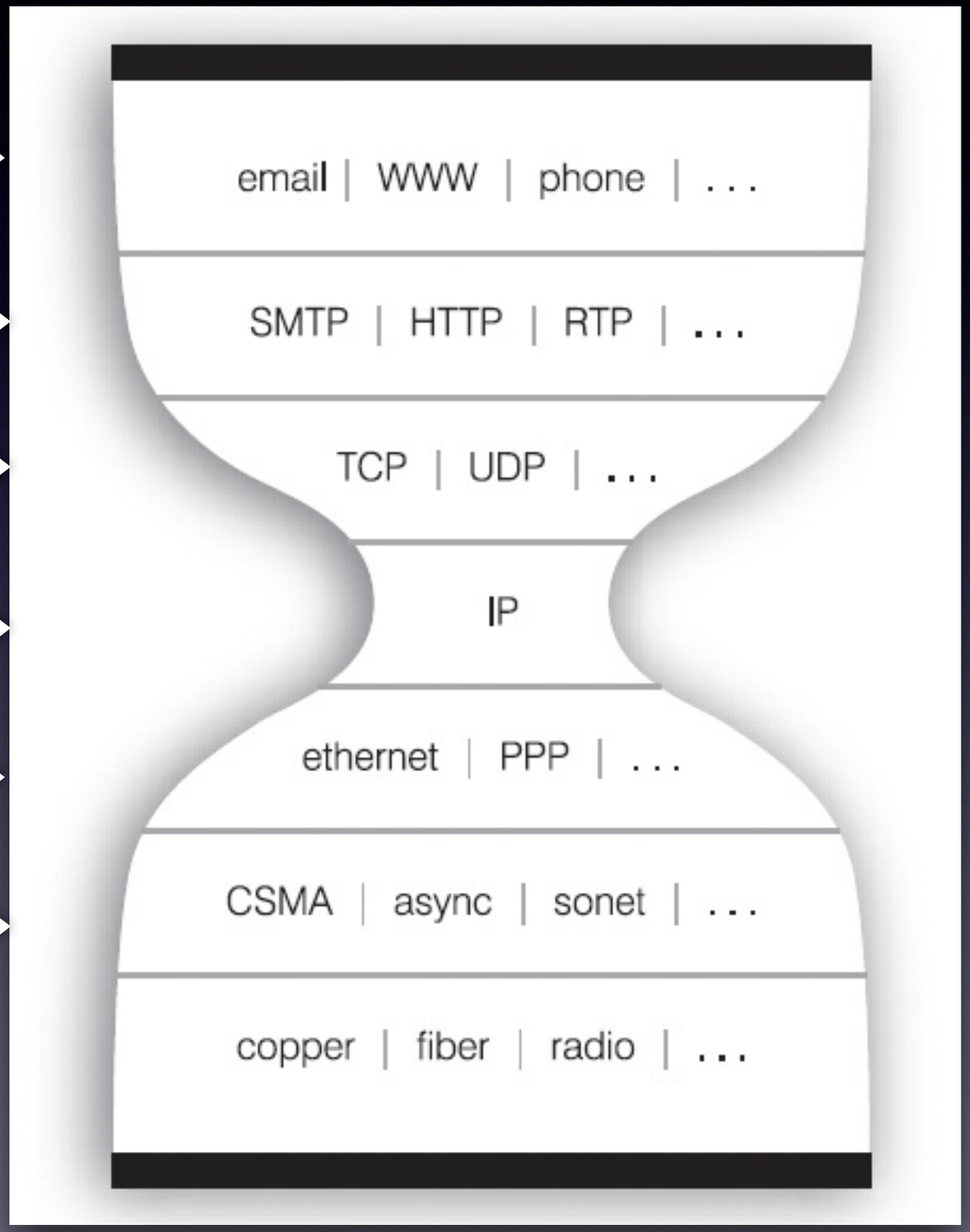
Applications Protocols →

Transport Protocols →

Network Protocols →

Data Link Protocols →

Physical Layer Protocols →



OPTE Project

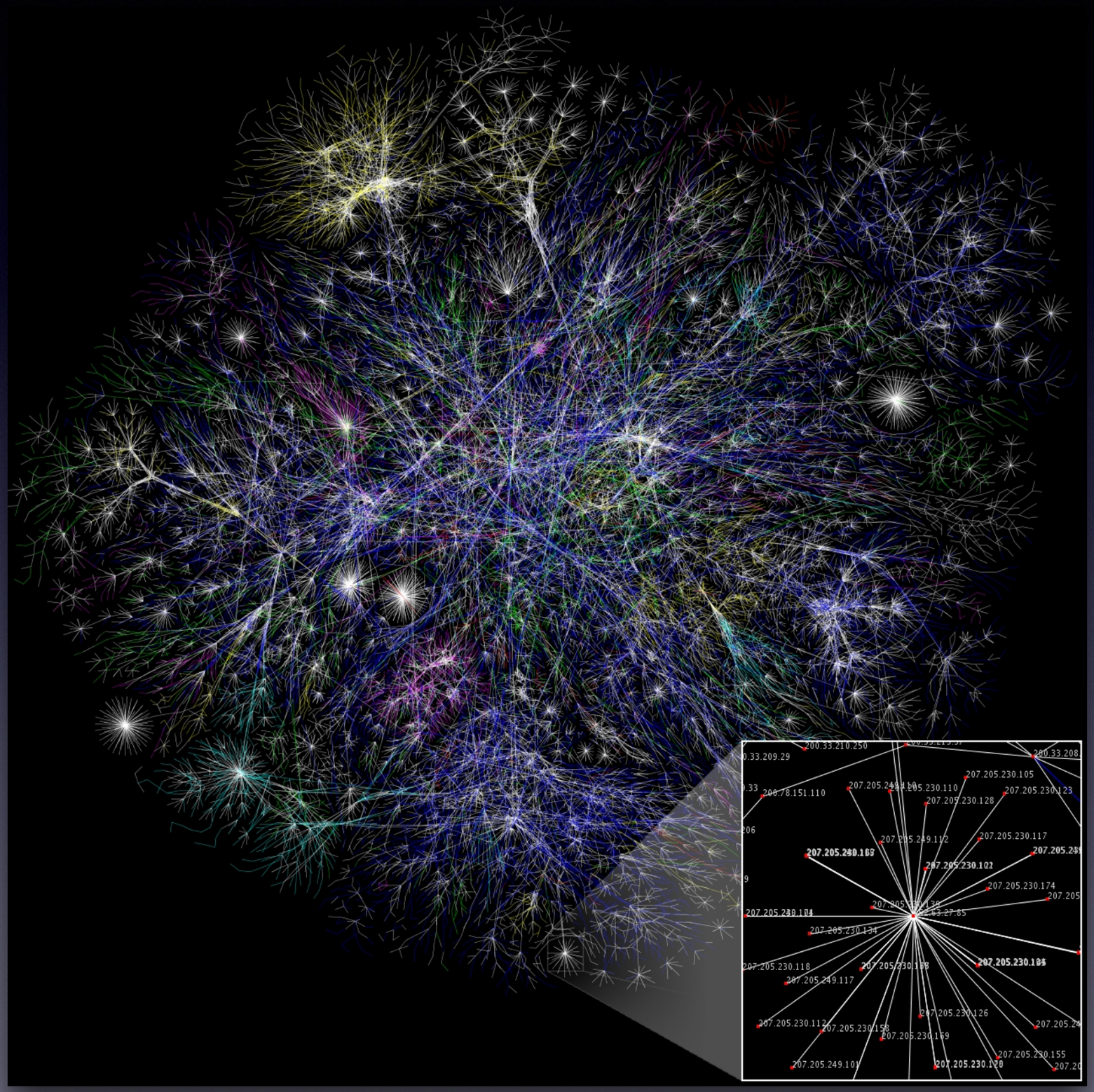
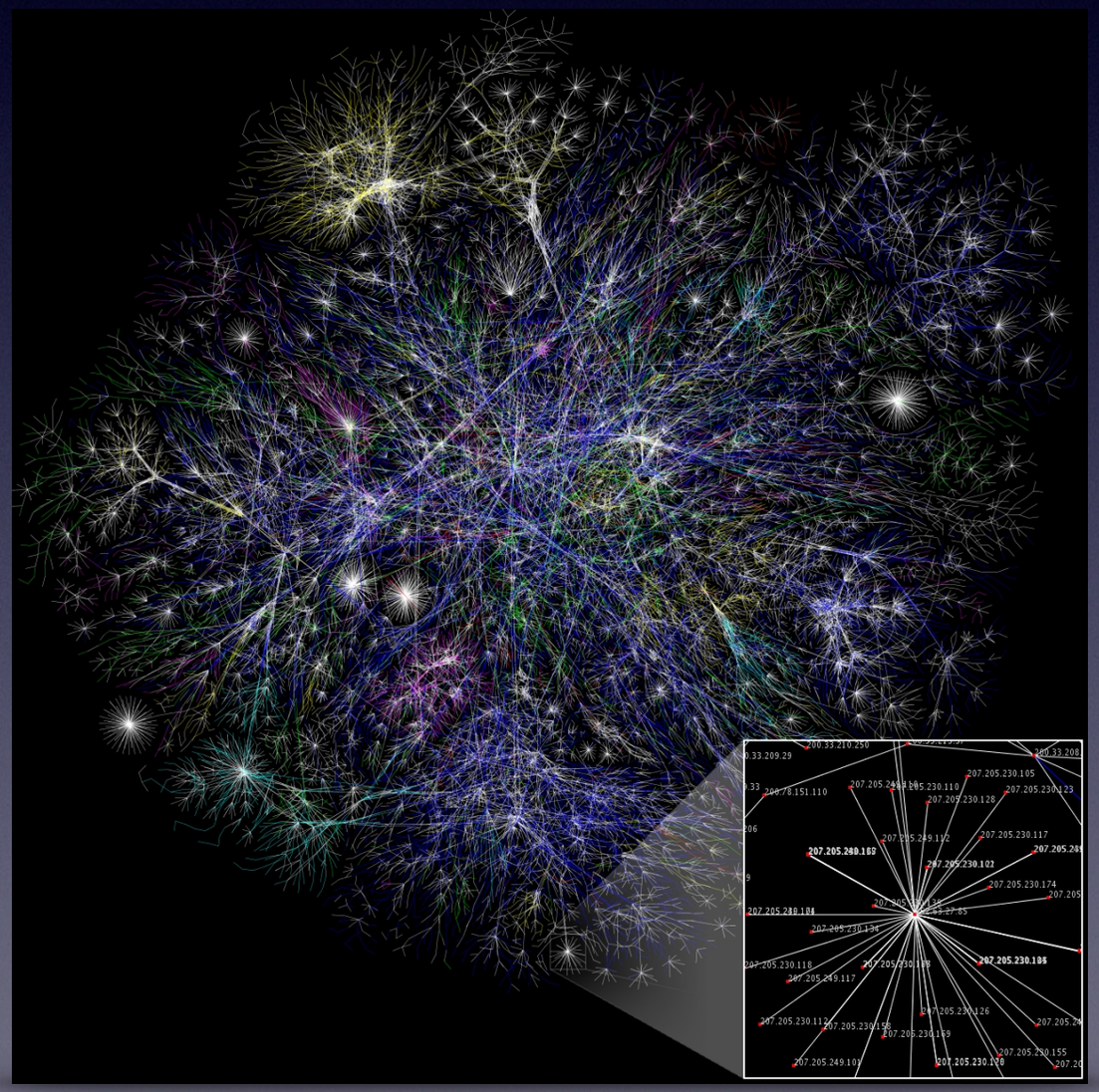


image produced in year 2003

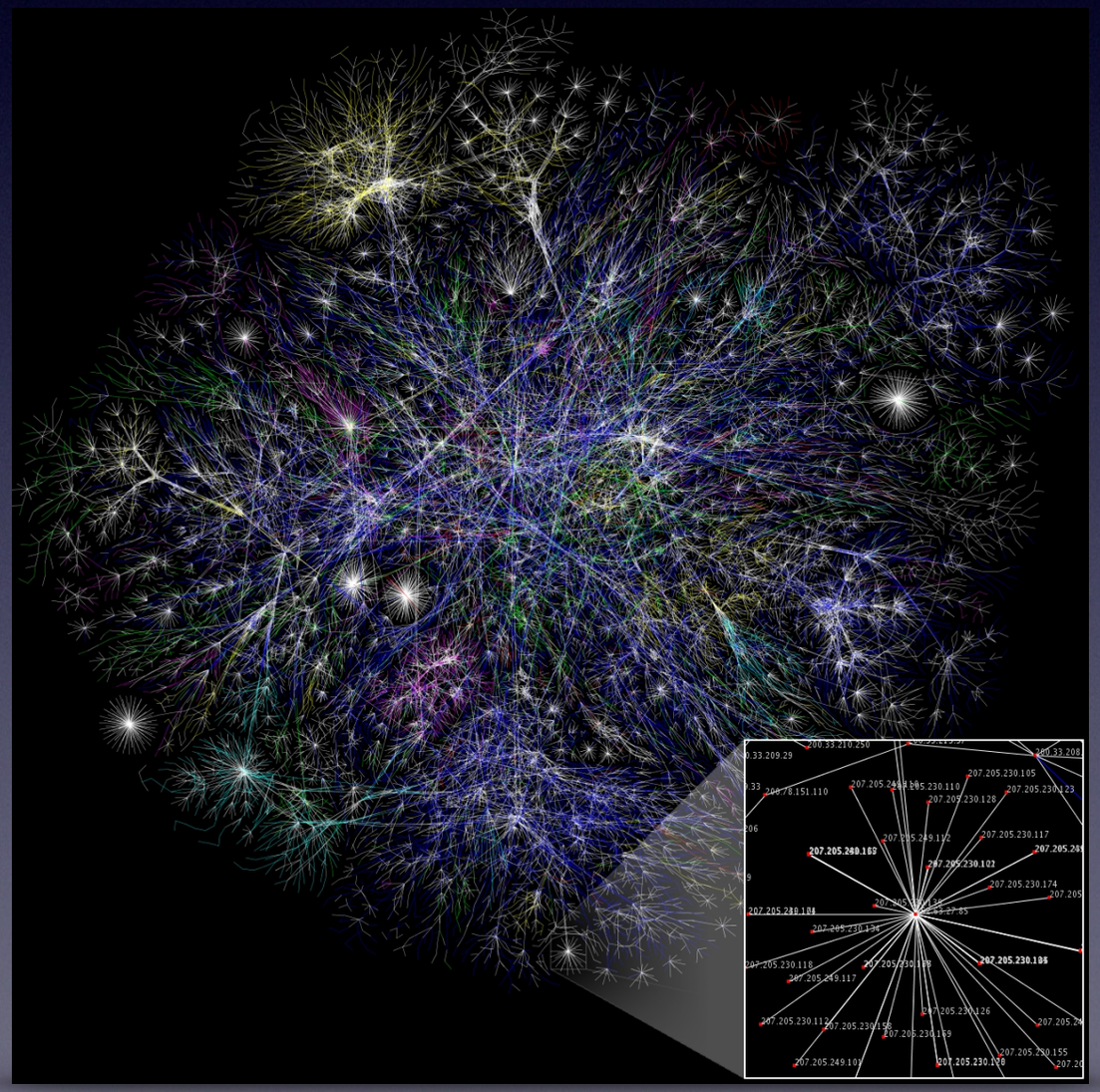
OPTE Project

- IP Range of:
  192.0.0.0
  223.255.255.255
- Graph visualises %30 of the network.
- The length of the wires represents the delay.
- Colours represents codes from RFC 1918.



OPTE Project

- Around half billion nodes in IPv4
- Idea could be worth to see
  - The growth of the net
  - How it reacts
    - positively (socially)
    - negatively (disasters)



History of WWW

- WWW: World Wide Web
- Invented in 1989 @ CERN by Tim Berners-Lee
- He submitted a proposal for hypertext project
- WWW is much younger than the internet..!

What's the motivation?

- Tim was working for CERN as SW Eng.
- @ CERN, There was a need to bridge:
  - People from all over the world
  - Different sorts of information
  - And different organisations…
- So there was a need of sharing reports and results on between scientists geographically distributed.

What's the motivation?

- His proposal first rejected :) then accepted one year later.
- In the proposal he defined:
  - HTML
    Language for document structures
  - URI
    Identifier for locating documentations
  - HTTP
    Protocol for transferring documentations

Ever wondered the first web site in the world?

First Web Site

World Wide Web

The WorldWideWeb (W3) is a wide-area hypermedia information retrieval initiative aiming to give universal access to a large universe of documents.

Everything there is online about W3 is linked directly or indirectly to this document, including an executive summary of the project, Mailing lists , Policy , November's W3 news , Frequently Asked Questions .

What's out there?
: Pointers to the world's online information, subjects , W3 servers, etc.

Help
: on the browser you are using

Software Products
: A list of W3 project components and their current state. (e.g. Line Mode ,X11 Viola , NeXTStep , Servers , Tools , Mail robot , Library)

Technical
: Details of protocols, formats, program internals etc

Bibliography
: Paper documentation on W3 and references.

People
: A list of some people involved in the project.

History
: A summary of the history of the project.

How can I help ?
: If you would like to support the web..

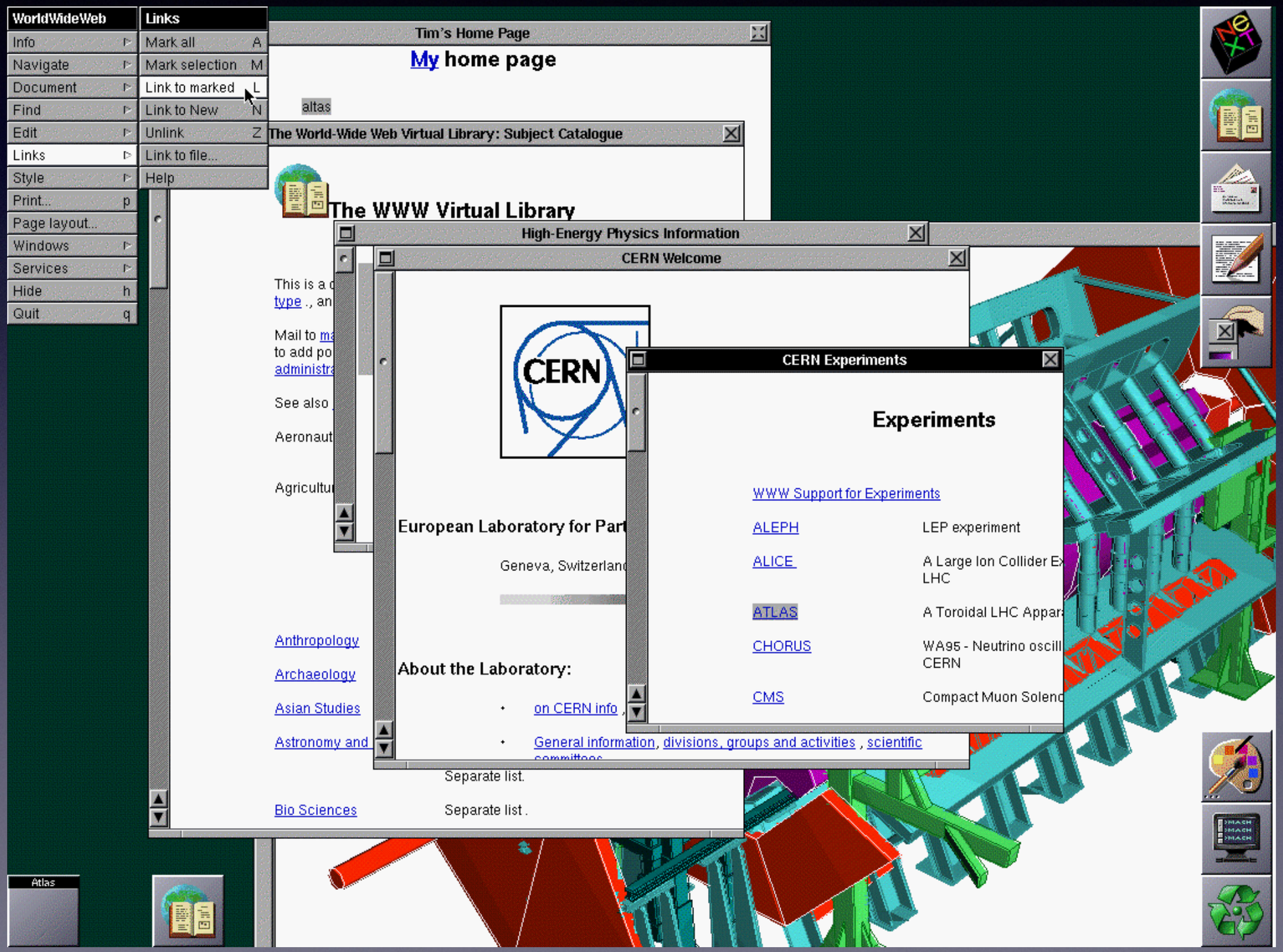
Getting code
: Getting the code by anonymous FTP , etc.

First Web Site - Real Look:)

How did they browse those very first web pages?

First Web Browser

WorldWideWeb



History of Browsers

- WorldWideWeb: First Browser by Berners-Lee working on Next.
- libwww: Written in C, more common platform. by Berners-Lee and Francois Groff.
- line-mode: Nicola Pellow implemented the browser that could work on any machine.
- Samba: Robert Cailliau started development of the first web browser for the Macintosh.

History of Browsers

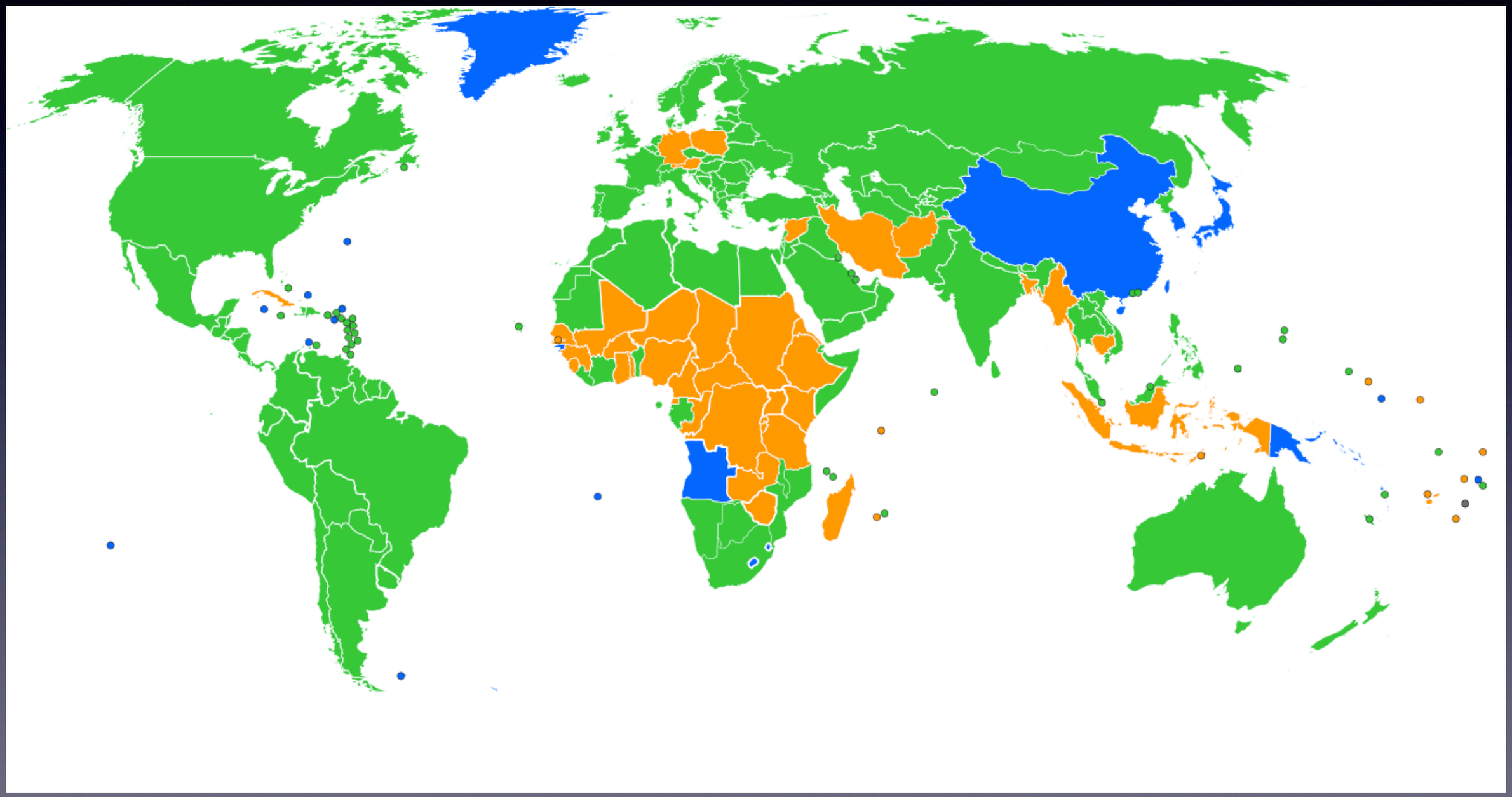
- Mosaic: First widely used Web Browser. Predecessor to Netscape. First browser with cross-platform support, X-Windows, Unix, Mac. Core also used by other browsers, like IE.
- lynx: Written in the University of Kansas. non-graphic text mode browser. It's still used today.
- Opera: Developed in Norway by a telco company.

History of Browsers

- Mozilla: Netscape company released 1st version in 1994. Since 2004 it's known as FireFox.
- IE: Released by Windows 95. Became leading web browser in 1999 by passing Netscape.
- Safari: Released in 2003 by Apple, Mac's default browser.
- Chrome: In 2008 released by Google.

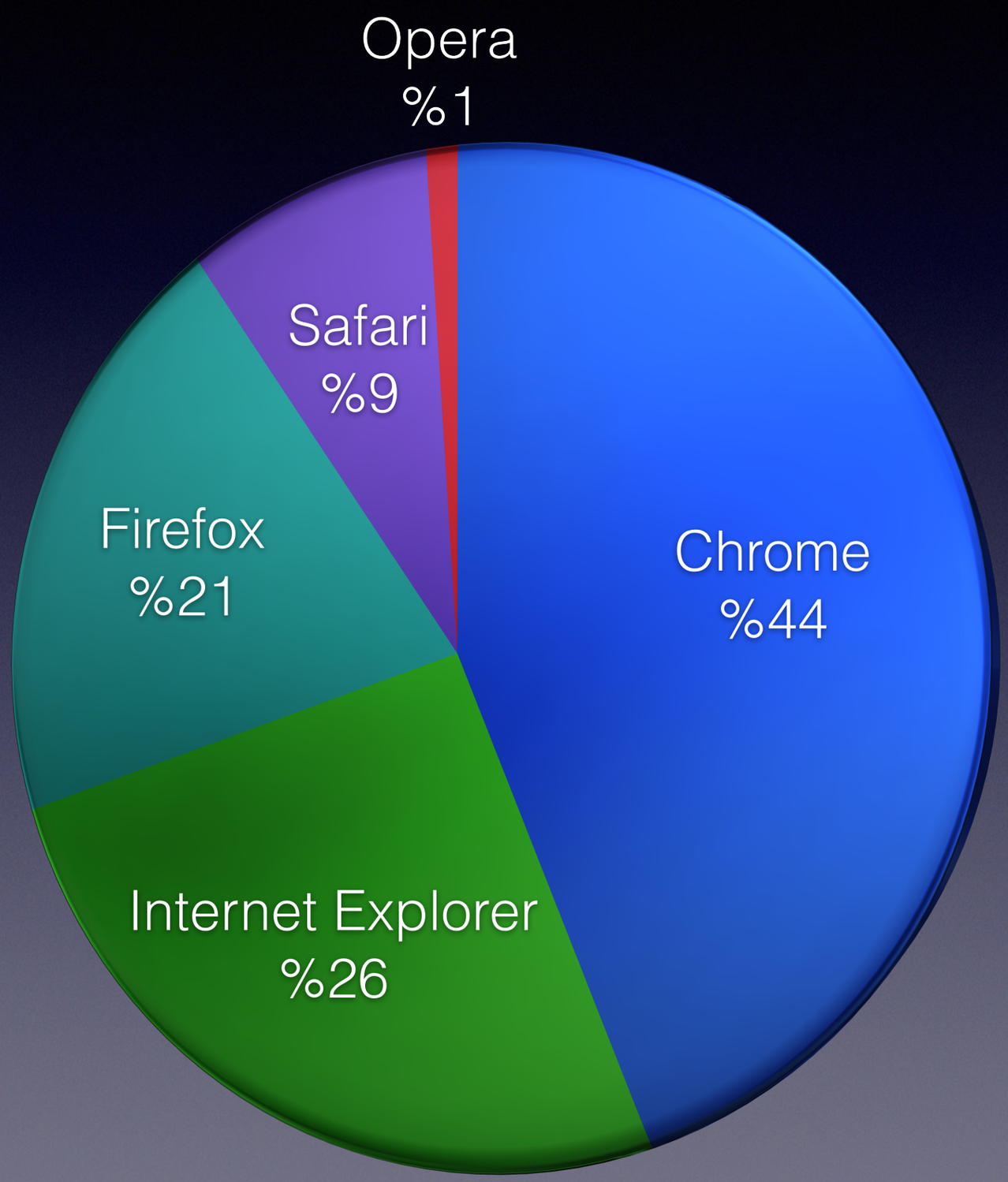
What's your favourite browser?

Usage of Browses



according to
statcounter.com

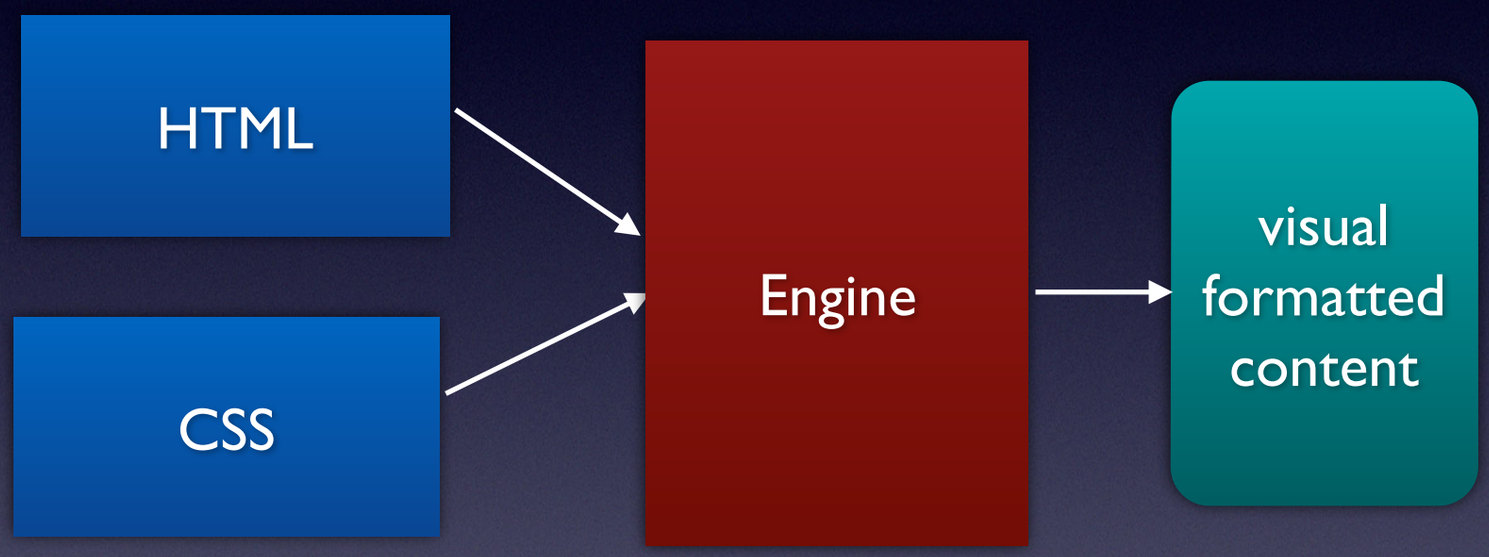
Usage of Browses



according to
statcounter.com

Browser Engines

- web browser engine
  a.k.a. rendering engine = layout engine.



- engine: takes URL, convert document to graphical representation
- host application: takes care of the browser's abilities: menubar, address bar, status bar & etc.

Browser Engines

- So,
  you can use the same engine can be used by an email client to render an HTML mail.

- anyone knows EPUB?
  they use a layout engine to render XHTML and CSS for an electronic book ;)

Available Browser Engines

- KHTML: Developed by KDE, used in Konqueror.
- WebKit: Developed by Apple. Used in Safari, derived from KHTML.
- Blink: Developed by Google, Used in Chrome, derived from WebKit.
- Gecko: Developed by Mozilla Corp, used by FireFox.

Where did Berners-Lee run the first web site?

First Web Server

How do they maintain all the terminologies and prevent from turning it into a mayhem?

World Wide Web Consortium

- w3.org
- Organisations & full-time staff to develop Web Standards
- A Web Standard:
  - Defines technologies, like CSS, SVG, WOFF, XML and APIs; for developers to build rich interactive Apps that embody vast amount of data.

Core of WEB

HTML

URI

HTTP

Core of WEB

- HTML : HyperText Markup Language
- URI : Uniform Resource Identifier
- HTTP : Hypertext Transfer Protocol

The English prefix hyper- comes from the Greek prefix "ὑπερ-" and means "over" or "beyond";

Depicts the overcoming the constraints of the written text.

HTML

- <u>Recap:</u>
  HTML: Language for document structures
- Tags enclosed in angle brackets (< and >)
- Anatomy of a tag:
  <html> </html>
  can also be represented as
- Tags can also contain attributes.
- Reference contains 100+ tags

Versions of HTML

- HTML : Simple Stupid.. used ‘till 1995. (1989)
- HTML 2 : IETF standardised it with version 2. (1995)
- HTML 3.2 : First version published by W3C (1997)
- HTML 4.01 : It was build upon SGML. (1999)
- HTML 5 : Brings multi media to the Web. (2008)

Simplest HTML

```
<!DOCTYPE html>
<html>
  <body>
    Hello World
  </body>
</html>
```

HTML Tags

Simplest HTML:

```
<!DOCTYPE html>
<html>
  <body>
    Hello World
  </body>
</html>
```

HTML Tags

- <!DOCTYPE>: Defines document type. must be the first thing in the document. It's not an HTML Tag.

- <html>: Defines the root of the HTML document Container for all HTML tags, except <!DOCTYPE>

- <body>: Defines the document body. Contains all HTML elements, texts, links, images, tables & etc.

<head>

- Container for Head elements. Descriptors for the content. Also includes styling and scripting documents.

<title>	Defines the title of a document
<base>	Defines a default address or a default target for all links on a page
<link>	Defines the relationship between a document and an external resource
<meta>	Defines metadata about an HTML document
<script>	Defines a client-side script
<style>	Defines style information for a document

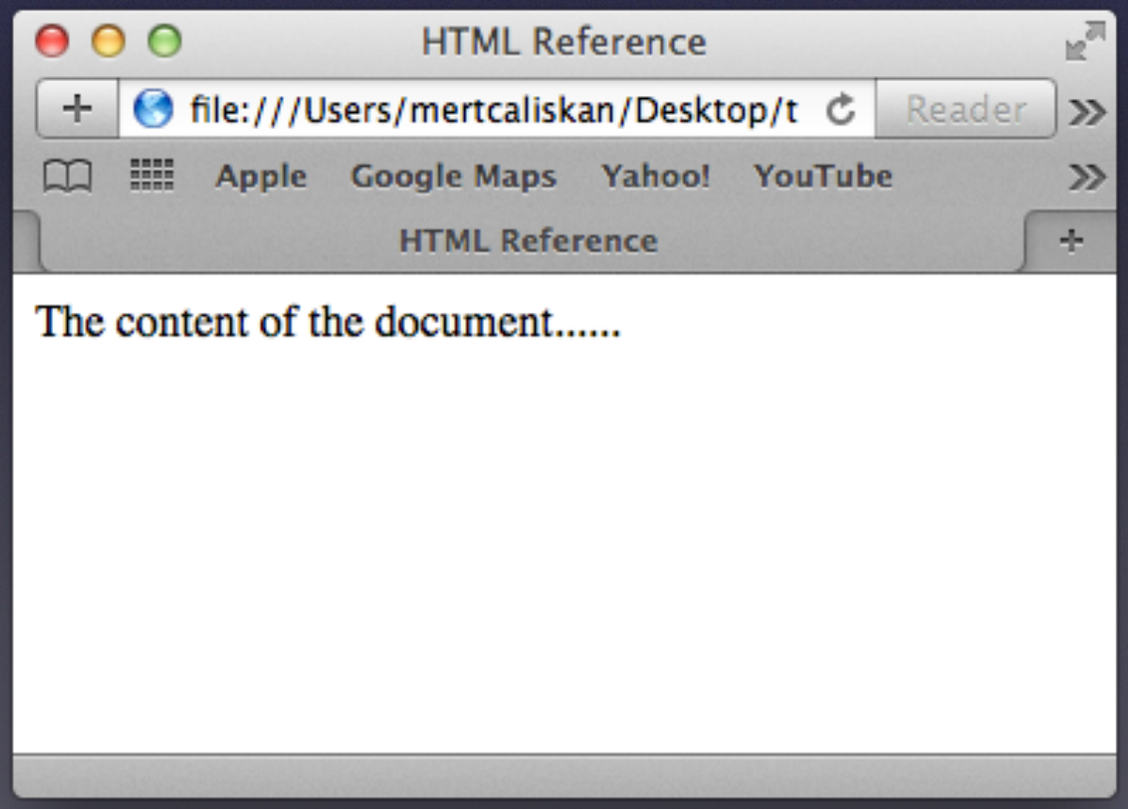
<title>

- The <title> tag defines the title of the document. Could only be one definition inside the <head>.

- Defines a title in the browser toolbar.
- Provides a title for the page when it is added to favourites.
- Displays a title for the page in search-engine results.

<title>

```
<HTML>
   <HEAD>
      <TITLE>HTML Reference</TITLE>
   </HEAD>
   <BODY>
      The content of the document.....
   </BODY>
</HTML>
```



<link>

- A link is a connection from one Web resource to another.
- Defines the relationship between a document and an external resource, it resides in <head>.
- Mostly used to link to style sheets.

<link>

- Definition of a style sheet:

```
<HEAD>
    <LINK href="special.css" rel="stylesheet" type="“text/css">
</HEAD>
```

- A reverse link and a forward link definition.

```
<HEAD>
    <TITLE>Chapter 5</TITLE>
   <LINK rel="prev" href="chapter4.html">
   <LINK rel="next" href="chapter6.html">
</HEAD>
```

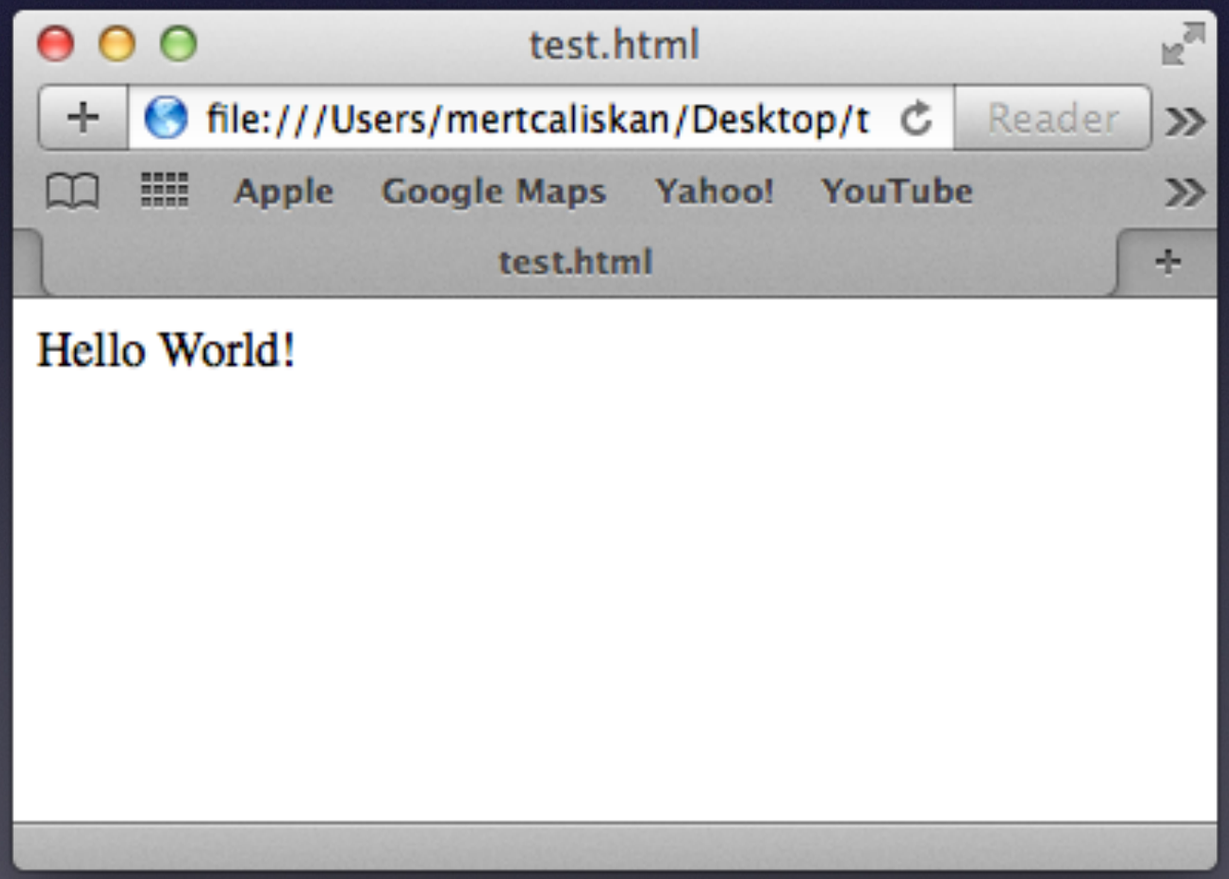
<script>

- tag is used to define a client-side script, such as a JavaScript.

- <script> element either contains scripting statements or it points to an external script file through the *src* attribute.

<script>

```
<html>
    <head>
        <script>
            document.write("Hello World!”);
        </script>
    </head>
</html>
```



<script>

- External Script resource:

```
<html>
    <head>
        <script src="myScript.js"></script>
    </head>
</html>
```

Question here is:

What is JavaScript?

JavaScript

- Prototype-based scripting language.
- First introduced by the NetScape browser in 1995.
- Microsoft released IE at the time so there was a competition between the browsers.
- Became a success as a client-side scripting language for web pages, Microsoft also integrated it into IE.
- Powerful JS frameworks out there now: jQuery, ExtJS, Dojo, ZK & etc…

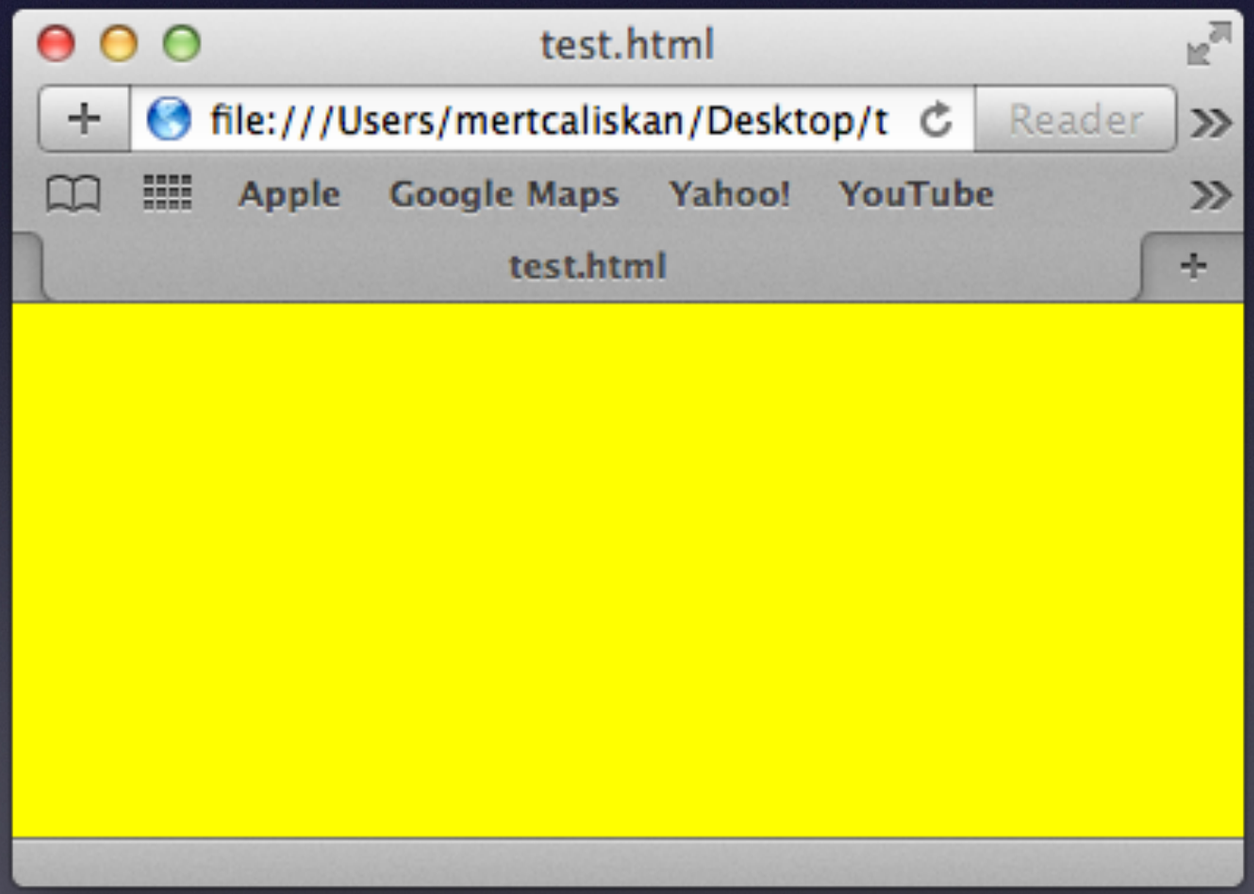
<style>

- tag is used to define the style information for an HTML document, with Cascading Style Sheets.

- Within the <head> tag, global styles per document can be introduced. Some HTML elements also have the *style* attribute.

<style>

```
<html>
    <head>
        <style type="text/css">
            body {background-color:yellow;}
        </style>
    </head>
</html>
```



Question here is:

What is Cascading Style Sheet?

Cascading Style Sheet

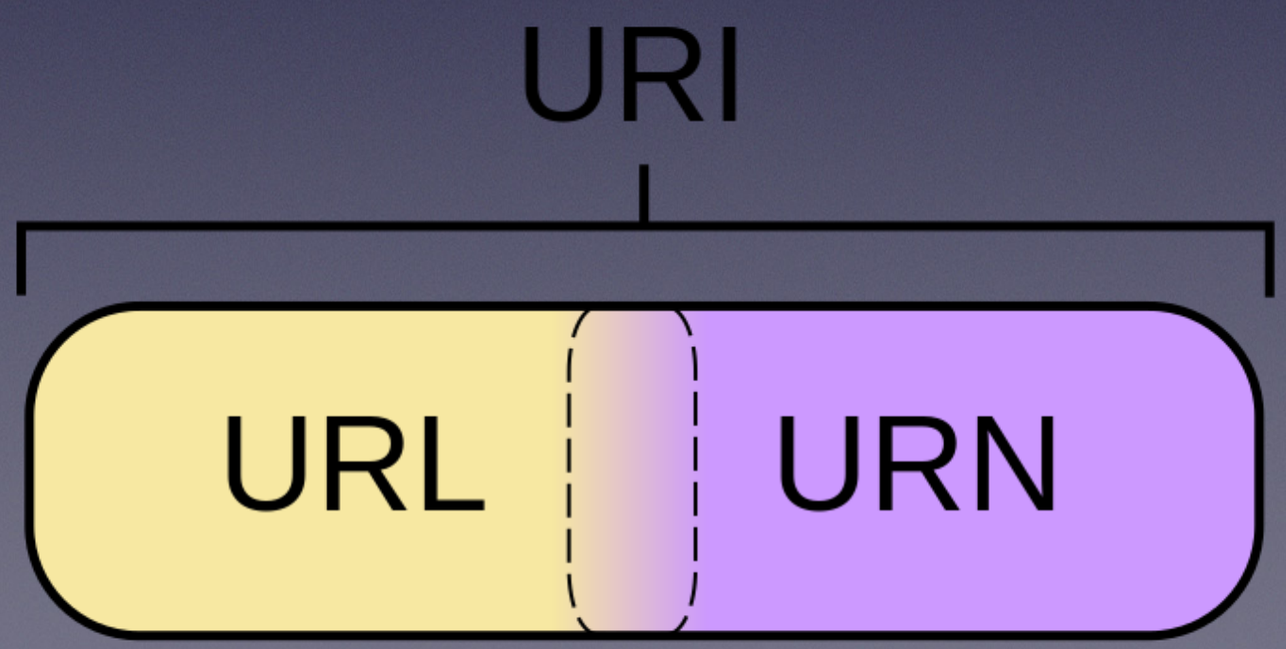
- A style sheet language used for describing the look and formatting of a document.
- To improve presentation capabilities of the Web, W3C selected 2 proposals,
  - CSS: Cascading HTML Style Sheets (CHSS)
  - Stream-based Style Sheet Proposal (SSP)
- And by the end of 1996, CSS became official.

Cascading Style Sheet

- What CSS offers:
  - Separation of content from presentation
  - Site-wide consistency
  - Bandwidth
  - Page reformatting
  - Accessibility
  - Maintainability

URI

- <u>Recap</u>
  Identifier for locating documentations
- Stands for: Uniform Resource Identifier
- String of characters used to identify a resource on the Internet.
- and what about URL and URN?



URI, URL, URN

- URL: Uniform Resource Locator
  Specifies where an identified resource is available and the mechanism for retrieving it.
  ex: person's street address.

- URN: Uniform Resource Name
  Specifies the name of the resource, provides no details about how to get the resource over a network.
  ex: person's name.

URI, URL, URN

```
foo://example.com:8042/over/there?name=horse#nose
\_/   \______________/\_________/ \_________/ \__/
 |           |            |           |        |
scheme     server address  path       query   fragment
                        _|_
                       /   \
urn:example:animal:horse:nose
```

- scheme could either be http, https, ftp, news, mailto, file and telnet.
- server address also can also point out the IP
- path consists of folders and files.

We defined the ways to present the data (HTML)
to make it discoverable (URI)
but
How to we transfer the content?

HTTP

- Recap
  Protocol for transferring documentations
- Application Protocol (remember IP Hourglass?) for transfer hypertext.
- Based on request-response model. It's a stateless protocol like IP.
- First version had one method: GET, we'll get to the methods later.

HTTP Methods

- HEAD
- GET
- POST
- PUT
- DELETE
- TRACE
- OPTIONS
- CONNECT

8 request methods for the resource…

They are also called as *Verbs*

HTTP Methods

- HEAD
- GET
- POST
- PUT
- DELETE
- TRACE
- OPTIONS
- CONNECT

8 major methods.

Some of them are SAFE methods..Which are they? any guesses?

What we might want to say with the SAFE? any guesses?

HTTP Methods

- HEAD
- GET
- POST
- PUT
- DELETE
- TRACE
- OPTIONS
- CONNECT

The ones in yellow are intended only for information retrieval and should not change the state of the server.

HTTP

- The resources are defined by URIs.
- Current version is HTTP/1.1
- HTTP/1.0 was using separate connection to the server to get resources. 1.1 can reuse a connection multiple times to download images, scripts, stylesheets & etc.
- It's stateless but protocol offers the HTTP session, we'll also get to the later.

curl

- Command line tool for transferring data with URL syntax.
- We'll be using it to demo some of the HTTP methods.
- Sample usage:

  curl --request GET http://www.isinternetworking.com

GET Request

Method retrieves information via given URI.

with curl:
curl --request GET http://www.isinternetworking.com

GET / HTTP/1.1
Host: www.isinternetworking.com
User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10.9; rv:26.0) Gecko/20100101 Firefox/26.0
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate
Connection: keep-alive

GET Response

```
<html>
<head>
  <title>Is internet working?</title>
</head>
<body style="text-align: center; padding-top: 200px;
background: white; color: black;;">
<!-- Yes, I completely stole these lines from
hasthelhcdestroyedtheearth.com. Call it laziness or an
homage or what you want. -->
<span style="font-weight: bold; font-size: 120pt;
font-family: Arial, sans-serif; text-decoration:
none;"  >YES</span>
</body>
</html>
```

HEAD / Header

Same as GET but only response headers get retrieved.

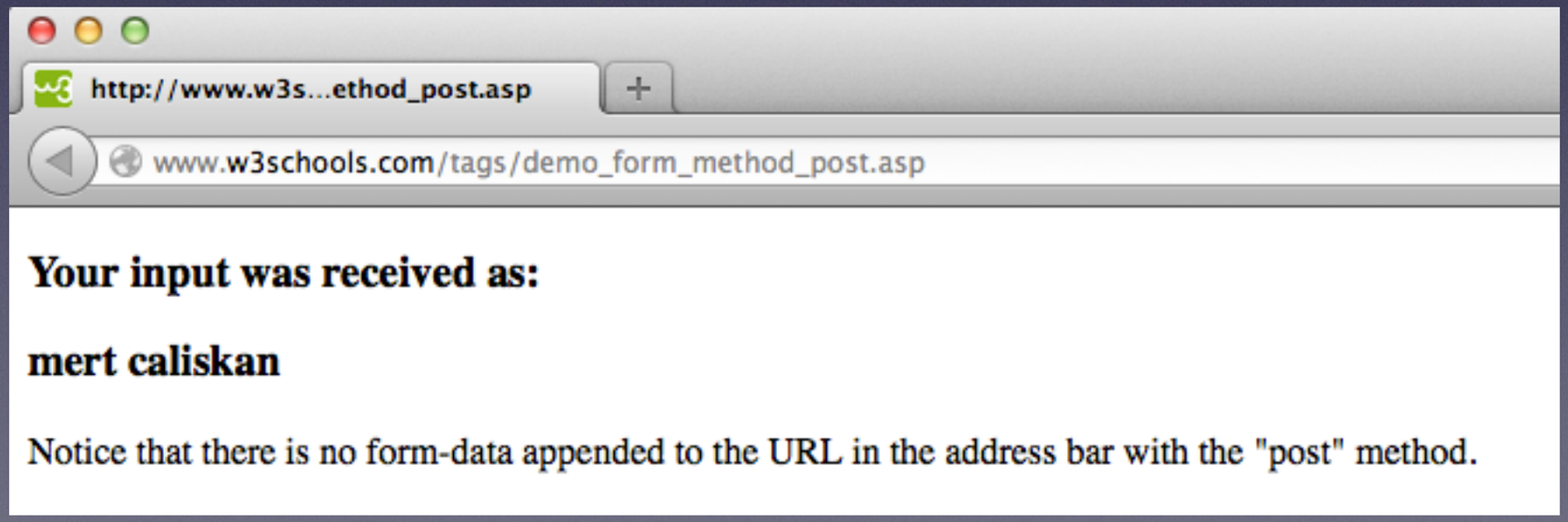
```
HTTP/1.1 200 OK
Date: Sun, 26 Jan 2014 20:22:03 GMT
Server: Apache/2.2.16 (Debian)
Last-Modified: Thu, 19 Jan 2012 06:08:56 GMT
Etag: "240ecc-19d-4b6db6639ce00"
Accept-Ranges: bytes
Vary: Accept-Encoding
Content-Encoding: gzip
Content-Length: 302
Keep-Alive: timeout=15, max=97
Connection: Keep-Alive
Content-Type: text/html
```

POST

- Method to send data to the server enclosed in a request message's body.
- curl:
  curl --request POST --data "fname=mert&lname=caliskan" http://www.w3schools.com/tags/demo_form_method_post.asp
- Can be used to upload a file or to submit a form.

POST

```
<form target="_blank" method="post" action="demo_form_method_post.asp">
First name:
<input type="text" name="fname">
<br>
Last name:
<input type="text" name="lname">
<br>
<input type="submit" value="Submit">
</form>
```



PUT

- Method to put a file or resource at a specific URI, and exactly at that URI.
- It modifies the resource as POST but a PUT to a URI affects exactly that URI. But a POST to a URI could have any effect at all.

DELETE

- Method requests to the server to delete the resource identified by the URI.

Anyone knows ReST?

What does it stand for?

ReST

- Representational State Transfer
- Resource Identification through URI.
- Any "Thing", Anything you would want to point to.
- via HTTP Methods
  GET / PUT / POST / DELETE
- We'll get to this topic (SOAP based services and ResT based services) in upcoming weeks.

HTTP Session

- HTTP is a stateless protocol.
- HTTP Session is a sequence of network request-response transactions.
- Cookies or hidden variables can be used for providing the HTTP session.

HTTP Cookies

- Small text files stored in browsers directories.
- Anatomy of a Cookie:
  - The name of the server the cookie was sent from
  - The lifetime of the cookie
  - A value - usually a randomly generated unique number

HTTP Cookies

- There are 2 types of cookies.
- Session Cookies: Created temporarily, gets deleted when you leave the site / close the browser.

  They help on tracking HTTP sessions.

- Persistent Cookies: Remains in the browser's subfolder for the duration period set within the cookie's file.

  They can be used to store settings for the user.

We invoked HTTP methods,
what do we get in return?

HTTP STATUS CODES

RFC2616

- 1xx : Informational
- 2xx : Success
- 3xx : Redirection
- 4xx : Client Side Error
- 5xx : Server Side Error

100: Continue

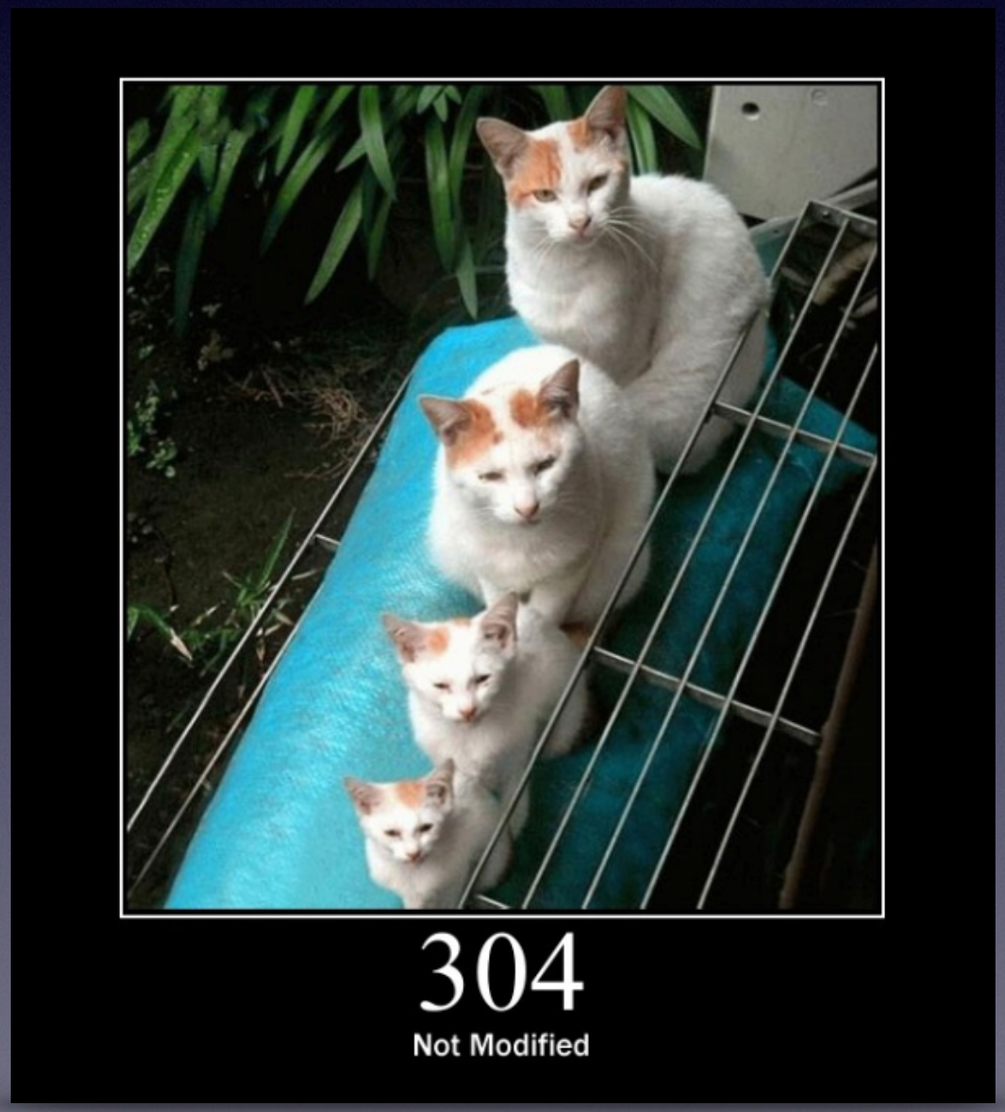
- Code means that:
  Server has received the request headers, and that the client should proceed to send the request body.
- You could be sending a large request body.
- Or you could be on a slow connection.

200: OK

- Code means that:
  Standard response for successful HTTP requests.

304: Not Modified

- Code means that:
  Indicates that the resource has not been modified since the version specified by the request headers <u>If-Modified-Since</u> or <u>If-Match</u>.
- Resource will not be retransmitted again and previously downloaded version will be used.



404: Not Found

- Code means that:
  The requested resource could not be found but may be available again in the future.

History of Java and Java EE

YOU KNOW THIS TRANS-ATLANTIC?

- RMS Titanic
  sank in North Atlantic Ocean
  on 15 April, 1912 on maiden voyage

So Eventually <u>Everything Dies</u>...!

- You, Me, All of Us…
  Companies, Technologies...

- <u>Key point is:</u> You should avoid not making it like Titanic, which sunk in 2hrs and 40 minutes...!

Founded February 24, 1982

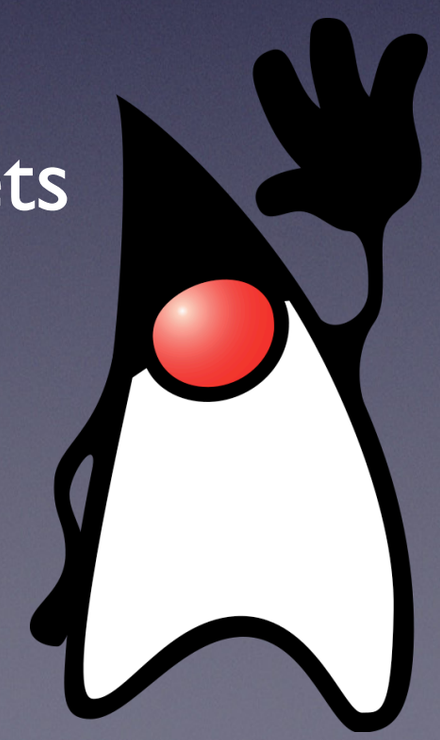
Sold to Oracle January 27, 2010 for $7.4 billion..!

Sun was mainly selling Hardware, but they also working on computer software like Java, MySQL and NFS..

Founded in 1977 by Larry Ellison and a couple of clever guys, their motivation is to compete with IBM's System R, which was a relational database.

History of JAVA

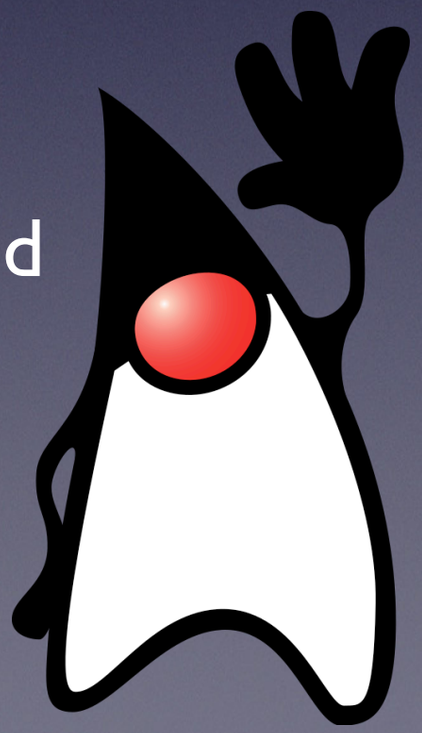
- Java Language Project started in June 1991
- (James Gosling and his fellas)
- Running byteCode on Java Virtual Machine
- WORA (Write Once, Run Anywhere)
- First started with applets in the WEB world
- With the dawn of Java Enterprise Edition, Servlets made their way to rule the world.



The Duke

Editions of JAVA

- Java Card: applets on smart cards (sim cards)
- Micro Edition (ME): mobile phones + set-top boxes
- Standard Edition (SE): Cool Software Platform
- Enterprise Edition (EE): Oracle's Enterprise Computing Platform
- JavaFX: Aim was RIA (looks dead to me)
- Personal Java: (discontinued) Java edition for mobile and embedded systems based on Java 1.1.8



James Gosling...
was the FATHER of Java

Age: 59

Age: 70

Which one is younger? :)

Larry Ellison...
is the new BOSS

CHRONOLOGY OF JAVA SE

JDK 1.0
January 23, 1996

JDK 1.1
February 19, 1997

Introducing
Abstract Window Toolkit

Swing was on Board

J2SE 1.2
December 8, 1998

HotSpot JVM

J2SE 1.3
May 8, 2000

CHRONOLOGY OF JAVA SE

J2SE 1.4
February 6, 2002

reg-ex, Java Web Start
embedded XML parser

J2SE 1.5
September 30, 2004

New Cool Language Features
Generics, AutoBoxing, var-args & etc..

Java SE 6
December 11, 2006

Renamed to Java SE instead of
J2SE from now on.
Support for running scripting lang. like
Rhino.

Java SE 7
July 28, 2011

Multi-Catch in Exceptions
String in switch (finally!)
more cools features in the lang...

Enterprise Java

- Java EE = Java Enterprise Edition
- Extends Java SE

`javax.faces.*`	UI + JSF Related Stuff
`javax.servlet.*`	Handling HTTP invocations
`javax.enterprise.inject.*`	CDI, Like Spring depedency Inj.
`javax.ejb.*`	EJB Stuff
`javax.validation.*`	Bean Validation
`javax.persistence.*`	Persistency
`javax.transaction.*`	Stuff for transactions
`javax.jms.*`	Messaging Stuff