



What Makes the World Wide Web Work (WMWWW)

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The New Revolution

“The shift to network computing is profound. I believe it will reshape the world as fundamentally as the invention of the printing press... It will reshape every business and institution in the world.”

— Lou Gerstner (IBM)

April 1996

Internet Early History: ARPAnet

- ARPA, 1969
- Networked computer systems of a dozen universities and institutions
 - 56kbps communications lines
- Grandparent of today's Internet
- Intended to allow computers to be shared
- Decentralized network, designed for survivability
 - runs without centralized control
 - if portion of network fails, remaining portions still able to route data packets
- Security not a consideration
- Key benefit was easy/fast communication between researchers

Internet History

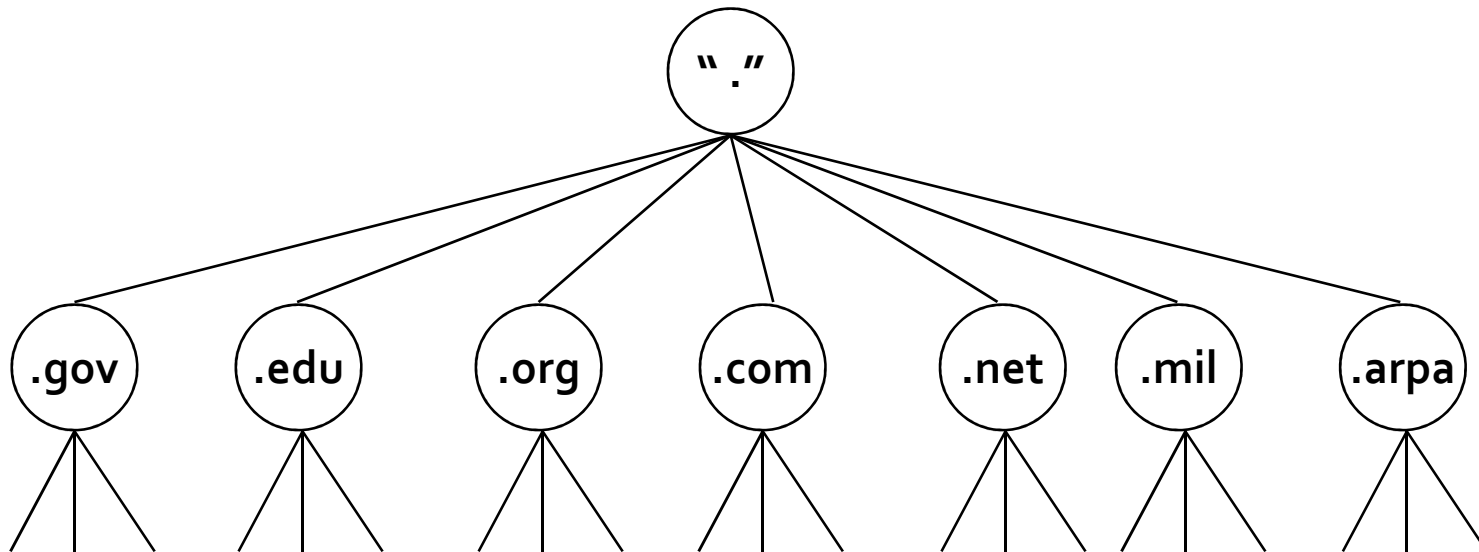
- Originally limited to universities and research institutions
 - Military became big user
 - Blending of ARPAnet, CSnet, Bitnet, and more
 - Access allowed for commercial purposes (early 1990s) (Thank you, Al Gore!)
- Internet traffic grew
 - Businesses spent heavily to improve Internet
 - Better service to their clients
 - Fierce competition among communications carriers and hardware/software suppliers
 - Result:
 - Bandwidth of Internet increased tremendously
 - Costs plummeted

What is “The Internet”?

- A worldwide cooperative
 - Public/private networks, globally interconnected
 - Functions as a single Wide Area Network
 - Nobody really in charge
- Explosive growth
 - Over 70,000 networks (as of 1995)
 - 140 million registered domains (as of May 2012)
 - 443 million connected hosts
 - Hosts advertised in Domain Name Service, January 2007
 - 2.3 billion users (as of December 2011)
 - 33% of world population
 - Connects 230 countries worldwide

Top-Level Domains

- .com
- .net
- .org
- .edu
- .gov
- .mil
- .biz
- .info
- .us



Protocols and Services



Early Internet Protocols

- TCP: Transmission Control Protocol
- UDP: User Datagram Protocol
- IP: Internet Protocol

TCP/IP underpins much of the Internet

- FTP: File Transfer Protocol
- NTP: Network Time Protocol
- SMTP: Simple Mail Transport Protocol
- POP: Post Office Protocol
- IMAP: Internet Message Access Protocol

Evolving Protocols

- Gopher (1991)
 - Hierarchical structuring of documents
- WAIS: Wide Area Information Service
 - Used to search Gopher servers
- *Best option, at the time, for text documents*

World Wide Web

- 1991, Tim Berners-Lee, CERN
- Locate and view hypertext-linked multimedia documents
- Mixes computing and communications technologies
- Makes information constantly and instantly available to anyone with a connection
- Most popular Internet protocol
 - (along with e-mail)

World Wide Web Consortium (W3C)

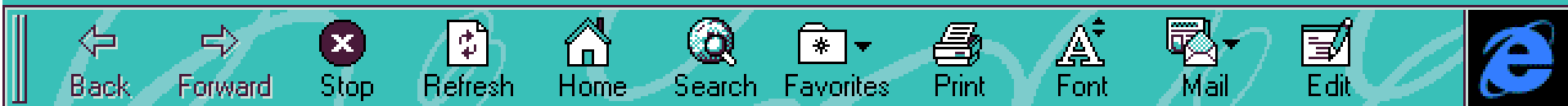
- Previously, anarchy!
- Founded in 1994 by Tim Berners-Lee
- Develops non-proprietary, interoperable technologies for the WWW
 - Goal: making the Web universally accessible
- Issues standards
 - Extensible HyperText Markup Language (XHTML)
 - Cascading Style Sheets (CSS)
 - Extensible Markup Language (XML)
 - Accessibility

That Long Ago?

- 1972: first e-mail program
- 1988: Morris worm unleashed
- 1994: Yahoo!
- 1995: Auctionweb → eBay
Amazon.com
- 1996: Google
- 1999: Napster

WWW Underpinnings

- Client-server architecture
- Hypertext Transmission Protocol (HTTP)
 - Simple and fast
- Hypertext Markup Language (HTML)
 - “View source” from browser
 - Variants: XHTML, HTML5
- Cascading Style Sheets (CSS)
 - Separate content from presentation



Welcome to Tom's Secure WebServer

Systems Engineering in the Nation's Capital

[Tom's security-related stuff](#)

[Other sites](#)

This web site maintained by Tom Gutnick, 703.827.9669



Sample [ugly] web page

```
<html>
  <head>
    <title>Tom's Secure WebServer</title>
  </head>
  <body>
    <h1>Welcome to Tom's Secure WebServer</h1>
    <h2>Systems Engineering <br>in the Nation's Capital</h2>
    <hr />
    <p><a href="security-stuff.html">
      Tom's security-related stuff</a></p>
    <p><a href="other-sites.html">Other sites</a></p>
    <hr />
    <p><i>This web site maintained by Tom Gutnick, 703.827.9669</i></p>
    
  </body>
</html>
```

Sample [less ugly] web page

```
<html>
  <head>
    <title>Tom's Secure WebServer</title>
    <style type="text/css">
      body: { background-color: #dddddd; }
      h1, h2 { font-family: verdana, sans-serif; }
    </style>
  </head>
  <body>
    <h1>Welcome to Tom's Secure WebServer</h1>
    <h2>Systems Engineering <br>in the Nation's Capital</h2>
    <hr />
    <p><a href="security-stuff.html">
      Tom's security-related stuff</a></p>
    <p><a href="other-sites.html">Other sites</a></p>
    <hr />
    <p><i>This web site maintained by Tom Gutnick, 703.827.9669</i></p>
    
  </body>
</html>
```


Uniform Resource Locator (URL)

- Address used to access objects on a web server
 - Uniquely identifies a resource on the WWW
- Components:
 - Method
 - Host
 - Port (optional, defaults to 80)
 - Path (usually defaults to index.htm or index.html)
 - Fragment identifier (optional)
 - Query string (optional)

Examples:

`http://washingtonpost.com`

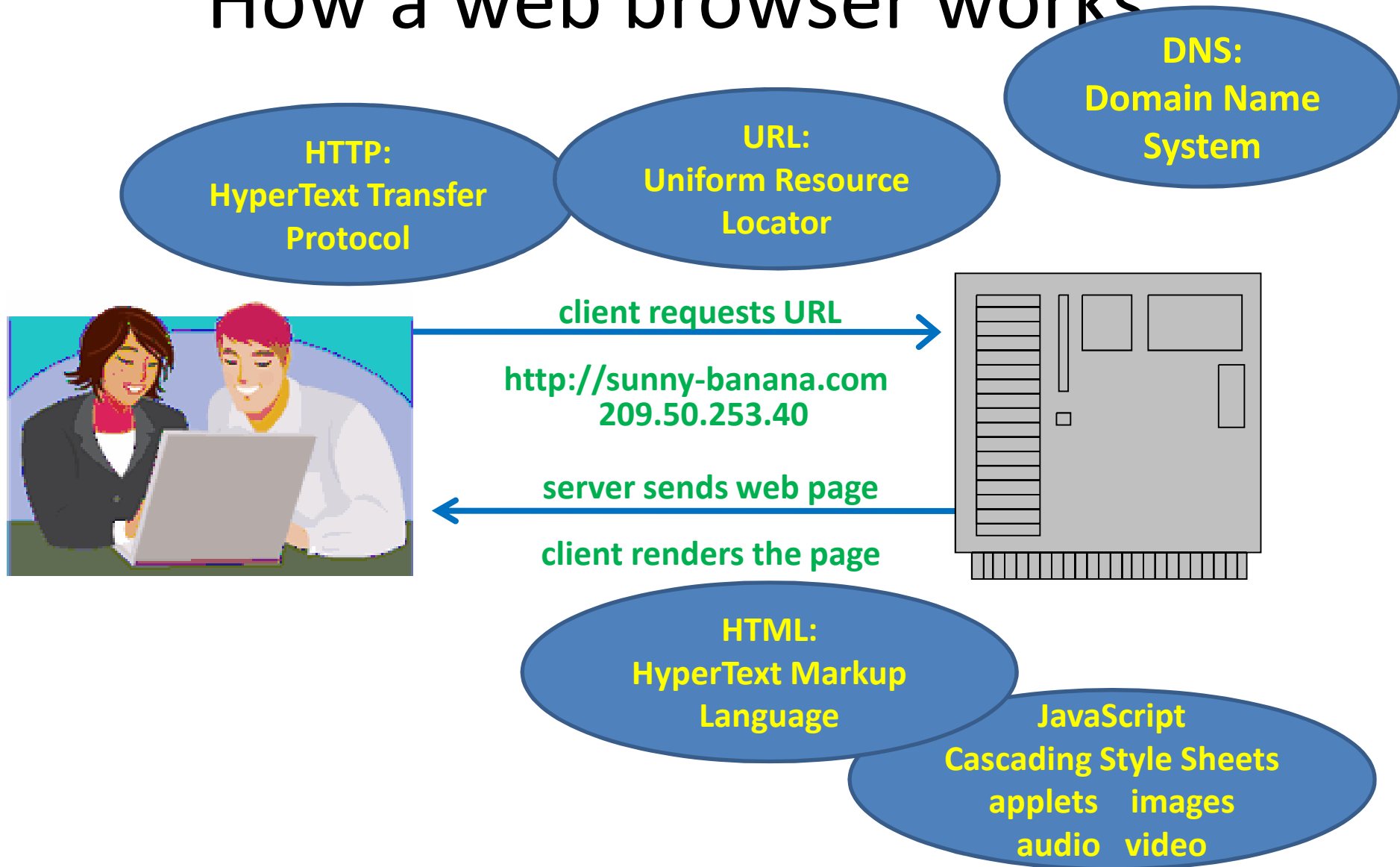
`http://www.dg.com:8080/support/test.cgi/?data`

`http://www.nvcc.edu/home/tgutnick/itd110/syllabus.html#calendar`

Internet Addressing

- Domain Name Server (DNS) does the work
- Translates a logical web address into a physical address
 - Invoked every time you attempt to access an Internet resource
 - Request: `http://www.yahoo.com`
 - Returns: IP address `98.139.183.24`
- Use *nslookup* if curious

How a web browser works



Cookies

- The dark side? or benign?
- Just a bit of data
 - Set by server, stored by browser
 - Sent back to server later
- Many functions
 - Create “session”
 - Remember preferences
- Curious? Examine with browser



Odds and Ends

- Client-side scripting
 - JavaScript
- Server-side scripting
 - Perl, PHP, ASP
 - Integrates with databases — MySQL
- Ajax
 - Asynchronous JavaScript and XML

Your Own Web Presence

- (Hosted by others?)
- Register a domain
 - Network Solutions, DomainSite
- Get hosted
 - Weebly
 - Bluehost, Dreamhost, A Small Orange
- Create content
 - Write HTML code
 - Use site builder tool

Browser Wars

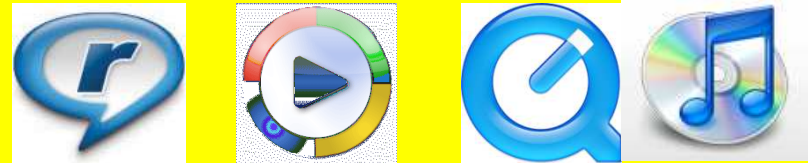
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“The battle for the desktop
is over. Microsoft won.”

-Tom West, Data General

The Battle for the Desktop

Media player



Office suite

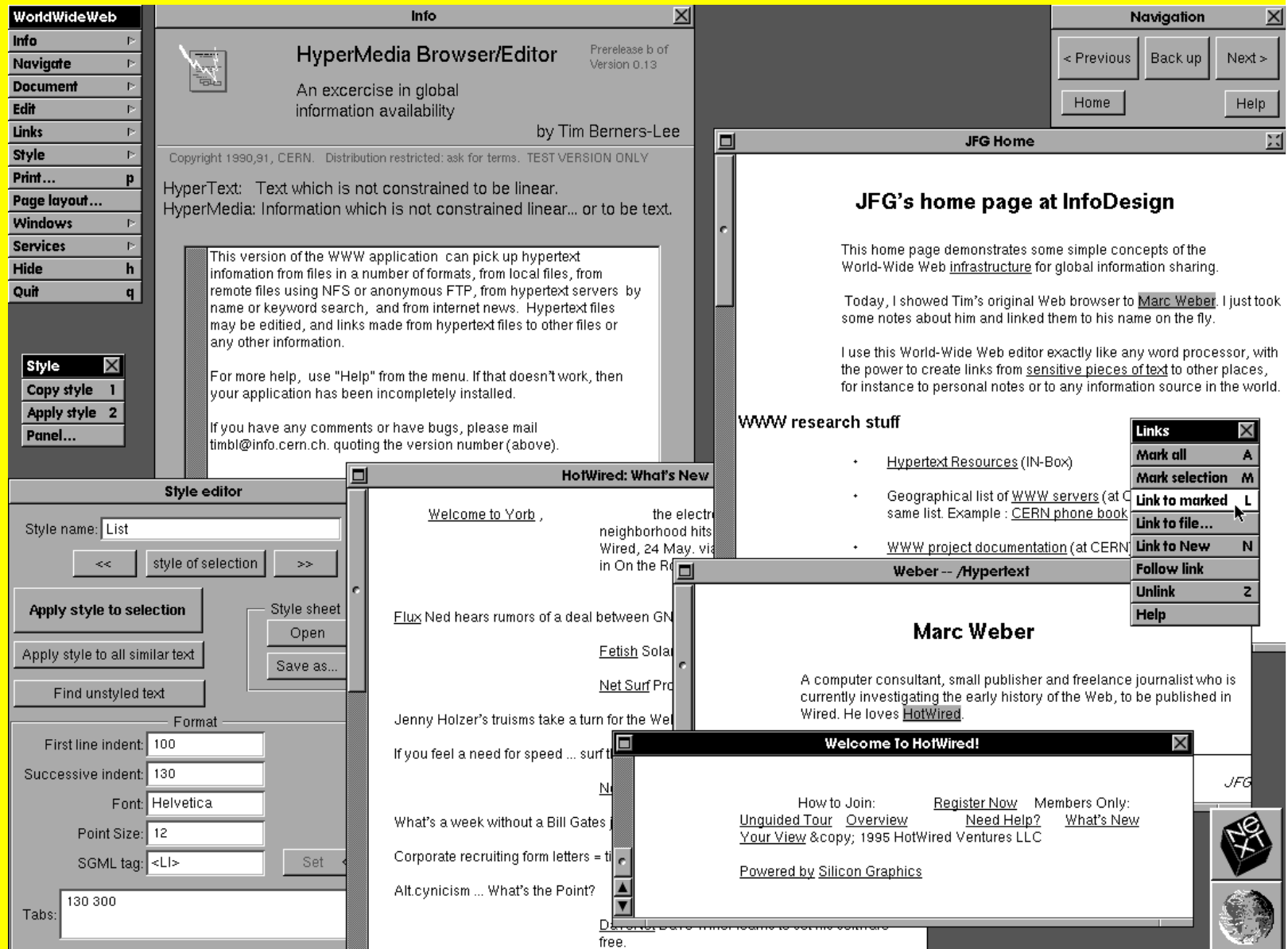


Web browser

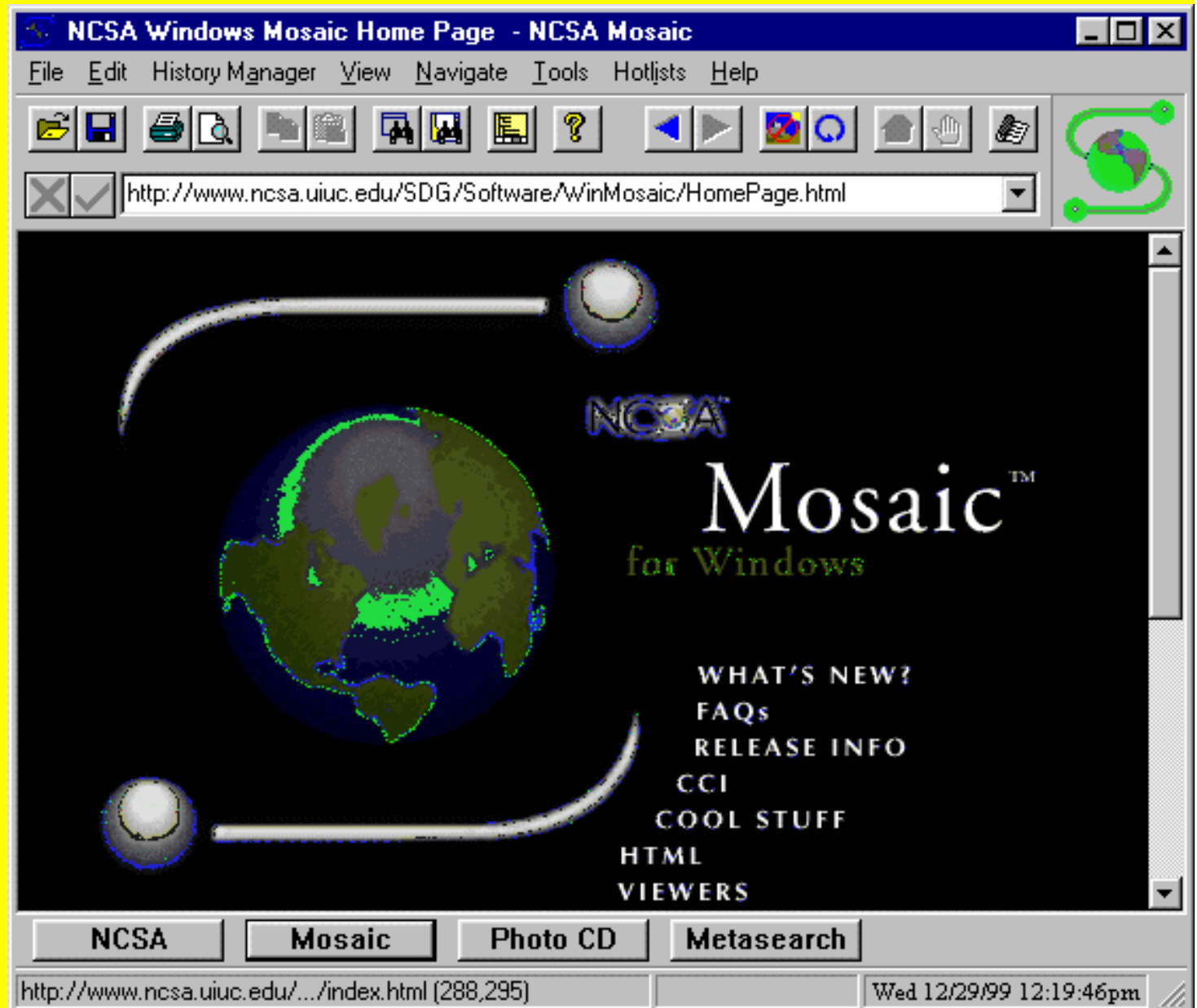
Operating system



In the beginning (1991)...



Before the skirmishes...



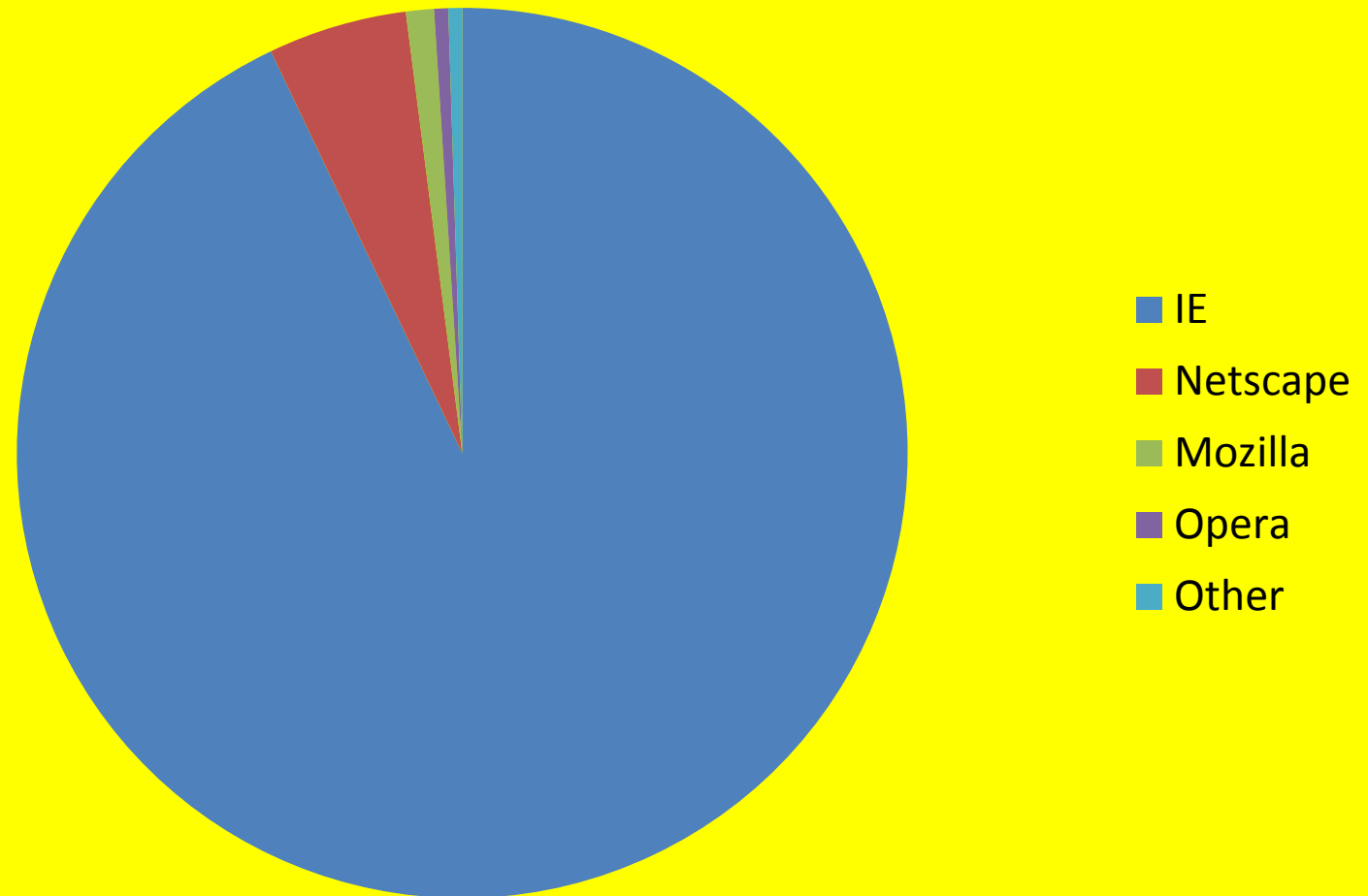
The First Round



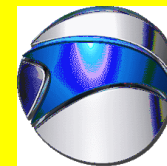
Browser "market" share

Q1/2002

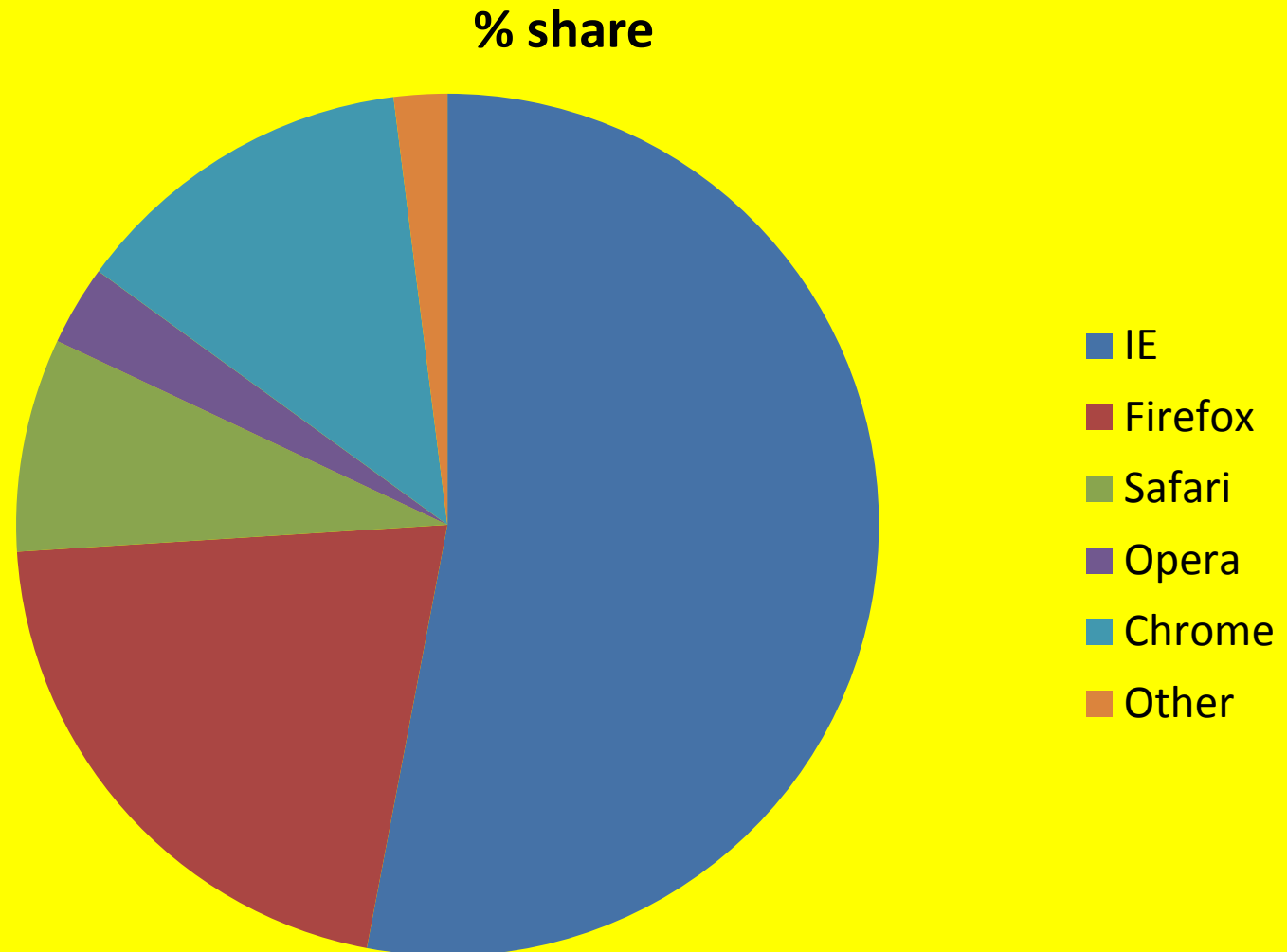
% share



The Current Combatants



Browser market share (Q3 2011)



Why Use Safari?



- Blazing performance
- Elegant user interface
- Easy bookmarks
- Pop-up blocking
- Tabbed browsing
- SnapBack
- Forms autofill
- Built-in RSS
- Resizable text areas
- Private browsing
- Security
- HTML5
- iPhone

Why Use Chrome?



- Search from the address bar
- Thumbnails of your top sites
- Private browsing
- “One box for everything”
- Optimized for Google Apps*
- Role in world domination?

Why Use Opera?



- *The innovator*
- Speed dial
- Tabs and sessions
- Mouse gestures
- Content blocking
- Widgets
- Download manager
 - with BitTorrent
- Zoom, fit to width
- Fraud protection, extended validation
- Feed preview
- Opera Link
- New browser engine
- Quick find
- Quick, customizable search
- Turbo mode for slow connections
- Mobile version

Why Use Firefox?



- Tabbed browsing
- Session saving
- Themes
- Extensions
- One-click bookmarking
- Phishing protection
- Search suggestions
- Smart location bar
- Smart keywords
- Open source

Why Use IE?



- Easy default
- Tabbed browsing
- Quick tabs
- Tab groups
- Advanced printing
- Instant search
- Favorites Center
- RSS Feeds
- Page zoom
- Security Status bar
- Phishing filter
- Extended validation

The Coming Convergence



Security Shoot-out

Actually 2 different wars!

YOU are the target!

Challenge:

Browsers are complex software.
How to mitigate the threats to
systems and privacy?

Bad news ! Good news

“If you’re looking for the perfectly secure browser, stop looking.”

“Any fully patched browser can be used relatively safely.”

Bonus: Browsing Safely

- Don't run with privileges
 - Run in sandbox or VM
- Make sure browser, O/S, add-ons patched
- Don't be tricked into running malicious code
- If prompted for plug-in, get from vendor site
- Know your add-ons before using

Making the Switch

(Okay to have more than one!)

- Download
- Install
 - When in doubt, default!
- Import IE settings
 - Bookmarks, cookies, history, passwords
- Customize as needed
- Happy surfing!

Future combat: Mobile



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