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Web Engineering (WBCS008-05)

Set 1: Introduction

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Outline

- Course content
- Historical retrospective
- W3C
- Organizational matters

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Course content

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Definitions

[Web Engineering] uses *scientific, engineering, and management principles and systematic approaches* to successfully *develop, deploy, and maintain* high-quality *Web systems and applications* [Ginige and Murugesan 2001]

Multidisciplinary concerns

Lifecycle in focus

Functionality delivered over the Web, usually a **browser**

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Why Web Engineering?

- Web engineering ≠ Software engineering
  - Shares many principles and approaches with SE, but
  - Has its own life cycle and nature
  - Web-specific approaches, methodologies, tools, etc.
- Large share of software delivered over the Web

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What is the Web?

- World Wide Web: an information system for the retrieval of resources that are
  - Identified by Uniform Resource Locators (URLs)
  - Connected to each to other by (hyper)links
  - Accessible over the Internet
  - Resources: any type of (hyper)media but mainly hypertext

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HyperText & HyperMedia

What is HyperText

Hypertext is text which is not constrained to be linear.

Hypertext is text which contains links to other texts. The term was coined by Ted Nelson around 1965 (see History).

HyperMedia is a term used for hypertext which is not constrained to be text: it can include graphics, video and sound, for example. Apparently Ted Nelson was the first to use this term too.

Hypertext and HyperMedia are concepts, not products.

Reproduced from https://www.w3.org/WhatIs.html

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Goals of the course

- Aim: To provide you with the foundations of **designing, developing, and maintaining** of Web-based systems and applications

- Focus on
  - Architecture and design concerns
  - Lifecycle of Web-based systems
  - Technologies

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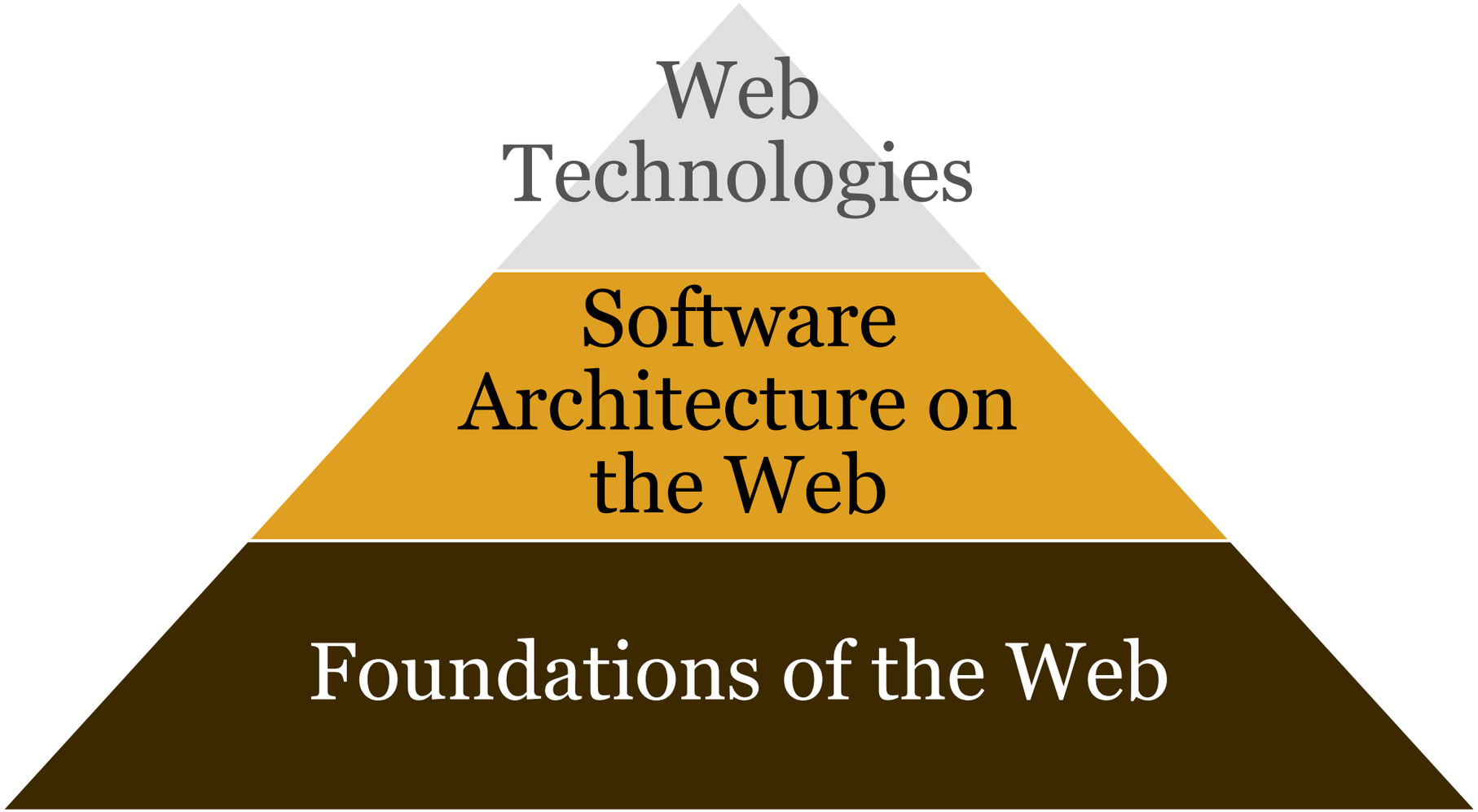
Structure of the course



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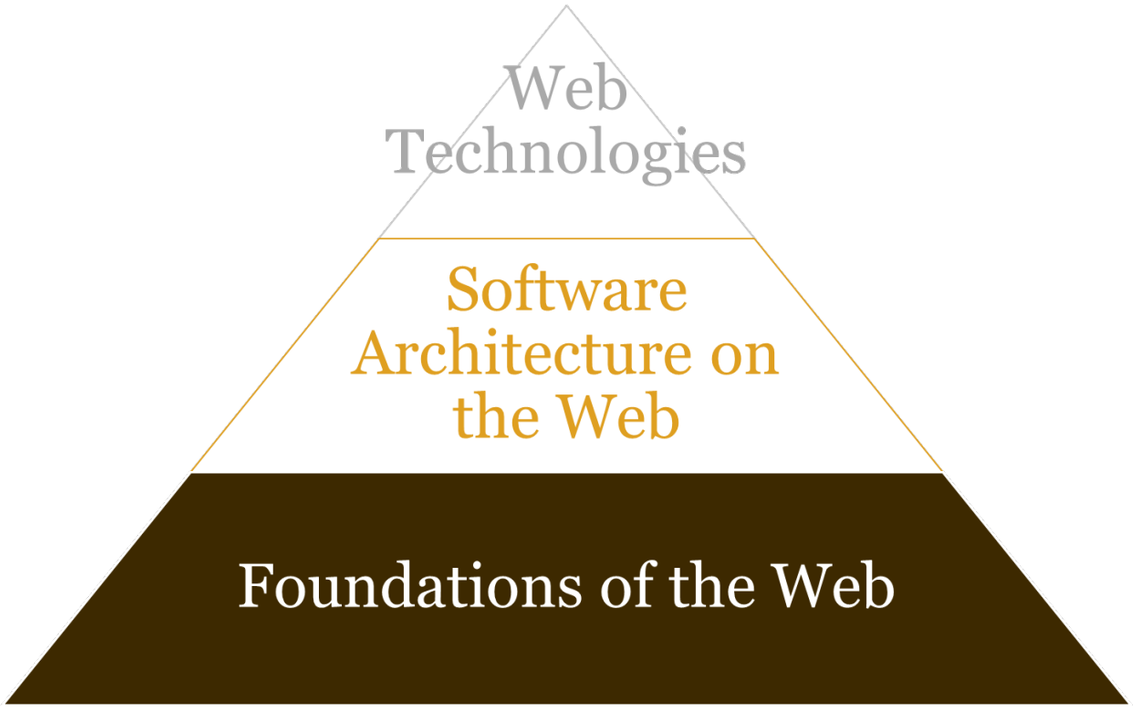
Structure of the course

- The Internet
- URIs
- HTTP
- Caches
- Content delivery



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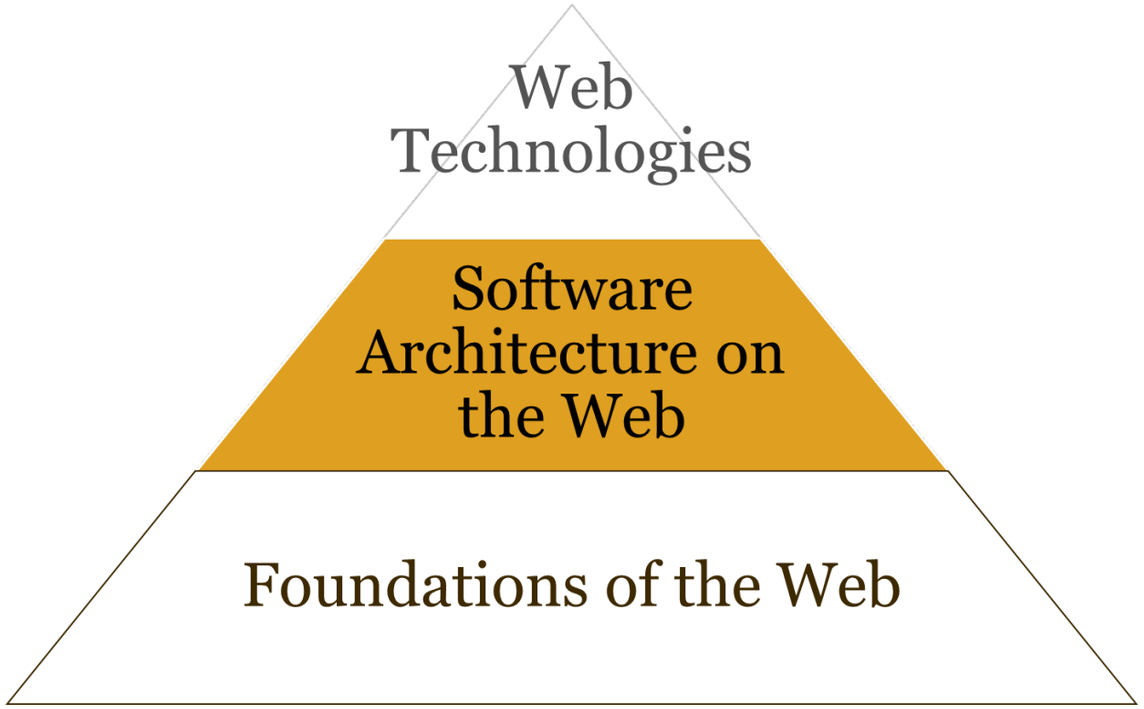
Structure of the course

- REST & RESTful APIs
- Service Oriented Architecture (?)
- Architectural principles



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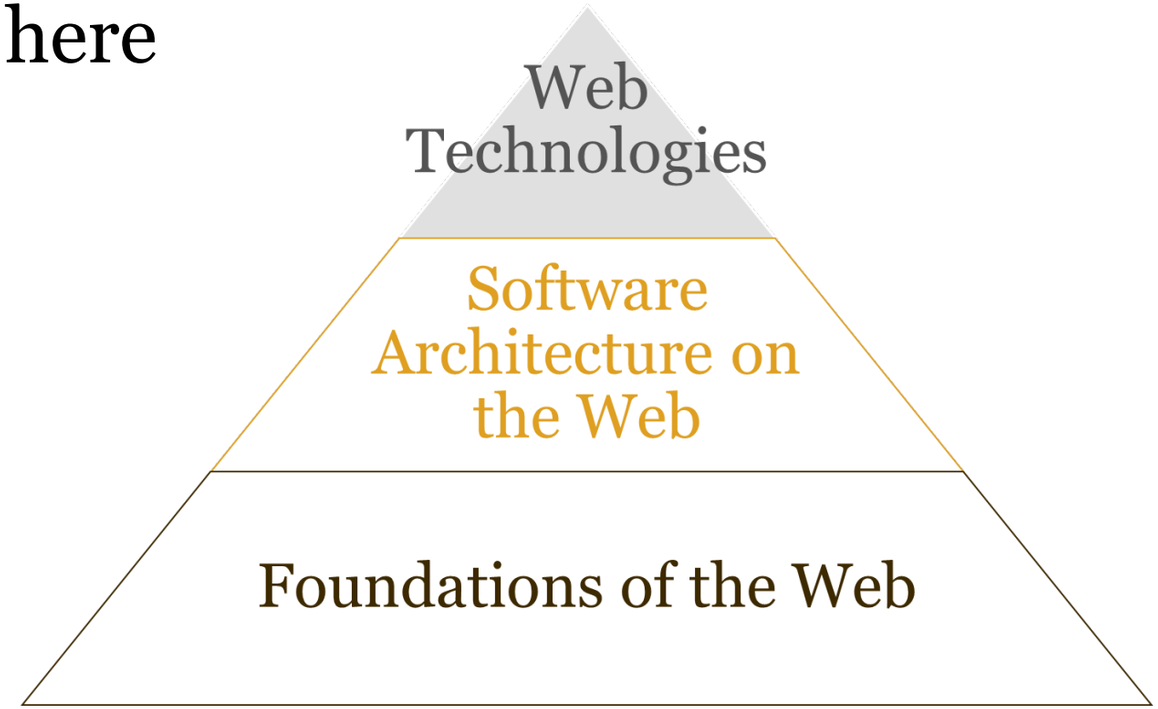
Structure of the course

- Basic technologies
- Static/Dynamic Web pages
  - JavaScript frameworks are here
- Design patterns



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Not covered by this course

- UI/Web design patterns & principles
- Security on the Web
- Mobile computing/app development
- [Insert here other Web-related subject of your choice]

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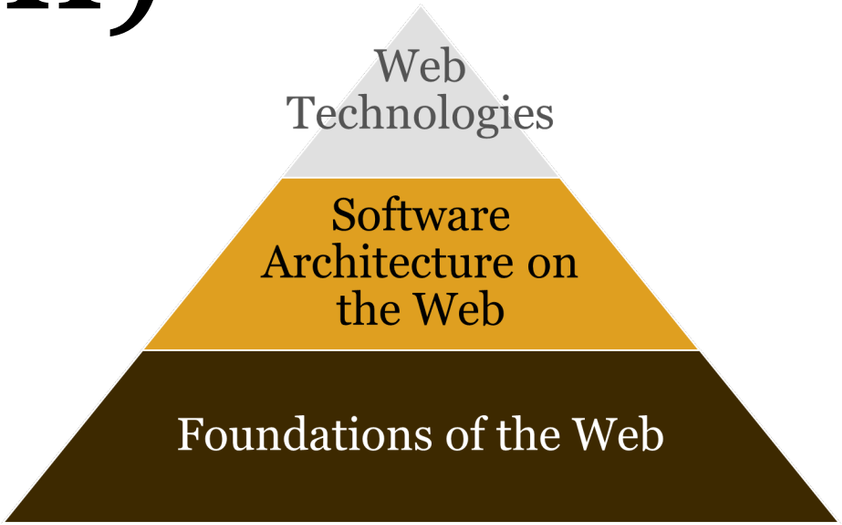
Disclaimers

- Field is fast and constantly evolving in terms of technologies and languages used
  - Some self study is required by this course
- No definite “winner” among technologies/languages
  - No single programming language/framework adopted
- A number of technologies to become familiar with
  - Steep learning curve mitigated (somewhat) by tutorials

History of the Web (short version)



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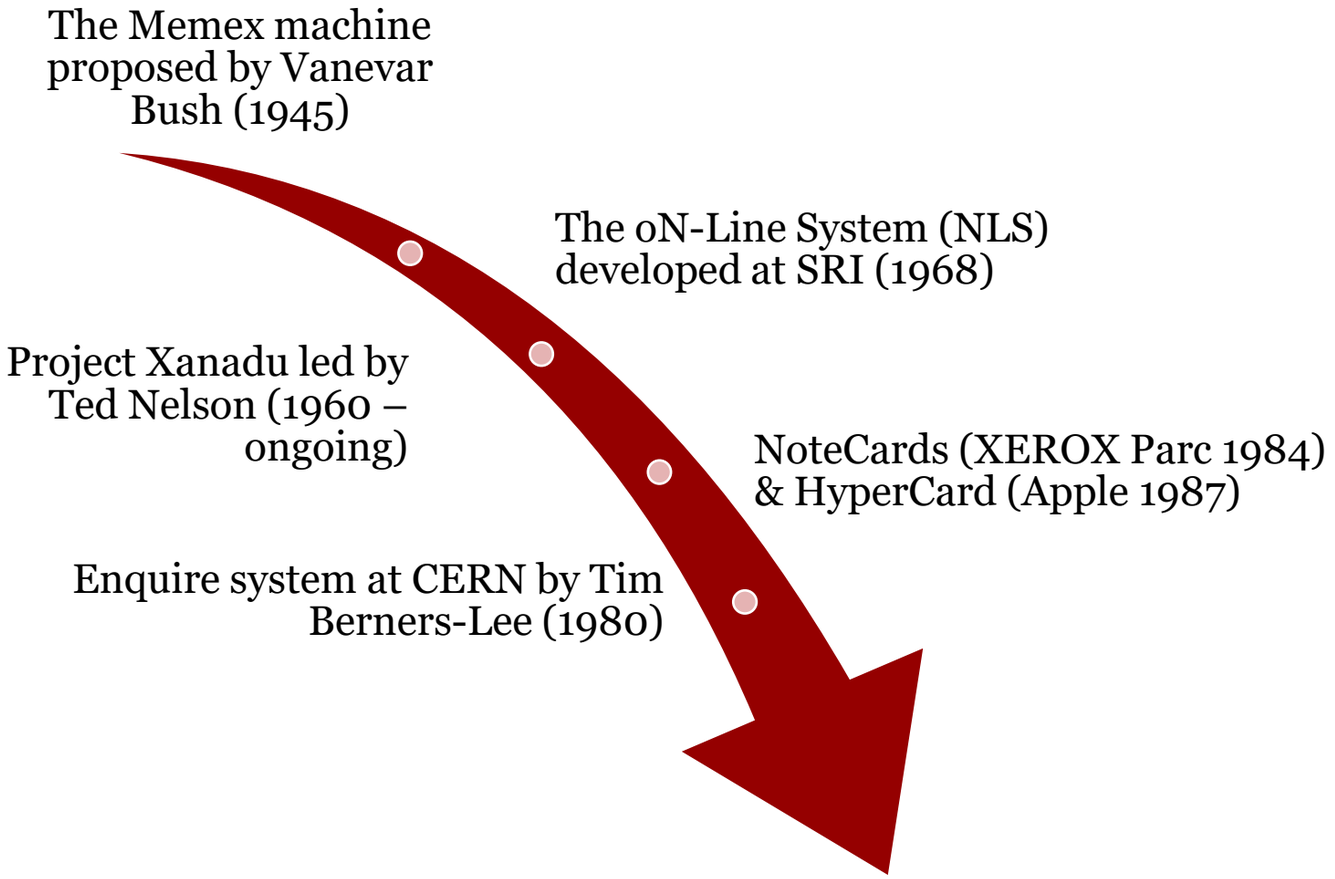
Precursors of the Web



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Early milestones

November 1990	First Web server and Web page come online
Christmas 1990	WorldWideWeb browser demonstrated (screenshot)
February 1993	First version of NCSA Mosaic browser released (screenshot)
March 1994	Marc Andreessen and colleagues leave NCSA to form "Mosaic Communications Corp." (later Netscape)
May 1994	First International WWW Conference held at CERN
October 1994	World Wide Web Consortium founded; Netscape browser released
August 1995	Microsoft releases Internet Explorer 1 (screenshot)

adapted from http://dret.net/lectures/web-spring11/history

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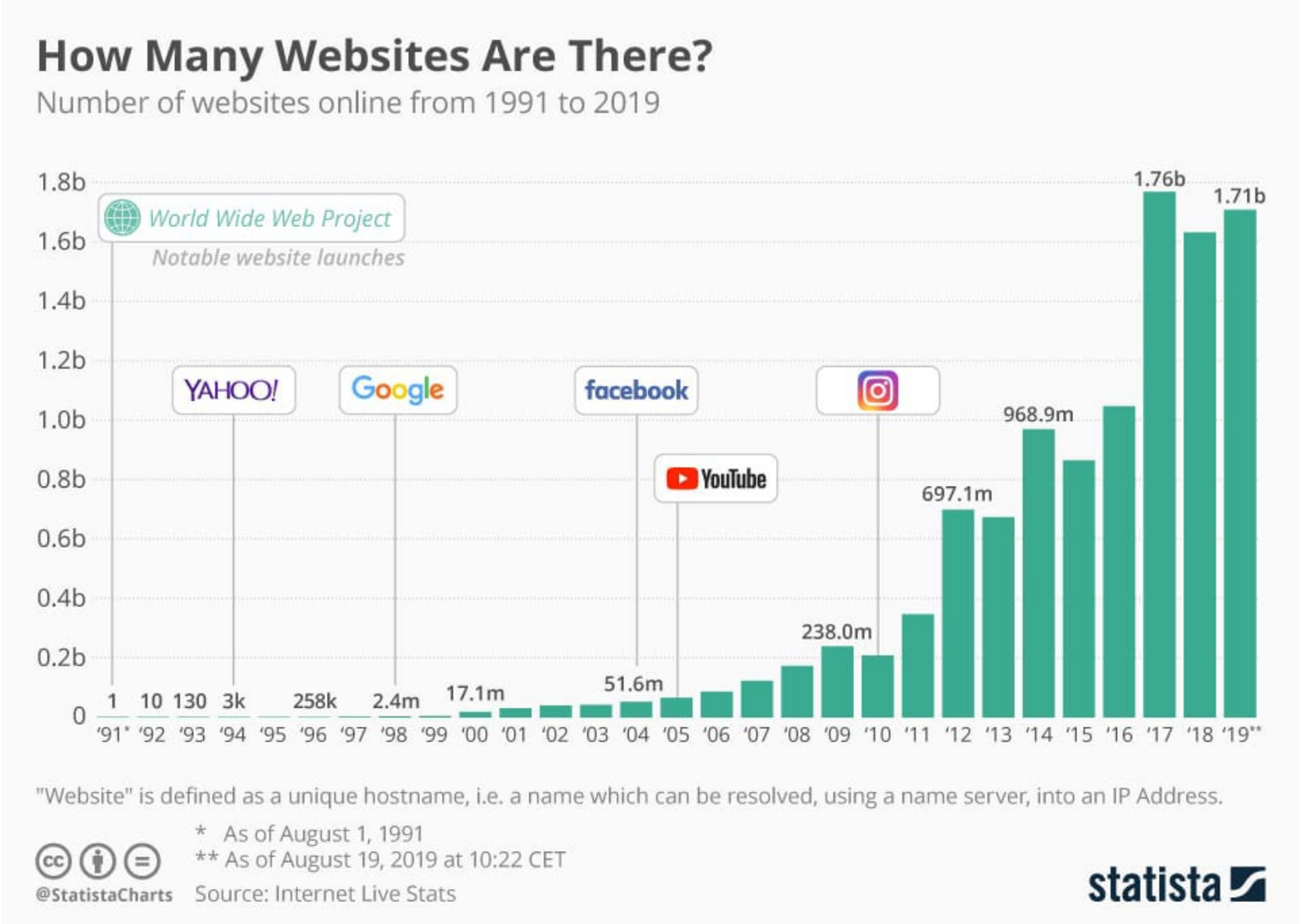
Exponential growth of the Web



The Browser Wars

- The First Browser War: Netscape vs Microsoft
  - Early Web: Netscape Navigator as the dominant browser
  - Microsoft joining the Web only after 1995
  - Microsoft ships Internet Explorer (IE) with Win 95 and takes over the market

- The Second Browser War: Google vs Everyone else
  - Firefox created by team leaving Netscape
  - Firefox is funded by Google (among others) and overtakes IE
  - Google releases Chrome and becomes most popular browser

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The World Wide Web Consortium (W3C)

- Founded on 1994 and led by Tim Berners-Lee
- “Hosted” by MIT (USA), ERCIM (France), Keio University (Japan), and Beihang University (China)
- Develops protocols and guidelines that ensure the long-term growth of the Web

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The World Wide Web Consortium (W3C)

- Main standardization body for the Web through a process:
  1. Expression of interest by members/the public
  2. When interest reaches sufficient mass, a new Activity or Working Group is formed on the topic
  3. The charter for the Working Group is defined, if necessary
  4. The Working Group produces specification(s) and guideline(s) in revision/review cycles
  5. The Advisory Committee decides if/when they can be published as Recommendations

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Organizational matters

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Grading

- 50/50 between written (digital) exam and assignment
- Minimum of 5 for the written exam (digital) only
- Attention: *only exam* grade retention from last year
  - Ping me by email, mention Web Engineering in the subject

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Assignment Type 1: Capstone project

- In groups of 2-3 (strict)
- Three aspects to be assessed over a number of deliverables
  - Software (back- and front-end)
  - Technical report & documentation
  - Demonstrable functionality
- Common initial data set, and requirements for API design
- Groups to define/choose their own functionality to be delivered as a Web application

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Assignment Type 1: Capstone project

- See course forum for Looking for Group thread

- Submission through Merge Requests (MRs) on group repository on GitLab
  - Registration of groups through self-enrollment
  - Consolidation of groups
  - Submission of GitLab handles
  - Automated repository creation (by week 2 of the course)

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Assignment Type 1: Capstone project

- Fixed deadlines for some deliverables:
  - Week 2: group registration
  - Week 3: project plan submission – define your own deadlines
  - Week 8: final project
  - (Week 10: project resit)

- The rest of deadlines between Weeks 4 and 7
  - Can only be moved by updating project plan
  - No intermediate grading

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Assignment Type 1: Capstone project

- Coaching available by the TAs
  - If and only if deadlines are respected and MRs are meaningful
  - Meetings can be arranged with TAs on demand under the same condition

- Communication channels:
  - Online through issues; no emails/chat groups!
  - Same holds for project-related questions – check FAQ first

Assignment Type 1: Capstone project

- Evaluation by the lecturer and the TAs
  - Weighted sum of the three aspects
  - Max grade is 7.0 for *convincingly* satisfying all requirements per milestone
  - Rest of 3.0 points available for advanced features but **only if all milestone requirements have been met**

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A note on the use of Generative AI (GenAI)

- GenAI approaches such as the use of LLMs is **not** prohibited/penalized by the course
- Their use has to be documented appropriately – otherwise it is plagiarism
- Not necessarily leading to better grades (see also: Garbage In/Garbage Out)

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Assignment Type 2: Tutorial

- Solo or in larger groups (after arrangement)
- Deliverables
  - A 1x or 2x45' tutorial on a specific Web technology/framework
  - The tutorial script
- Available for students with provable experience on selected technology
- All tutorials to use/build on the same example
- Evaluation by lecturer & audience after the tutorial

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Changes with respect to last year

- Added project plan deliverable
- Added recommended tech stacks section in project description as starting points
- Added in person coaching meetings with TAs
- Added FAQ section for reference

Questions?

Source material

Aiello, Marco. *The Web Was Done by Amateurs: A Reflection on One of the Largest Collective Systems Ever Engineered*. Springer, 2018.

Ginige, Athula, and San Murugesan. "Web engineering: An introduction." *IEEE multimedia* 8, no. 1 (2001): 14-18.

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Self-evaluation questions

- How are the terms HyperText and HyperMedia defined?
- What initiatives and tools are considered the precursors of the Web?
- What are the steps and stakeholders involved in W3C's standardization process?

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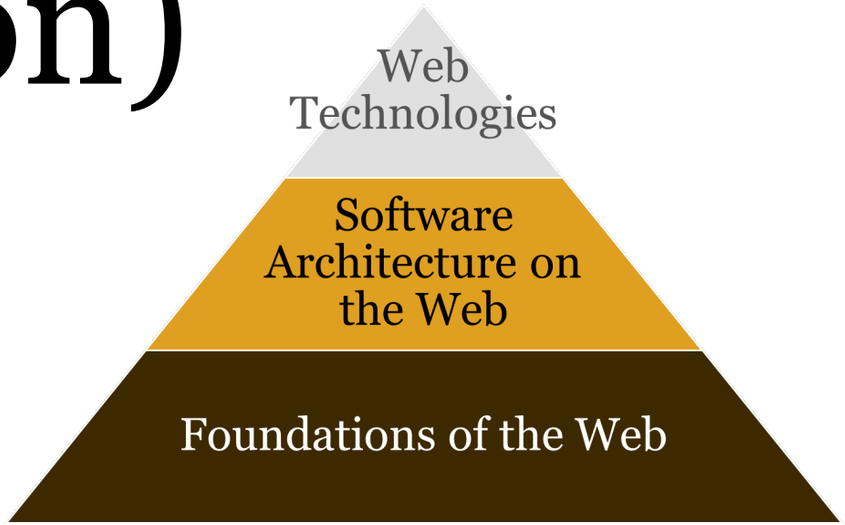
Next lecture

Web foundations, or
The Net and the Web

Appendix: (Pre)History of the Web (longer version)



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The Memex

- Discussed in As We May Think (1945) by Vannevar Bush
- Microfilms for storage
- Trail of facts for given keyword or symbol
- Links and notes for each entry
- Scanner for bulk input

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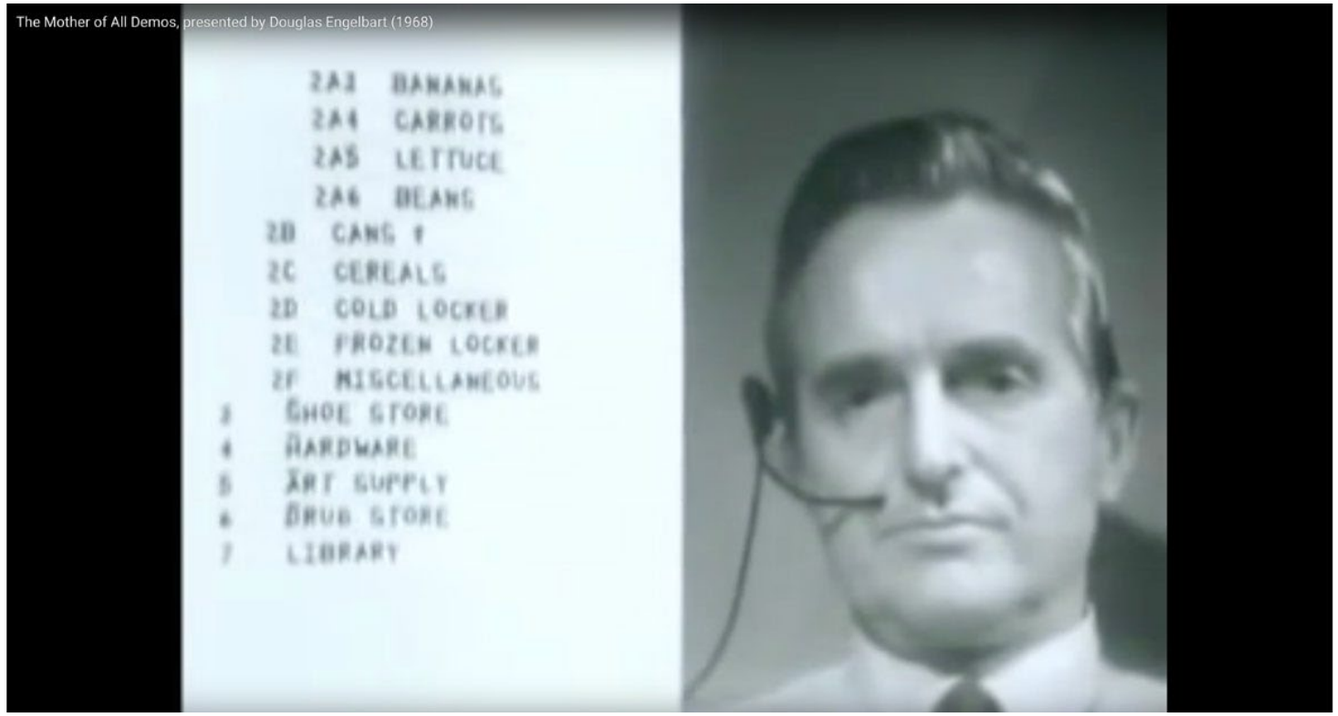
The oN-Line System (NLS)



- Project led by Douglas Engelbart at SRI
- Demonstrated in the Mother of all Demos (1968)
- Effective but basic support for hypertext

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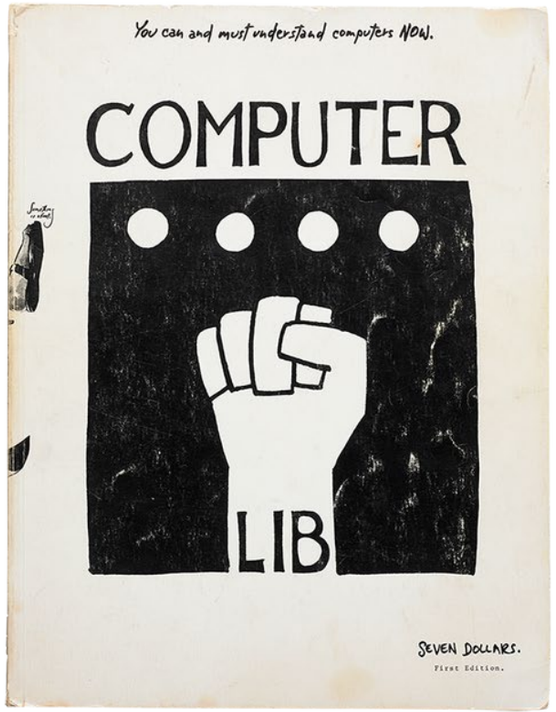
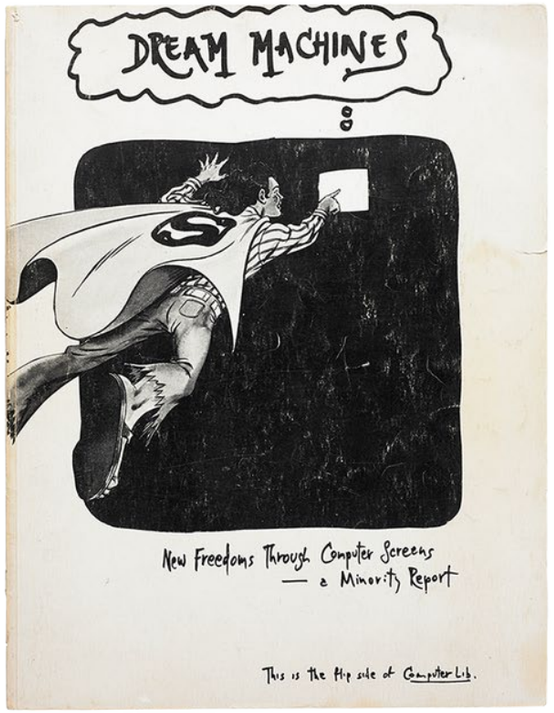
Project Xanadu





- The brainchild of Ted Nelson
- Running since 1960

- First release in 2014 as OpenXanadu
- Hypertext/media discussed in the 1965 paper A File Structure for The Complex, The Changing and the Indeterminate at the 20th ACM Conference

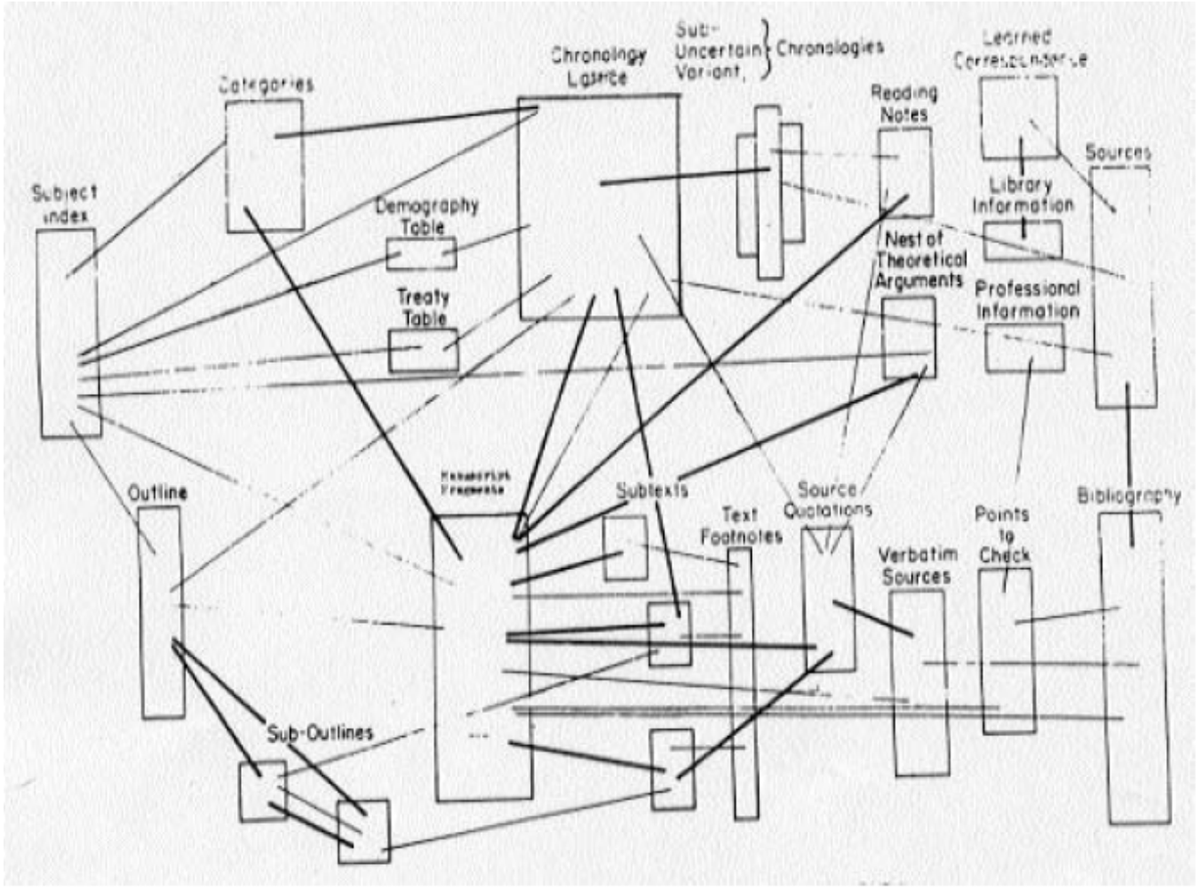


Figure 11.4. ELF's capacity for total filing: hypothetical use by historian. (A thin line indicates the presence of links; a heavy line indicates that some linked entries are identical.)

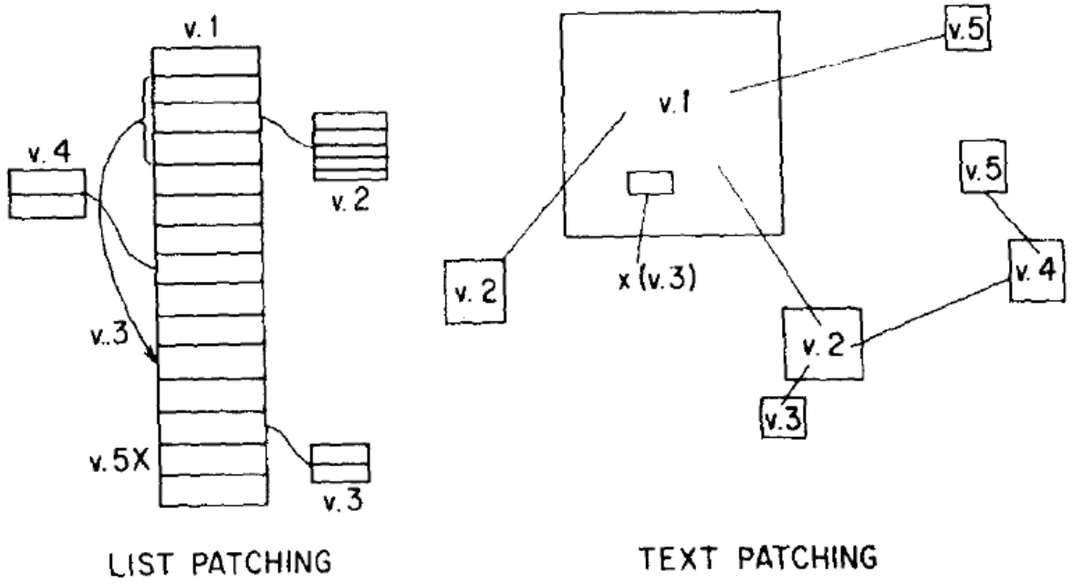


***FIGURE 2*—Spinoff of variants: extra versions need little space.**

- Documents as compositions of **text fragments** expressed as sets of **bidirectional links**
  - Each fragment has multiple versions
- **Unique identification** of users
- Copyright enforcement/royalties payment **through links**

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NoteCards (XEROX PARC, 1984)

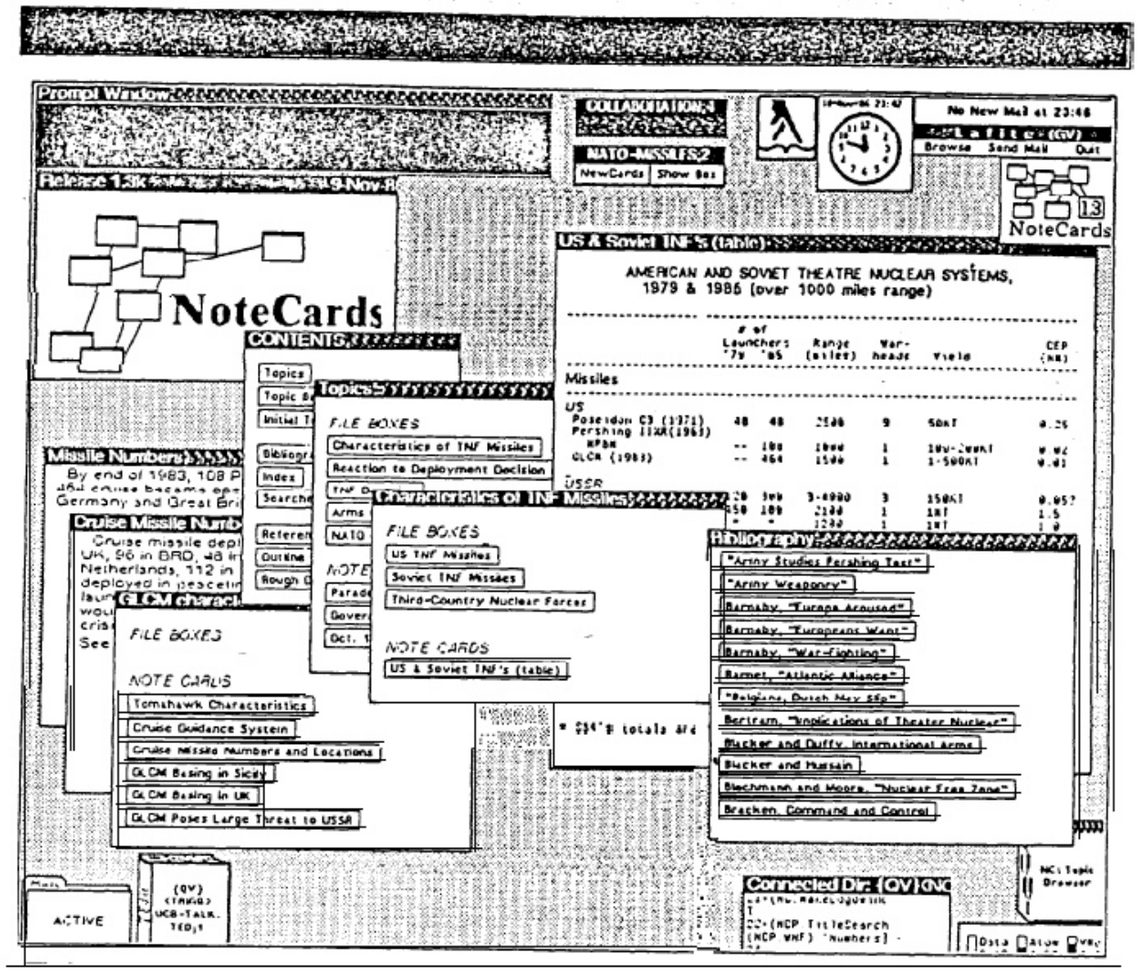
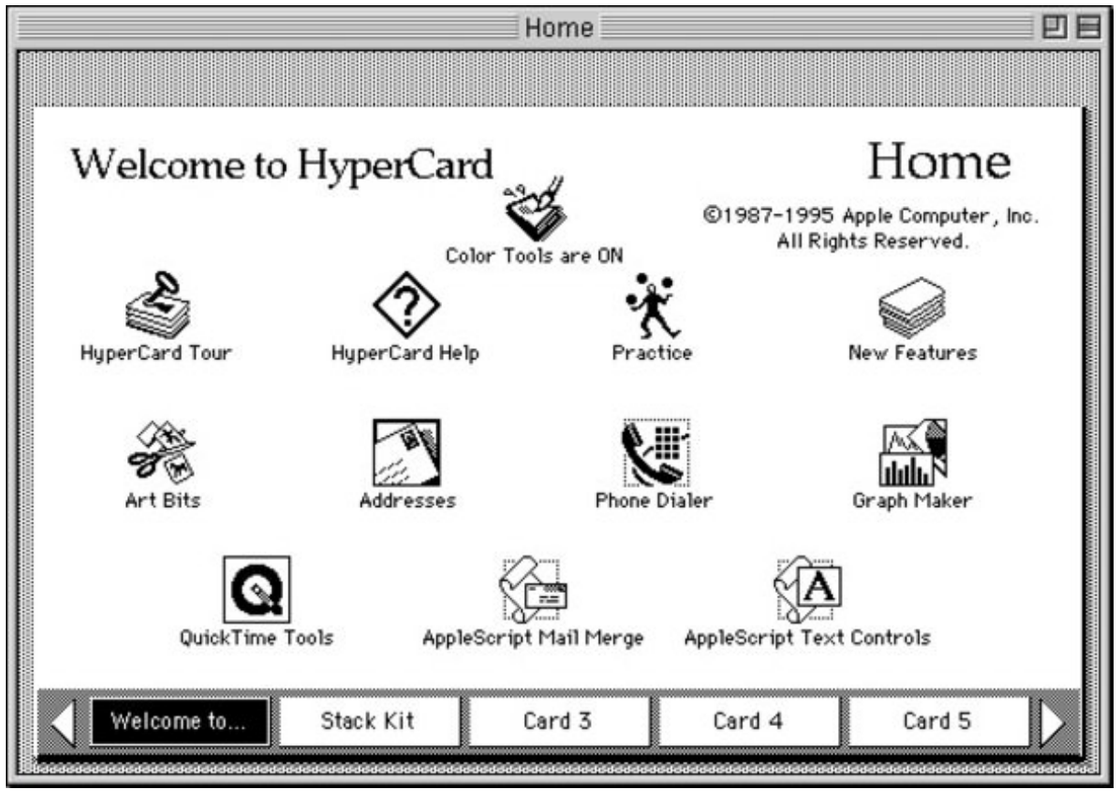


Figure 7. A typical NoteCards screen with five FileBox cards, two unformatted Test cards, and one Text card formatted as a table. Links between cards are represented by the boxed text inside the cards. The two menus at the top/middle of the screen control two different note files. The remainder of the icons on the screen belong to non-NoteCard applications running in the Xerox Lisp environment.

HyperCard (Apple 1987)



- Text, images, other files in a card
- Interactions (including links) through buttons

Reality check

- Many hyper* projects developed in the 70s and 80s; see for example Conklin, Jeff. "Hypertext: A survey and introduction." *IEEE Computer* 20, no. 9 (1987): 17-41.
- ACM Conference on Hypertext and ~~Hypermedia~~ Social Media established by 1987
- Community initially rejected the Web

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Birth of the Web

- Tim Berners-Lee side-project at CERN resulted first into the Enquire system (1980)
  - Information in nodes (people, projects, data items) and links (internal/*directional) or external (unidirectional) between them
  - Simply link types as annotations (*made*, *includes*, *uses*, *describes*)
  - Monolithic app

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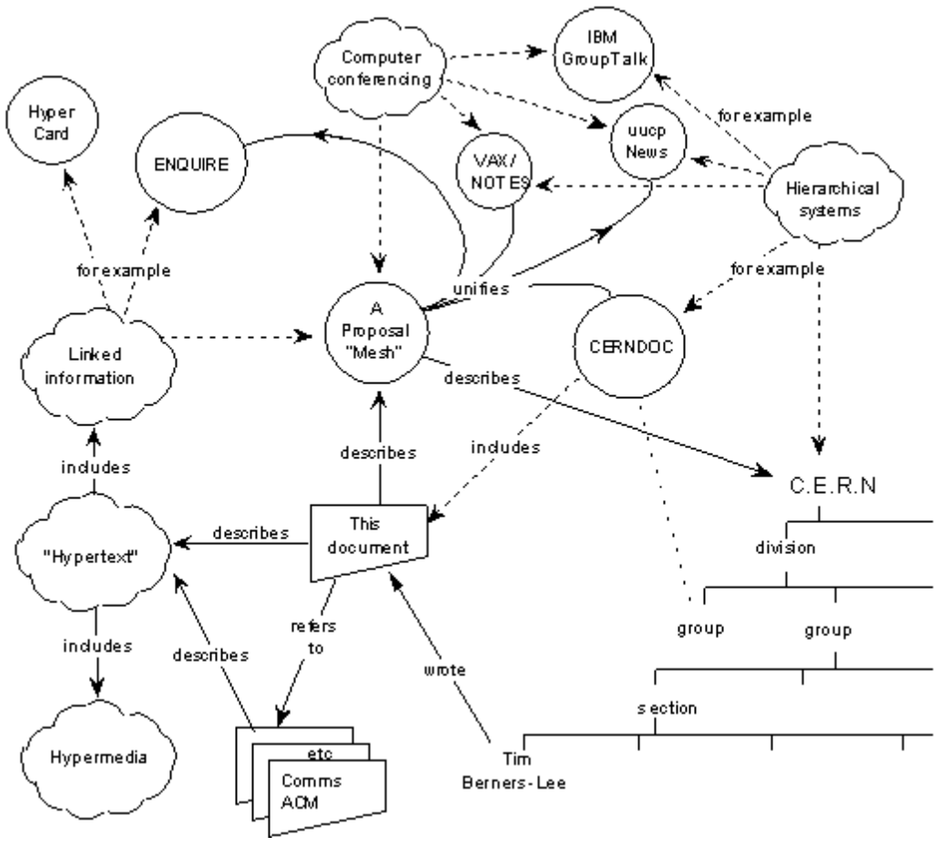
Evolution of Enquire into the Web

- TimBL submitted Information Management: A Proposal for funding in March 1989
  - To address the difficulty of managing a web of notes and links between them
  - Explicitly referring to HyperText (and Ted Nelson) and HyperCard as related work
  - Deemed as "vague by exciting"



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adapted from http://dret.net/lectures/web-spring11/history

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The First Browser War: Netscape vs Microsoft

- Netscape Navigator offering beta versions for free and official releases through licensing
- Version 2.0 (1995) implemented HTML frames and early JavaScript
- Bill Gates sends “The Internet Tidal Wave” memo in May 1995
- The infamous meeting takes place in June 1995 and the cold war starts
- Internet Explorer version 1 is released in August 1995

The First Browser War: Netscape vs Microsoft

- The war escalates over control of HTML elements and (over-engineered) features
- Navigator hits 90% of browser share in 1997
- IE 3 is shipped for free with Windows 95
- Netscape open sources Navigator in January 1998
- By end of 1998 IE has 50% of the market and 96% by 2002
- The rest is legal history

The Second Browser War: Google vs everyone

- Ex-members of Netscape found Mozilla and work on the Navigator successor, codename “Phoenix”
- Firefox beta is released in 2002, official release in 2004
- Firefox 3.5 overtakes IE 7 (only) in usage in 2009
- Google releases Chrome in the same year (despite having a contract with Mozilla), and the second browser war starts
- By 2012 Chrome is the most popular browser
- IE is discontinued in 2013

Watch it happen in real-time (short of)

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THE Sun

Monday, May 20, 1991 25p

World Wide What?

COMPUTER 'WEB' TO CHANGE BILLIONS OF LIVES (YEAH, RIGHT)

A BRITISH computer geek's brainwave could be one of the greatest inventions ever, it was claimed last night.

By DOT COMME

Tim Berners-Lee, 35, has enabled computer users to see documents and pictures made available by others in "cyberspace".

He uses the "Internet" system, which so far only links academics but could eventually include anyone.

Berners-Lee, who works at a nuclear research base near Geneva, calls his idea the "World Wide Web".

One scientist said: "This could be huge. The idea of strangers worldwide sharing ideas instantly is mind-boggling." But another sneered: "They said Sinclair's C5 would change the world. Now you'd struggle to give one away."

Riddle of 'E' mail — Page 8

Web feat . . . Berners-Lee

SHE'S IN OR-BRIT

She's a star . . . Helen, ringed, boards the Soviet craft last night

Girl from Mars is our first astronaut

BRAVE Helen Sharman was enjoying being the first Briton in space yesterday after blasting off in a Soviet rocket.

Helen, 27, a chemist for sweets giant Mars, is also the first non-American or Soviet spacewoman in history. The Sheffield lass will spend eight days on the Mir space station.

She won her place on the mission in a radio contest which 13,000 people entered — and spent 18 months training for it at Star City in the Soviet Union.

Wish You Were Mir — Pages 6&7