

The Designed Object

INFO 200

Part I



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The Designed Object

agenda

- ♦ what is a book
- ♦ how did it get the way it did/origins and evolution
- ♦ printing

what's a book?

"a storehouse of human knowledge intended for dissemination in the form of an artifact that is portable - or at least transportable - and that contains arrangements of signs that convey information." (Kilgour 3)

what makes it change?

necessary elements to book evolution (Kilgour 4-5)

1. societal need for information
2. technological knowledge and experience
3. organizational experience and capability
4. capability of integrating a new form into existing information systems
5. economic viability

clay tokens/envelope

7500? BCE



cuneiform c3000 BCE



A Neo-Babylonian Clay Cuneiform Foundation Cylinder. Reign of Nebuchadnezzar II, 604-562 B.C. Estimate: \$250,000 — 350,000. This work and those featured below are offered in our [Antiquities Sale at Christie's New York](#) on 4 June.

MEANING	OUTLINE CHARACTER, S. C. 3500	ARCHAIC CONFORM, S. C. 1500	ASSYRIAN, S. E. 700	LATE BABYLONIAN, S. E. 300
1. The sun	◇	◇	𒀭	𒀭
2. God, heaven	*	*	𒀭	𒀭
3. Mountain	☒	☒	☒	☒
4. Man	𠂇	𠂇	𠂇	𠂇
5. Ox	▷	▷	☒	☒
6. Fish	𩙶	𩙶	𩙶	𩙶

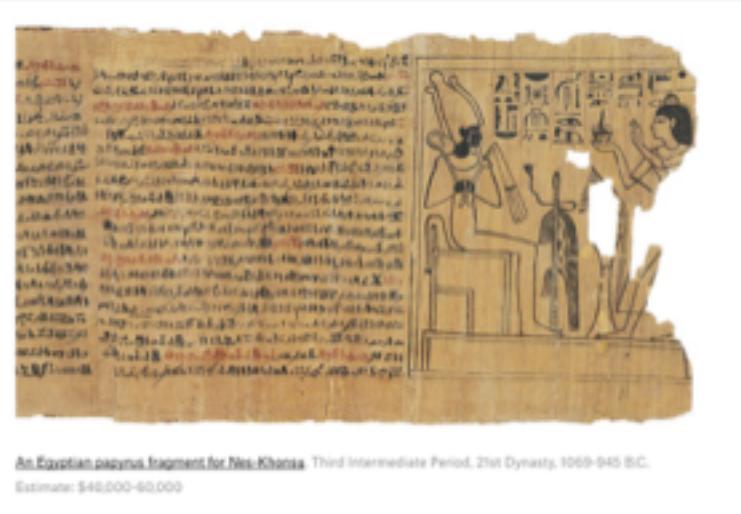
Evolution of the Latin Alphabet



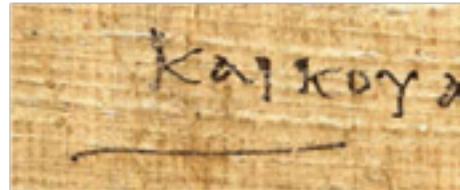
By Matt Baker | UsefulCharts.com | CC BY-NC-SA 3.0

Oracle bone script 甲骨文 (jiǎ gǔ wén)	horse 马	cart 车	fish 鱼	dust 尘	see 看
Bronze script 金文 (jīn wén)	馬	車	魚	𠂇	見
Large Seal script 大篆 (dà zhuàn)	馬	車	魚	𠂇	見
Small Seal script 小篆 (xiǎo zhuàn)	馬	車	魚	𠂇	見
Clerical script 隸書 (lì shù)	馬	車	魚	𠂇	見
Standard script 楷書 (kǎi shù)	馬	车	鱼	尘	见
Running script 行書 (xíng shù)	馬	车	鱼	尘	见
Draft script 草書 (cǎo shù)	馬	车	鱼	尘	见
Simplified script 简化字 (jǎi hán zì)	马	车	鱼	尘	见
hángyǔ pinyin 汉语拼音	mǎ	chē	yú	chén	jiàn
zhuyīn fúshù 注音符号	ㄇㄉㄢ	ㄔㄝ	ㄩㄝ	ㄔㄣ	ㄐㄧㄢˋ

papyrus scroll
by 2500 BCE (Egypt; Greece by 400 BCE)



paragraphos



codex

tablet form by 1300 BCE; repurposed 1c? CE



Codex Zacynthius (palimpsest) 6-7c



incipit/explicit

¶ Incipit speculum naturale Vincentij belusacis
fratris ordinis poicitorum. Et primo plegus
causa suscepit ogio et eius materia. Primus.

Incipit of Speculum naturale

¶ Explicit expositio Cassiodori in psalmu
Centesimu quinquagesimu et ultimu ter
tii Quinquaginta.

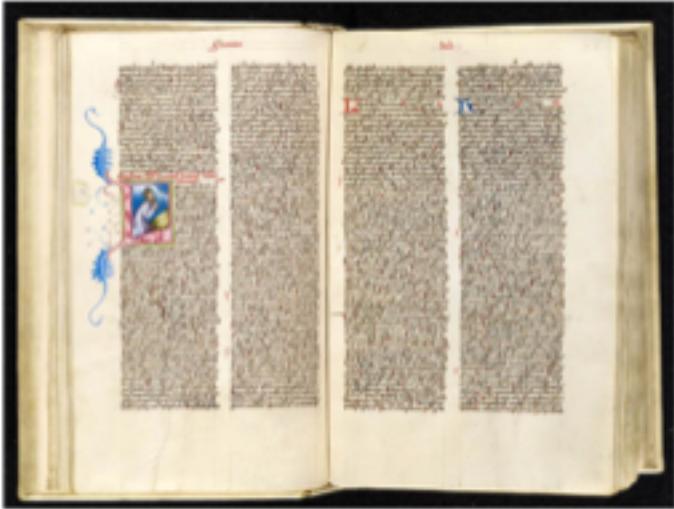
Explicit of Expositio in Psalterium

¶ Explicit Biblia impensis Venetis p[re]dictis
de laiburno et Nicolati et frankofodia socios.
M: CCCC: LXXV:

Explicit of Biblia Latina

manuscript bible

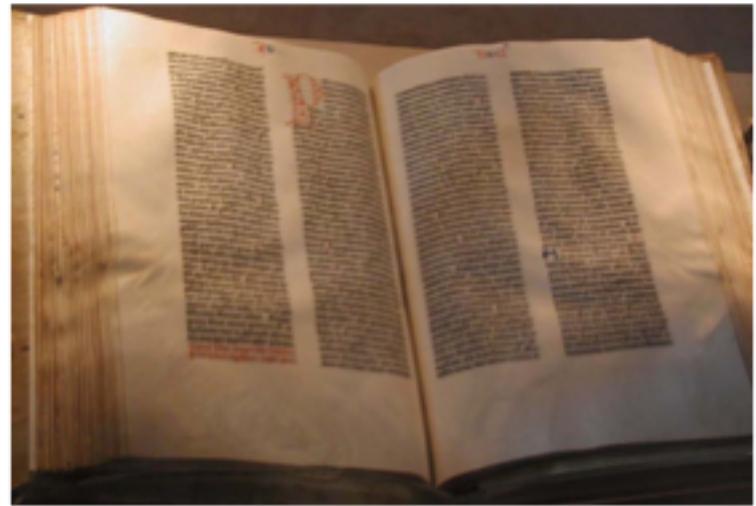
15c



Biblia Latina (Bible in Latin). Bohemia, fifteenth century. Parchment. Medieval and Renaissance Manuscript Collection, Rare Book and Special Collections Division, Library of Congress

"Gutenberg" (Mainz) bible

1455



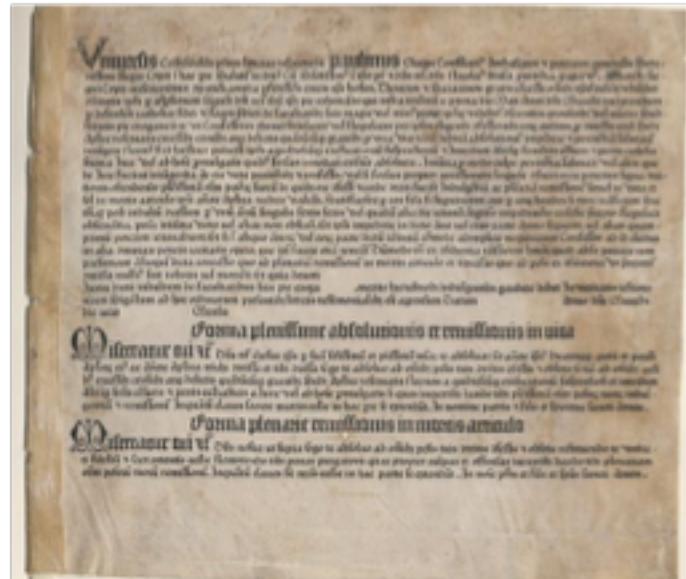
skeumorph

Biblia Latina (Bible in Latin). Bohemia, fifteenth century. Parchment. Medieval and Renaissance Manuscript Collection, Rare Book and Special Collections Division, Library of Congress



indulgence

1453





The Designed Object

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Part II



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The Designed Object 2

agenda

- ♦ the rest of the story
- ♦ design decisions that didn't quite work out
- ♦ the codex still evolves
- ♦ and then the ebook

bamboo stitched ("concertina") book
18c The Art of War



"Madrid Codex" Maya almanac/calendar
between 1200-1450?



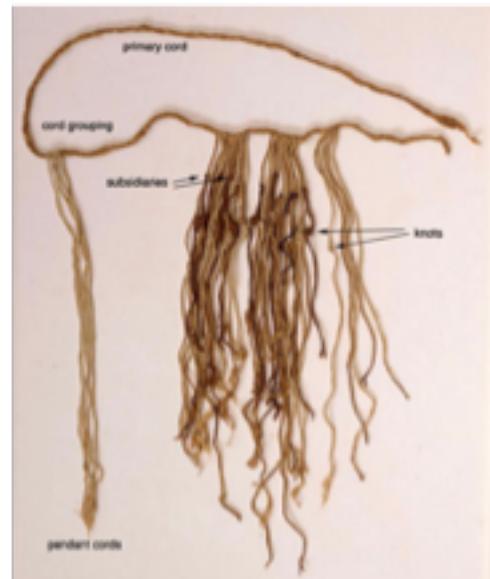
Maya codex vase
7c-10c



Garima Gospels
4c-7c



khipu (quipu)
15c-16c



and, in Asia...a few centuries earlier...

Asian printing history

wood blocks: China 6c (1st surviving book 868)

moveable type: Pi Sheng, China, c1040 (wood, then clay or porcelain? type);
Korea 1234 (earliest surviving book 1377 (tin type))



The intricate frontispiece of the Diamond Sutra from Tang Dynasty China, 868 AD (British Museum), which is widely seen as the **earliest extant printed book**.



Jikji, "Selected Teachings of Buddhist Sages and Zen Masters", the **earliest known book printed with movable metal type**, printed in Korea in 1377. Bibliothèque Nationale de France

boustrophedon



winter count

1786-1876 Boide (The Flame), Lakota, Western Sioux



scripto continua



EARLY IRISH AND ANGLO-SAXON SCRIBES ARE CREDITED WITH THE INTRODUCTION OF CONSISTENT WORD SPACING AS A COMPONENT OF INSULAR MINUSCULE SCRIPTS AT THIS REMOTE END OF EUROPE. LATIN WAS BEING LEARNED FROM GRAMMAR BOOKS RATHER THAN FROM ORAL CULTURE AND THE SPACING WAS BASED ON GRAMMATICAL UNITS (IE. WORDS) RATHER THAN FORMS OF ORAL PRESENTATION. NOTE THAT IN THE ABOVE EXAMPLE, IN WHICH THE SCRIPT HAS FEATURES OF INSULAR HALF UNCIAL AND INSULAR MINUSCULE, WHILE THE WORDS ARE CAREFULLY SPACED, THEY RUN OVER FROM LINE TO LINE, AS IN INCARNATIONIS AT THE END OF THE FIRST LINE, OR gregorius IN THE SECOND. THE LINES ARE NOT GUIDES TO ORAL READING. NOTE ALSO THAT THE NAME papa gregorius DOES NOT GET CAPITAL LETTERS. THE CAPITALISATION OF PROPER NOUNS, OR NAMES, SEEMS TO BE PRETTY INCONSISTENT THROUGHOUT THE MEDEVILLE PERIOD.

EARLY IRISH AND ANGLO-SAXON SCRIBES ARE CREDITED WITH THE INTRODUCTION OF CONSISTENT WORD SPACING AS A COMPONENT OF INSULAR MINUSCULE SCRIPTS AT THIS REMOTE END OF EUROPE. LATIN WAS BEING LEARNED FROM GRAMMAR BOOKS RATHER THAN FROM ORAL CULTURE AND THE SPACING WAS BASED ON GRAMMATICAL UNITS (IE. WORDS) RATHER THAN FORMS OF ORAL PRESENTATION. NOTE THAT IN THE ABOVE EXAMPLE, IN WHICH THE SCRIPT HAS FEATURES OF INSULAR HALF UNCIAL AND INSULAR MINUSCULE, WHILE THE WORDS ARE CAREFULLY SPACED, THEY RUN OVER FROM LINE TO LINE, AS IN INCARNATIONIS AT THE END OF THE FIRST LINE, OR gregorius IN THE SECOND. THE LINES ARE NOT GUIDES TO ORAL READING. NOTE ALSO THAT THE NAME papa gregorius DOES NOT GET CAPITAL LETTERS. THE CAPITALISATION OF PROPER NOUNS, OR NAMES, SEEMS TO BE PRETTY INCONSISTENT THROUGHOUT THE MEDEVILLE PERIOD.

Early Irish and Anglo-Saxon scribes are credited with the introduction of consistent word spacing as a component of insular minuscule scripts. At this remote end of Europe, Latin was being learned from grammar books rather than from oral culture and the spacing was based on grammatical units, i.e. words, rather than forms of oral presentation. Note that in the above example, in which the script has features of insular half uncial and insular minuscule, while the words are carefully spaced, they run over from line to line, as in incarnationis at the end of the first line, or gregorius in the second. The lines are not guides to oral reading. Note also that the name papa gregorius does not get capital letters. The capitalisation of proper nouns, or names, seems to be pretty inconsistent throughout the medieval period.

<http://medievalwriting.50megs.com/scripts/punctuation/punctuation1.htm>

Missing part of oldest 'Tale of Genji' manuscript discovered in Japan

The Mainichi
Japan's National Daily Since 1872



This photo shows a missing part of the oldest copy of the classic Japanese novel "The Tale of Genji," written by Murasaki Shikibu. (Kyodo)

flipback
2010



Education publisher Pearson to phase out print textbooks

BBC



Hundreds of thousands of people read novels on Instagram. They may be the future

Last year, the New York Public Library released an experiment to put the full text of novels in its Instagram Stories. Today, an estimated 300,000 people are reading books this way.

FAST COMPANY



ebooks

lots of versions, formats, devices, etc
and new design decisions being made (scrolling)
so what might happen to

- tables of contents
- footnotes/citations
- margins
- dust covers
- tables of contents
- page numbers
- pages

and what new features might emerge?
and what comes next?

Information Architecture and Search

INFO 200

Part I



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information behaviors

information use, seeking, retrieval, organization, encountering, etc
all imply seeking or finding at some level (so does information destruction, censorship for that matter)

- so what enables search? what makes search work, makes it possible?

(and, by the way, all of what is to come are information behaviors too)

Information Architecture & Search 1

agenda

- ❖ search, and what makes it work: structured search
 - ❖ data modeling & encoding
 - ❖ database management systems

search, and what makes it work

for what?

information objects

fair enough - what are information objects?

Web pages, books & published materials, tweets

words, facts

people, organizations

sounds, images, moving images, objects

basically anything

different objects, different searches

the search for each of these is enabled differently, with common features

an example: [General Education Requirement Course Search](#)

search

search is the **matching of representations** in a **database** by means of an **algorithm**

(representations = **metadata**)

this implies those representations, databases, algorithms have been somehow **created, defined, decided on** (all information behaviors) and **structured**

so this "simple" instance is referred to as **structured search**

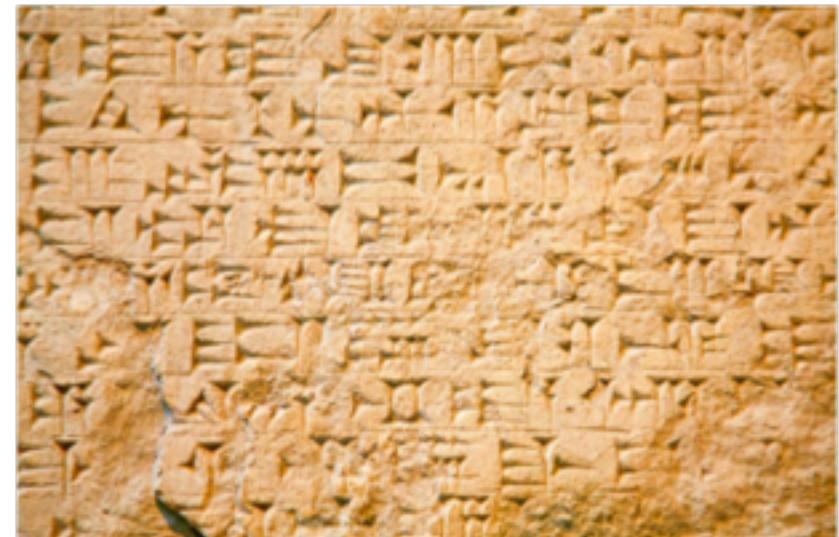
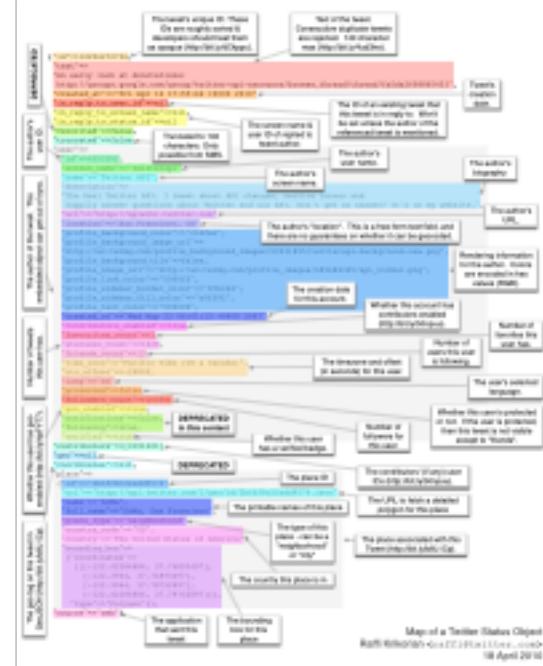
more examples:

[UW Faculty/Staff/Student Directory - Seattle](#)

[Olympedia](#)

no metadata, no search

these are all examples of **information systems** - so where is **power**?

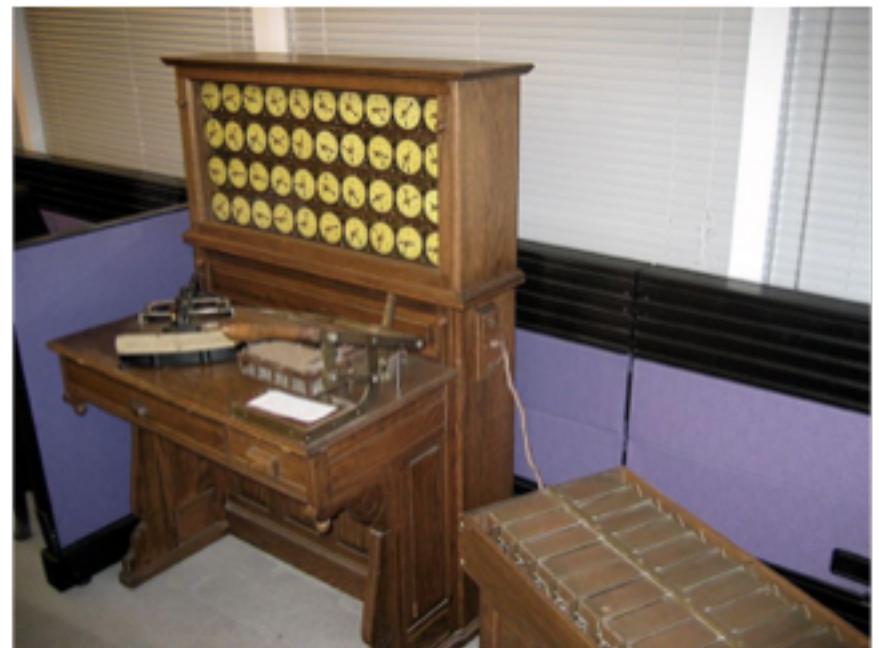


Jacquard Loom
1804



Hollerith punch card
1889

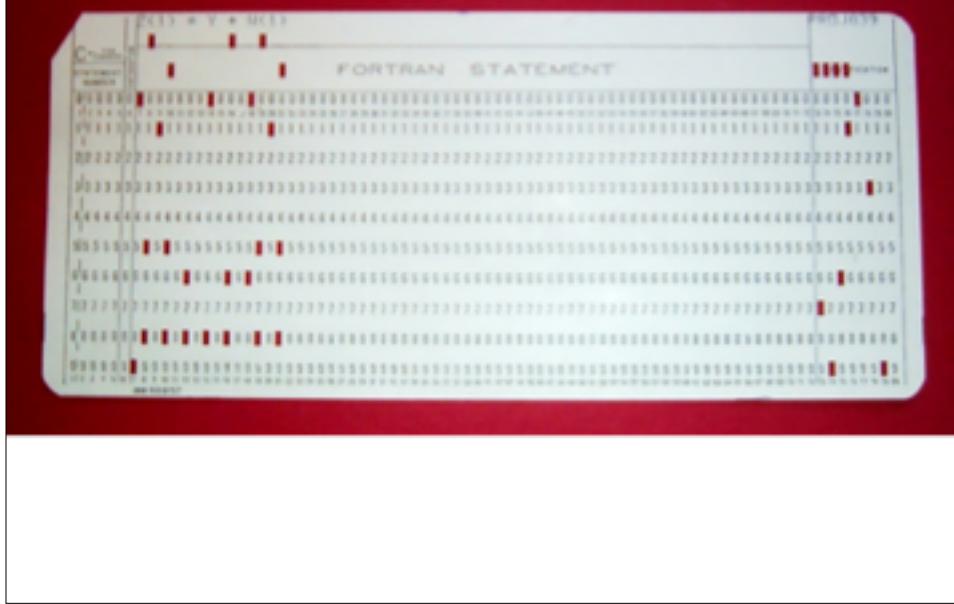
1	1	3	0	2	4	10	On	S	A	C	E	a	s	s	e	E	EB	SB	Ch	Sy	U	St	Hk	Br	Rm
2	2	4	1	3	E	15	Off	15	B	D	F	b	d	f	s	SY	X	Fp	Cn	R	X	Al	Cg	Kg	
3	0	0	0	0	W	20		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A	1	1	1	1	1	0	25	A	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
B	2	2	2	2	2	5	30	B	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
C	3	3	3	3	3	0	3	C	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
D	4	4	4	4	4	1	4	D	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
E	5	5	5	5	5	2	C	E	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
F	6	6	6	6	6	A	D	F	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
G	7	7	7	7	7	B	E	G	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
H	8	8	8	8	8	A	F	H	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
I	9	9	9	9	9	b	c	i	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9



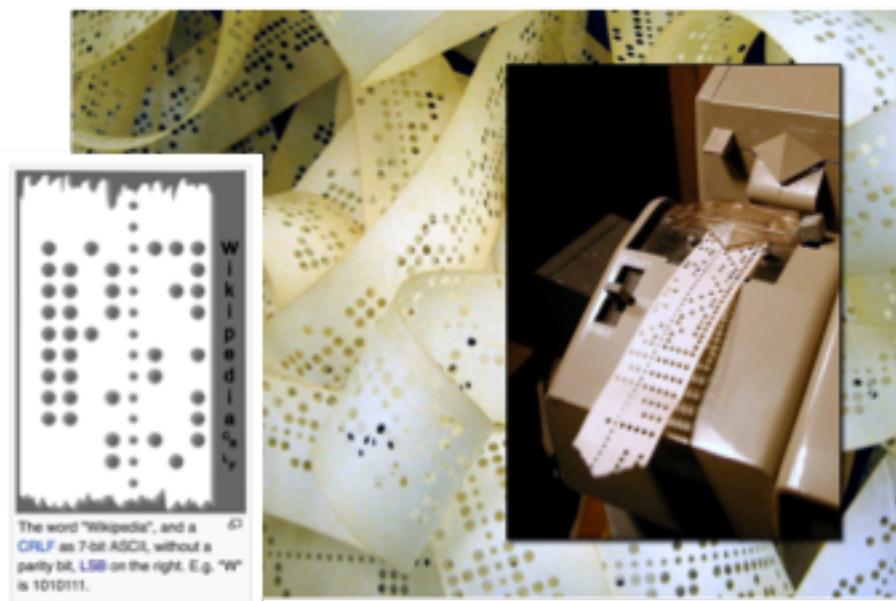
US Census schedule
1940



IBM punch card
1928



punch paper tape
orig. 1725 looms; computer/communication by 1944



The word "Wikipedia", and a CRLF as 7-bit ASCII, without a parity bit, LSSB on the right. E.g. "W" is 1010111.



character sets

Define a mapping between patterns of bits and characters

Contain decisions that may have significant social ramifications

Dec	Den	Char	Dec	Den	Char	Dec	Den	Char	Dec	Den	Char
0		NULL null	0x20	32	Space	0x40	64	▀	0x60	96	▀
1		SOH Start of heading	0x21	33	▀	0x61	93	▀	0x61	97	▀
2		STX Start of text	0x22	34	▀	0x62	94	▀	0x62	98	▀
3		ETX End of text	0x23	35	#	0x63	95	▀	0x63	99	▀
4		ETB End of transmission	0x24	36	▀	0x64	96	▀	0x64	100	▀
5		ENQ Enquiry	0x25	37	▀	0x65	97	▀	0x65	101	▀
6		ACK Acknowledge	0x26	38	▀	0x66	98	▀	0x66	102	▀
7		BEL Bell	0x27	39	▀	0x67	99	▀	0x67	103	▀
8		BS Backspace	0x28	40	▀	0x68	100	▀	0x68	104	▀
9		TAB Horizontal tab	0x29	41	▀	0x69	101	▀	0x69	105	▀
10		LF New line	0x2a	42	▀	0x6a	102	▀	0x6a	106	▀
11		VT Vertical tab	0x2b	43	#	0x6b	103	▀	0x6b	107	▀
12		FF Form feed	0x2c	44	▀	0x6c	104	▀	0x6c	108	▀
13		CR Carriage return	0x2d	45	▀	0x6d	105	▀	0x6d	109	▀
14		RD Shift out	0x2e	46	▀	0x6e	106	▀	0x6e	110	▀
15		SD Shift in	0x2f	47	▀	0x6f	107	▀	0x6f	111	▀
16		DLE Data link escape	0x30	48	▀	0x70	112	▀	0x70	113	▀
17		DC1 Device control 1	0x31	49	▀	0x71	113	▀	0x71	113	▀
18		DC2 Device control 2	0x32	50	▀	0x72	114	▀	0x72	114	▀
19		DC3 Device control 3	0x33	51	▀	0x73	115	▀	0x73	115	▀
20		DC4 Device control 4	0x34	52	▀	0x74	116	▀	0x74	116	▀
21		NAK Negative ack	0x35	53	▀	0x75	117	▀	0x75	117	▀
22		SYN Synchronous idle	0x36	54	▀	0x76	118	▀	0x76	118	▀
23		ETB End transmission block	0x37	55	▀	0x77	119	▀	0x77	119	▀
24		CAN Cancel	0x38	56	▀	0x78	120	▀	0x78	120	▀
25		EM End of medium	0x39	57	▀	0x79	121	▀	0x79	121	▀
26		SUB Substitute	0x3a	58	▀	0x7a	122	▀	0x7a	122	▀
27		FNC Escape	0x3b	59	▀	0x7b	123	▀	0x7b	123	▀
28		FS File separator	0x3c	60	▀	0x7c	124	▀	0x7c	124	▀
29		GS Group separator	0x3d	61	▀	0x7d	125	▀	0x7d	125	▀
30		RS Record separator	0x3e	62	▀	0x7e	126	▀	0x7e	126	▀
31		US Unit separator	0x3f	63	▀	0x7f	127	▀	0x7f	127	▀

ASCII Character Set (1963)
7 bits per character = 128 possible characters

If computers store only patterns of bits, how do we reliably encode **text** into files so that multiple programs can display that text again?

multiple character sets cause serious problems

bits	encoding	characters
11000100 01000010	Windows Latin 1	ÄB
11000100 01000010	Mac Roman	ƒB
11000100 01000010	GB18030	牒

characters	encoding	bits
Föö	Windows Latin 1	01000110 11111000 11110110
Föö	Mac Roman	01000110 10111111 10011010
Föö	UTF-8	01000110 11000011 10111000 11000011 10110110

Unicode (1991)

16 bits per character
65,536 possible “code points” (characters)



<http://unicode-table.com>

multiplane Unicode



32 bits per-character = 4.2 billion code points

Multiple encoding strategies:

UTF-32 32 bits for every character (UNIX)

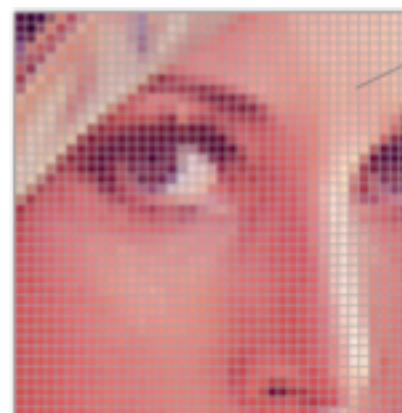
UTF-16 16 bits for low chars; 32 for high (Java, .Net)

UTF-8 8 to 32 bits, depending on char (the web, Go)

unicode encoding strategies

character	encoding	bits
A	UTF-8	01000001
A	UTF-16	00000000 01000001
A	UTF-32	00000000 00000000 00000000 01000001
あ	UTF-8	11100011 10000001 10000010
あ	UTF-16	00110000 01000010
あ	UTF-32	00000000 00000000 00110000 01000010

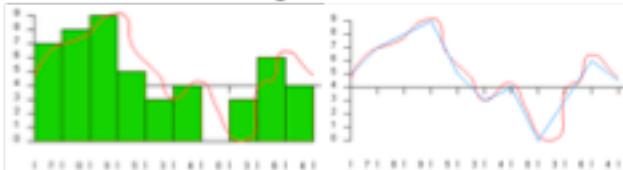
raster image encoding



Red: 233
Green: 157
Blue: 144

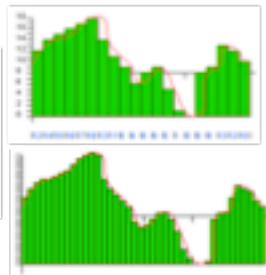
3 numbers per pixel, each 0-255
24 bits per pixel

sound encoding



Bit depth is the number of **bits** available for each **sample**. The higher the bit depth, the higher the quality of the audio. Bit depth is usually 16 bits on a CD and 24 bits on a DVD.

A bit depth of 16 has a resolution of 65,536 possible values (ranging from 0 to 65,535), and a bit depth of 24 has over 16 million possible values (ranging from 0 to 16,777,216).



The bit rate is calculated using the formula:

$$\text{Frequency} \times \text{bit depth} \times \text{channels} = \text{bit rate}$$

A typical, uncompressed high-quality audio file has a **sample rate** of 44,100 samples per second, a bit depth of 16 bits per sample and 2 channels of stereo audio. The bit rate for this file would be:

$$44,100 \text{ samples per second} \times 16 \text{ bits per sample} \times 2 \text{ channels} = 1,411,200 \text{ bits per second (or } 1,411.2 \text{ kbps)}$$

A four-minute (240 second) song at this bit rate would create a file size of:

$$14,411,200 \times 240 = 338,688,000 \text{ bits (or } 40.37 \text{ megabytes)}$$

<https://electronics.howstuffworks.com/analog-digital3.htm>

<https://www.bbc.com/bitesize/guides/z7vc7ty/revision/1>



anything stored, digitally or otherwise, has to be **represented** in a structured, standardized way - so that it can be accessed and found ("representation" has multiple meanings, yes?)
we've seen representing text, sound, images, moving images - now another kind at a higher conceptual level

representation

Database Management System (DBMS)

A software process that allows clients to define a data structure; add data to that structure; navigate, tabulate, update, and delete those data; maintain data security and integrity; and automatically recover from failure



entity

A person, place, thing, or concept included in a system

Look for the **core concepts** as people talk about their data, as well relationships that have their own data

"I want to track the **courses** we can teach, the **sections** of those courses we offer, the **students** who **register** for those sections, and what their **final grades** were."

relational data modeling

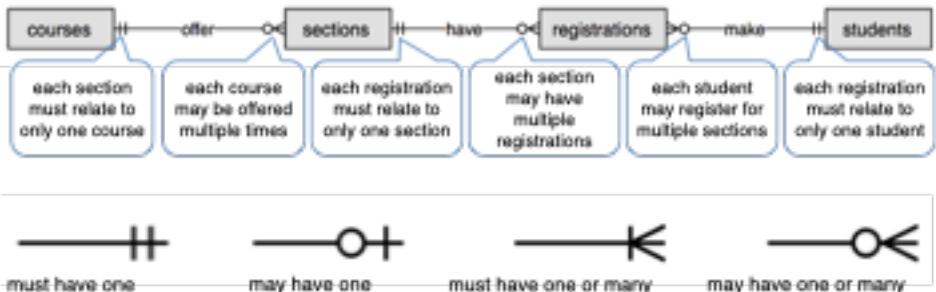
The process of designing a structure capable of holding the data the system needs to track, while avoiding redundancy and ensuring data integrity

Resulting structure is called a **schema**

Visually designed and represented in an **Entity-Relationship Diagram (ERD)**

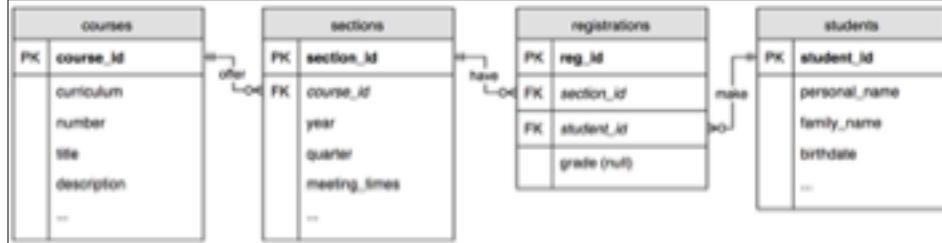
relationships

How do entities relate, and how many instances can they relate to?



attributes

What do you want to track about each entity?



PK = Primary Key = Unique record identifier

FK = Foreign Key = PK value in related table

other examples of keys?

attributes with (null) allow missing data (null values)

US Census schedule 1940

1940 US census instructions

INSTRUCTIONS FOR FILLING OUT THE POPULATION SCHEDULE

General Instructions

24. Use black ink. Write legibly and keep your schedules neat and clean. Make all entries carefully.

25. Study very carefully the headings of all questions on the schedule and the symbols and explanatory notes at the bottom of the schedule.

6. **The Census Day.**—There should be a return on the Population Schedule for each person alive at the beginning of the census day, i. e., 12:01 A. M. on April 1, 1940.

7. **Who is to be enumerated.**—Enumerate all men, women, and children (including infants) whose usual place of residence (the place where they "live" or have their "home") is in your district, including persons temporarily absent; all persons who are in your district at the time of the enumeration who have no usual place of residence elsewhere from which they will be reported; and all persons who move into your district after the enumeration begins and who have not previously been enumerated. Enumerate as residents of the institution all inmates of a jail, however short their term of sentence, and all inmates of a prison, home for orphans, or similar institution located in your district in which persons remain for long periods of time.

representation

anything stored, digitally or otherwise, has to be **represented** in a structured, standardized way - so that it can be accessed and found ("representation" has multiple meanings, yes?)

1940 US census instructions

40. How names are to be written.—Enter the last name first, then the given name and initial, making sure that the spelling is correct. Where the surname is the same as that of a member of the same household enumerated on a line above, do not repeat the name but enter a long dash. (See Illustrative Example, Form P-2.) Where there are not enough lines left on a schedule to enumerate all members of the household, fill out that side of the schedule completely, leaving no line vacant, make a check in the box labeled "Household continued on next page" in the lower left-hand margin of the schedule, and write "*Contd.*" (for "Continued") in cols. 1 and 2, (and leave cols. 3 to 6 blank) at the top of the "B" side of the schedule, or at the top of the

41. *Personal Description*

name
tion.
membe
hand
tion fr
44. Column 9. Sex.—Write "M" for male and "F" for female.

45. Column 10. Color or race.—For symbols to be entered in this column, see the note at the bottom of the schedule. Any mixtures of white and nonwhite blood should be recorded according to the race of the nonwhite parent. A person of mixed Negro and Indian blood should be reported as Negro unless the Indian blood greatly predominates and he is universally accepted in the community as an *Indian*. Other mixtures of nonwhite parentage should be reported according to the race of the father. Mexicans are to be returned as *white*, unless definitely of Indian or other nonwhite race.

<https://1940census.archives.gov/>

Information Architecture and Search

INFO 200

Part I

Joseph Janes
Associate Professor, Information School



Information Architecture and Search

INFO 200

Part II



Joseph Janes
Associate Professor, Information School

search

search is the **matching of representations** in a **database** by means of an **algorithm**

(representations = **metadata**)

this implies those representations, databases, algorithms have been somehow **created, defined, decided on** (all information behaviors) and **structured** - *but what if they're not? or at least not in the same way?*

this more complex instance is referred to as **unstructured search no metadata, no search**

these are all examples of **information systems** - so where is power?

Information Architecture & Search 2

agenda

- ♦ **search and what makes it work: unstructured search**
 - ♦ information organization
 - ♦ controlled vocabulary
 - ♦ **and what about Google?**

information architecture/organization

let's start here: **Washington State Legislature** (to find bills)

Rosenfeld et al: "We organize to **understand**, to **explain**, and to **control**."

"We organize information so that people can **find** the right answers to their questions, and to give them **context** to understand those answers. **context**

"We strive to support casual **browsing** and directed **searching**. **not the same things at all**

"Our aim is to **design** organization and labeling systems that **make sense to others.**" **you are not them**

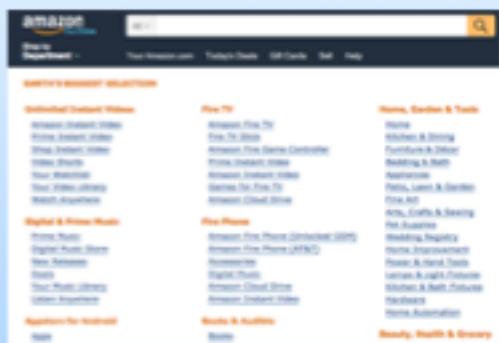
"Our classification systems **inherently** reflect social and political **perspectives and objectives.**" **inherently?**
what we call something can often become how we think about it

classification

Grouping things together based on their shared qualities

These groups form a **taxonomy**, which is often hierarchical

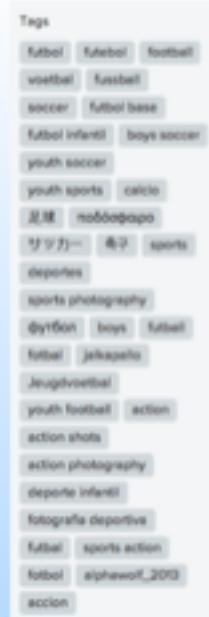
For example: [Amazon](#)



folksonomy

Allowing end-users to tag items with various categories or descriptive words

What are the benefits and drawbacks of this approach?



faceted classification

Organizing by multiple, parallel taxonomies

Each taxonomy considers a different quality (facet) and acts as an independent filter

Movies: genre, length, rating, directors, actors, distributor, etc. [IMDB](#)

Clothing: gender, function, fabric, color, etc.

Classes: level, credits, time, area of knowledge, size, etc.

A screenshot of the Amazon search results page for "xbox". On the right, there is a very tall and narrow sidebar titled "Show results for Xbox" with many facets listed:

- Video Games:** Xbox 360 Games, Xbox One Games, Consoles & Accessories, Xbox 360 Consoles, Xbox One Consoles, Xbox Games, See more.
- Gift Cards:** Gift Cards.
- Electronics:** Streaming Media Players, Stereo Players & Recorders.
- Apps & Games:** Sports & Fitness, Boxing Gloves, Clothing, Shoes & Jewelry, Cell Phones & Accessories, Sports & Outdoors, Toys & Games, Industrial & Scientific, Everything Else, Home & Kitchen, Office Products, Automotive, Books.

controlled vocabulary

these are all examples - **constructed** (decided, designed) set of words and phrases that **help people organize, browse, and search data**

authority file/thesaurus

what do you call people who do what I do for a living?

faculty (canonical, preferred form)

teachers

educators

instructors

professors

lecturers

coaches

guides

...

synonymy

disambiguation list

works both ways

pitch

pitch (throw)

pitch (propose)

pitch (assemble)

pitch (playing field)

pitch (frequency)

pitch (resin)

pitch (angle)

pitch (distance)

polysemy

so what about Google?

what about Google indeed...first some search examples Google
where is the metadata? (**no metadata, no search**, remember)

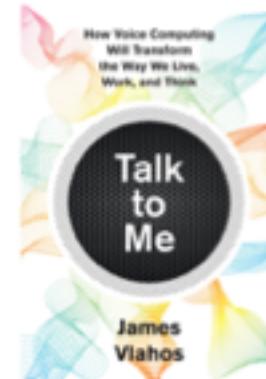
signals

and they're not the only game in town ---

Amazon Alexa and the Search for the One Perfect Answer

Voice computing seeks to deliver a single correct response to any query. That's why it's going to upend our relationship with information.

WIRED



This article is [adapted from](#) *Talk to Me: How Voice Computing Will Transform the Way We Live, Work, and Think*, by James Vlahos, to be published in March by Houghton Mifflin Harcourt. ©2010 Houghton Mifflin Harcourt

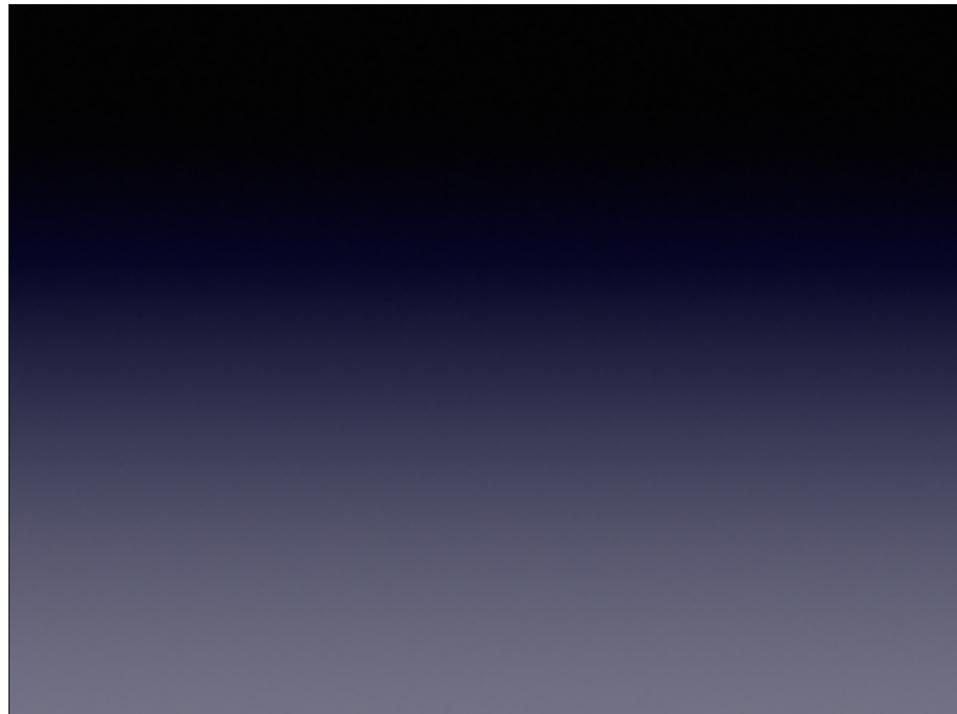
According to one market survey, people ask their smart speakers to answer questions more often than they do anything else with them. Tumstall—Pedoe's vision of computers responding to our queries in a single pass—providing one-shot answers, as they are known in the search community—has gone mainstream. The internet and the multibillion-dollar business ecosystems it supports are changing irrevocably. So, too, is the creation, distribution, and control of information—the very nature of how we know what we know.

The second component of the system amassed facts. Unlike a search engine, which simply pointed users toward websites, True Knowledge aspired to supply the answers itself. It needed to know that the population of London is 8.8 million, that LeBron James is 6'8", that George Washington's last words were "Tis well," and so on. The great majority of these facts were not manually keyed into the system; that would have been too arduous. Instead, they were automatically retrieved from sources of structured data, where information is listed in a computer-readable format.

so what about Google?

some deeper observations:

- you don't pay for it
- you are not their customer, you are their product
- opaque to human understanding or intervention
- change the way we search, change the way we think



Information Architecture and Search

INFO 200

Part II



Joseph Janes
Associate Professor, Information School

today is February 2 Week 5 agenda

- ♦ reminders
- ♦ information stories
- ♦ upcoming assignments
- ♦ last week: what stayed, questions
- ♦ books that made a difference
- ♦ the week to come

Happy Groundhog Day!

reminder: office hours by appointment today 5-6 :30pm PT, open Thursday 10:30 - 12noon PT

Please for now have microphones muted
Use the Chat feature (bottom of your screen) to type in questions or issues



Google threatens to pull search engine in Australia

Google on Friday threatened to make its search engine unavailable in Australia if the government went ahead with plans to make tech giants pay for news content. Australian Prime Minister Scott Morrison quickly hit back, saying: "We don't respond to threats."

"Australia makes our rules for things you can do in Australia," Morrison told reporters in Brisbane. "That's done in our Parliament. It's done by our government. And that's how things work here in Australia."

"If this version of the code were to become law, it would give us no real choice but to stop making Google search available in Australia," Silva told senators. "And that would be a bad outcome not only for us, but also for the Australian people, media diversity, and the small businesses who use our products every day."

The mandatory code of conduct proposed by the government aims to make Google and Facebook pay Australian media companies fairly for using news content they siphon from news sites.



As Google eyes Australia exit, Microsoft talks Bing with PM

SYDNEY (Reuters) -Software giant Microsoft Corp is confident its search product Bing can fill the gap in Australia if Google pulls its search over required payments to media outlets, Prime Minister Scott Morrison said on Monday.

Punxsutawney Phil sees his shadow and predicts six more weeks of winter

By Laura Ly, CNN
© Updated 8:44 AM ET, Tue February 2, 2021



Biden picks Jessica Rosenworcel as acting FCC chief



During her tenure at the agency, she coined the term "the homework gap" in 2014 to describe the overlap between families that lack broadband access at home and students who need the internet to do their homework. She has championed better access to broadband in rural areas with high maternal mortality rates and poor internet access, to help women who live far from an obstetric center to receive care. And Rosenworcel used her platform as a commissioner at the FCC to elevate women in technology, launching the first podcast from any regulatory agency in the U.S., *Broadband Conversations*, where she only interviews women. Recently, that's included a panel of school superintendents from across the country discussing the challenges of moving school online during the pandemic.



upcoming assignments

User Research Report (Group Project) due February 15

Position Paper due February 22

last week's lectures what stayed

- The topic of information system stayed with me the most because I was surprised to find that it is actually present in our daily lives.
- Information systems and the disparity between different people's ability or opportunity to leverage them.
- Information and information entities are powerful entities and entities of power.
- Information systems don't happen in a vacuum.
- Something as seemingly simple as a transcript is the product of the interaction between many different information systems.
- I find myself really into the user interface and design, especially taking into practice with the analysis and redesign paper. Looking forward to learn the tools and techniques used for designing.
- Information can grant people power, but it is up to people to use it responsibly.
- (I think of this in the blackmailing sense. sometimes information about a person/things can be released without their consent).
- The importance of prioritizing user needs when designing a product/interface over our own preference, as we are directing our design to users, not ourselves.
- Information and information systems are powerful entities and entities of power. I wrote this in blue bold and underlined it. . The intent behind the use of an information system is what is most important. Information and information systems can help create and innovate ways for people to connect and innovate together. However, it also has the power to control and to manipulate and it seems that in a world revolving around capitalism that power can be dangerous, "Addiction code". I noted how scary that overlaid Venn diagram looked with social, political, legal, tech and other systems overlapping information systems almost obscuring the system itself.

last week's lectures what stayed

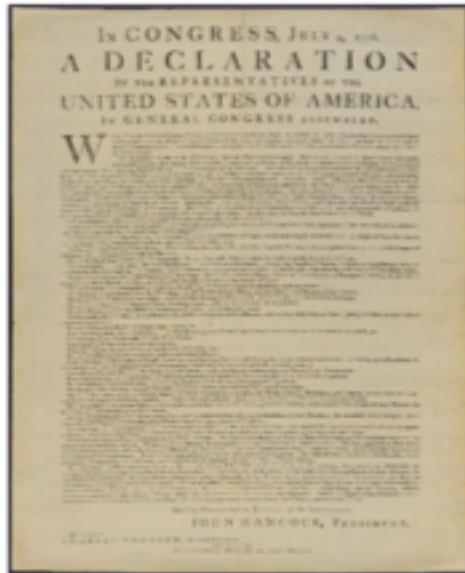
- Every design has a meaning. Just looking at the webpage right now that I am wringing this answer down, every single buttons, fonts, colors, and icons that I see right now has a meaning and purpose as a user interfaces.
- The video about Brain Hacking was super fascinating and creepy. The thought that tech companies have so much power when it comes to luring us and making us addicted to their product is scary. However, there is a plus side in which some companies are using this to improve society, example would be the bad habit breaking app.
- I think the idea of information systems gaining power is a somewhat frustrating one. It's definitely true that certain systems are ingrained into our society. I don't like that. We're stuck using the same outdated patterns. Things like transcripts are an example, but systems are everywhere. Though this isn't really new, it's still true. Either way, this just stuck with me.
- Learning about what graphical user interface is was what stayed with me from the lectures this week, because computer system terms have always confused me as they are abstract. Now I know they are a system that allows users to interact with a computer visually by using items such as windows, icons, etc.
- Information system and power. I never really thought about information system of having power... It's an interesting concept that I wished I knew about it earlier. The thought of how "information systems inherit power and transmit power" to shape the society and people just blows my mind.

last week's lectures questions

- I've got questions about user research, and how to go about studying behaviors for non-tech, subjective environments.
- Do we have an example of a bad information system?
- Why some products didn't change their outlook with the obvious design errors? Is it because it is in a capitalist society?
- what if an informative system helps me, but against me somehow.
- why do designers make unethical choices just to get people to use their product more? what kind of laws are there to prevent this? or is it easy for companies to find loopholes around ethical guidelines?
- How can we make information systems better?
- for user interface do we need to do user research?
- How could I utilize the power from information into something positive and beneficial?
- Can a beautiful interface hide a simple product?
- As there are so many factors to consider when designing UI, will these factors conflict? If so, do some of them have higher priority when leveraging?
- What's the best way to get started with product design if you're interested but feel like you're not that good at designing things?
- Apple or Microsoft: Which company was the leader in computers in the 80s and 90s?
- Not from the lecture, but can we hear the story about how Professor Janes almost sneezed on the Declaration of Independence?

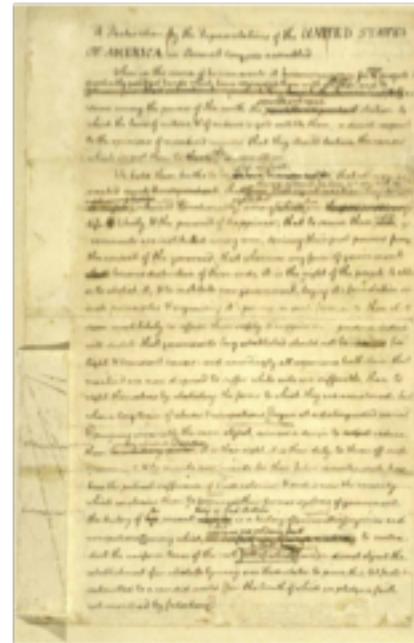
"Dunlap Broadside"

1776



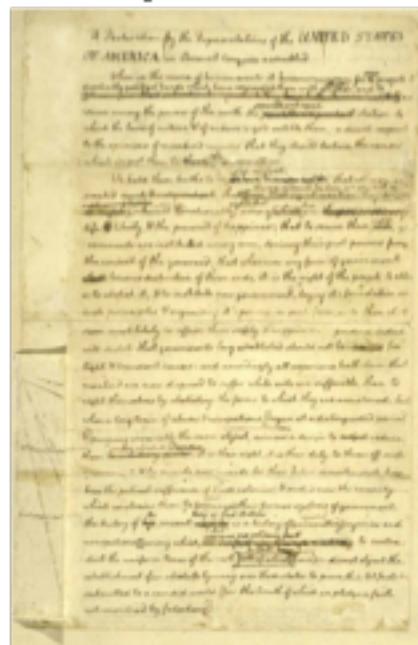
Declaration of Independence

1776



Declaration of Independence "original rough draft"

1776



deleted passage ("He has waged cruel war...")

He has waged cruel war against human nature itself, violating its most sacred rights of life and liberty in the persons of a distant people who never offended him, captivating & carrying them into slavery in another hemisphere or to incur miserable death in their transportation thither. This piratical warfare, the opprobrium of infidel powers, is the warfare of the Christian King of Great Britain. Determined to keep open a market where Men should be bought & sold, he has prostituted his negative for suppressing every legislative attempt to prohibit or restrain this execrable commerce. And that this assemblage of horrors might want no fact of distinguished die, he is now exciting those very people to rise in arms among us, and to purchase that liberty of which he has deprived them, by murdering the people on whom he has obtruded them: thus paying off former crimes committed again the Liberties of one people, with crimes which he urges them to commit against the lives of another.

books that made a difference

- Outliers by Malcolm Gladwell
- Zen & the Art of Motorcycle Maintenance - Robert Pirsig
- The Story of Seattle - Roberta Frys Watt
- Harry Potter, without a doubt. It was the book series that made me fall in love with reading and realize just how powerful the world of words can be.
- The Myth of Sisyphus by Albert Camus
- East of Eden by John Steinbeck
- D&D 5E Player's Handbook
- The Subtle Art of Not Giving a F*** by Mark Manson
- Existentialism is a Humanism By Jean Paul Sartre
- During Greatly by Bronte Brown
- Big Little Lies
- Unbroken
- Books about stoic and Buddhist philosophy have had a large influence on me
- Harry Potter was the first book I could not stop reading when I was in 4th grade. Also, I read "Thirteen reasons Why" when I was in high school (before the Netflix show came out) and I have never tried so much from a book, it also changed my perspectives on how I treat my peers and how saying something harmful could be affecting them
- Of all the books that I've read, the books from the Percy Jackson series have had the greatest influence on me. I grew to love reading (certain books) and use it as a method of relaxation.
- I like reading about people. Their lives and their resilient and moment moments. What did they learn from this moments and what impact did it have on them.
- Many rare history books no longer printed
- Last year I read Dostoevsky's Demons. It was the first really comprehensive and politically applicable novel I have read. It left a lasting impact because it opened my eyes to not only the impact a fictional novel can have, but how history repeats itself time and time again.
- The Moment of Lift by Melinda Gates
- I Am Not Your Perfect Mexican Daughter by Erika L. Sánchez
- Currently reading Data Feminism in re INFO 201 class which is awesome but also The Alchemist by Paulo Coelho and Siddhartha by Hermann Hesse are two books I could read over and over again just picking up all those little messages I missed the first time
- Fantasy and Sci-Fi books that allow me to imagine things we don't have in our world.
- I love to read but I think one that has had the most impact on me is one that I read recently called The Four Agreements. It has helped me grow tremendously as well as serve as a reminder to be kind.
- Elon Musk: Tesla, SpaceX, and the Quest for a Fantastic Future
- Ishmael by Daniel Quinn had to have had the greatest impact on me. It completely changed my perspective on society.
- As a Christian, the Bible has had the greatest influence on me in terms of how I live my life. Also, books such as "Freakonomics", which implements economic ideas into a more enjoyable reading (ie. What do some wrestlers and school teachers have in common? Focuses on the topic of incentives), have been more informative to me than school textbooks that are just bland and very hard to read through.
- Everybody, Always by Bob Goff
- The Old Man and the Sea.
- A few books have had large impact on me, based on the time in my life. When I was really young, I loved educational books, particularly magic school bus. Another book I enjoyed was A Midwife in Times. These largely led to my interests in science in the future. This was reinforced by The Invention of Irony, which despite being fantasy, largely touch on scientific principles. I'd recommend that series. Either way, the books that had the greatest impact on me are the ones that gave me an interest in the sciences and helped me build a creative mindset.
- Seven Habits of Highly Effective People, Marie
- The Gracile
- Fahrenheit 451
- Space Odyssey

the week to come

- ❖ lecture 10 on Accessible Systems, Figma
- ❖ lecture 11 on The Designed Object
- ❖ lab on Figma/prototyping
- ❖ questions to bear in mind for the week:

How does designing specifically for accessibility concerns help everyone?

What examples can you think of - of objects that have been designed and redesigned for a very long time?

today is February 9 Week 6 agenda

- reminders & notes
- information stories
- upcoming assignments (due 2/16)
- last week: what stayed, questions
- words words words
- the week to come

reminder: office hours by appointment today 5 - 6:30pm PT, open Thursday 11am - 12pm PT (note late start)

Happy New Year!

Presidents Day holiday, February 15

Exam 2, Thursday, February 18, 6-9pm PT

Please for now have microphones muted

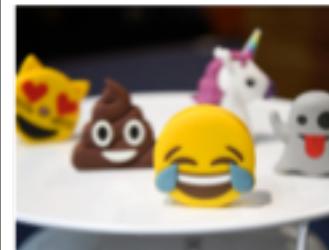
Use the **Chat** feature (bottom of your screen) to type in questions or issues

last week's lectures what stayed

- Figma definitely stayed with me the most as it was really fascinating to learn hands-on a new type of program.
- The voice over activity. I got frustrated.
- Boustrophedon is backwards writing.
- Designing accessible systems is going to be very important. This actually parallels somewhat what we're doing in CSE 373, where we cover the social impacts of machine learning. Essentially, a "toxicity" filter was biased against certain social groups. As I hope to go into machine learning, the connection between classes stood out for me.
- Figma was cool but it was a little hard to initially use, the TA explained things very quickly and I was continuously pausing and rewinding which detracted from my learning experience. I was more concerned with completing the assignment than understanding the software.
- Figma I enjoyed but definitely a learning curve. I also really enjoyed the designing accessible systems, because it showed how applicable it is and how important it is to be incorporating that type of design into technology. I think it's something really easy to forget about if you do not experience a disability, so I greatly appreciated the reminder and further knowledge on the topic.
- What stayed with me the most was the idea that if we design a system to fit the average person it may not work for most people.
- when the social context changes, design decisions change too
- I love books! I don't believe there will ever be a day when the necessity for books ceases. I'd never taken into account the design of some of my favorite books. The way the words sit differently on the page or are words are spaced a bit differently than normal. These quirks about these books drew me into them. Figma was really awesome to use once you get the hang of it.
- I never thought about what could be considered a book- like that string thing that supposedly transmits information- I never thought that would count.

THE INDICATOR FROM PLANET MONEY Emojiconomics

February 2, 2021 · 6:36 PM ET



Pickup Truck

Unicode details for Pickup Truck (▴) emoji.

Character	▴
Codepoints	U+1F6FB
Description	read more
Presentation	Emoji
Modifiers	-
Shortcodes	:pickup_truck:
Tags	pickup, pick-up, truck
Browse	Every Emoji by Codepoint

<https://www.npr.org/2021/02/02/963370085/emojiconomics>

last week's lectures questions

- is it possible to design a thing that would fit the needs of any given person? an example even? (like the average person, disabled people, etc)
- How can we make our world more accessible for those who have disabilities?
- Can there be situations where an accessible design made for certain group of people bring more discomfort to another group of people?
- In what ways can knowing about the ins and outs of information, what it is, and its different forms, be applicable in other aspects of life?
- I was wondering do professionals use Figma?
- Why is Figma so difficult to use?
- Why did some styles of writing information go out of "style?" Like boustrophedon and scripto continua.
- What isn't a book?
- What do YOU think will be the next development of books?
- What is your opinion on audiobooks? Do you think it will get very popular in the future?
- How do you think the transition from paperback to e-books is changing the writing and publishing industry?

breakout groups

groups of ~3 | 6 minutes | documents

cameras and microphones on (if possible)

say hi, name, where you are

how many kinds of (intentional) documents can you think of?

- bills, receipts, license, map, shopping list, letter, schedule, calendar, etc etc etc

link to shared Google doc in chat

choose 1 person to record for the group

synonyms

- articulation - elocution
- Hard, difficult, challenging.
- fries and chips
- iPad and tablet
- MacBook and Laptop
- Yes. Sure. Certainly. I can. Absolutely. Aye. Definitely. etc. (that last one is not a synonym, but a reference to the fact that I am too lazy to add every synonym for yes.)
- sun & light
- utensil, fork, spoon, and knife
- foe and enemy
- victor and winner
- inflammable and flammable
- Example 1: inspect and investigate, which both mean to examine.
- Example 2: contemporary and modern, which both describe something as recent or new.
- happy and joyous
- intelligent and clever
- impart and inform
- Use, utilize
- Good, nice
- Terrible, bad
- phone/cellular device
- text/message (as verbs)
- brave, valiant, courageous
- beautiful, stunning, gorgeous, lovely
- admit, confess
- evidence, proof
- Korean bbq, sushi, ramen, tacos (all my favorite dishes)

polysemes

- Okay, it can be used to show that you understand something or that you don't understand it all depending on how you say it/phrase it.
- Set
- virtual
- dog bark/tree bark
- home address/ address the crowd
- - Wave (water waves and hand waves)
- - Park (grass park and car park)
- left, right
- Sick
- - Actually sick because of pathogens
- - Another way people in America say cool
- bat like the animal or a baseball bae
- lead like being a leader or lead like that a pencil has
- Season - time of year, verb of applying spice to food, or collection of episodes on a television show
- Table - something to put objects on, or an object to sort data
- mean: not nice
- mean: average
- mean: intend to convey
- ruler: king/leader
- ruler: measuring device
- date:
 - - the fruit
 - - the day it is
 - - romantic gathering
- Fair: pale or light-skinned, just, or gathering with games/ entertainment.
- Jam: the thing you eat, being stuck or unable to move due to a high density of objects/ people/etc
- Jam is a sweet paste often put on bread as part of a sandwich along with peanut butter (often referred to as jelly), but it can also be used in the context of a traffic jam or to jam a bunch of stuff into a small space, such as a suitcase.
- The word novel can refer to a few things. A novel can be used to represent a book. Referring to something as novel can mean it is important for some particular reason. You could also use novel as an adjective to mean something new or an unusual or different way of approaching a problem.
- cookies

the week to come

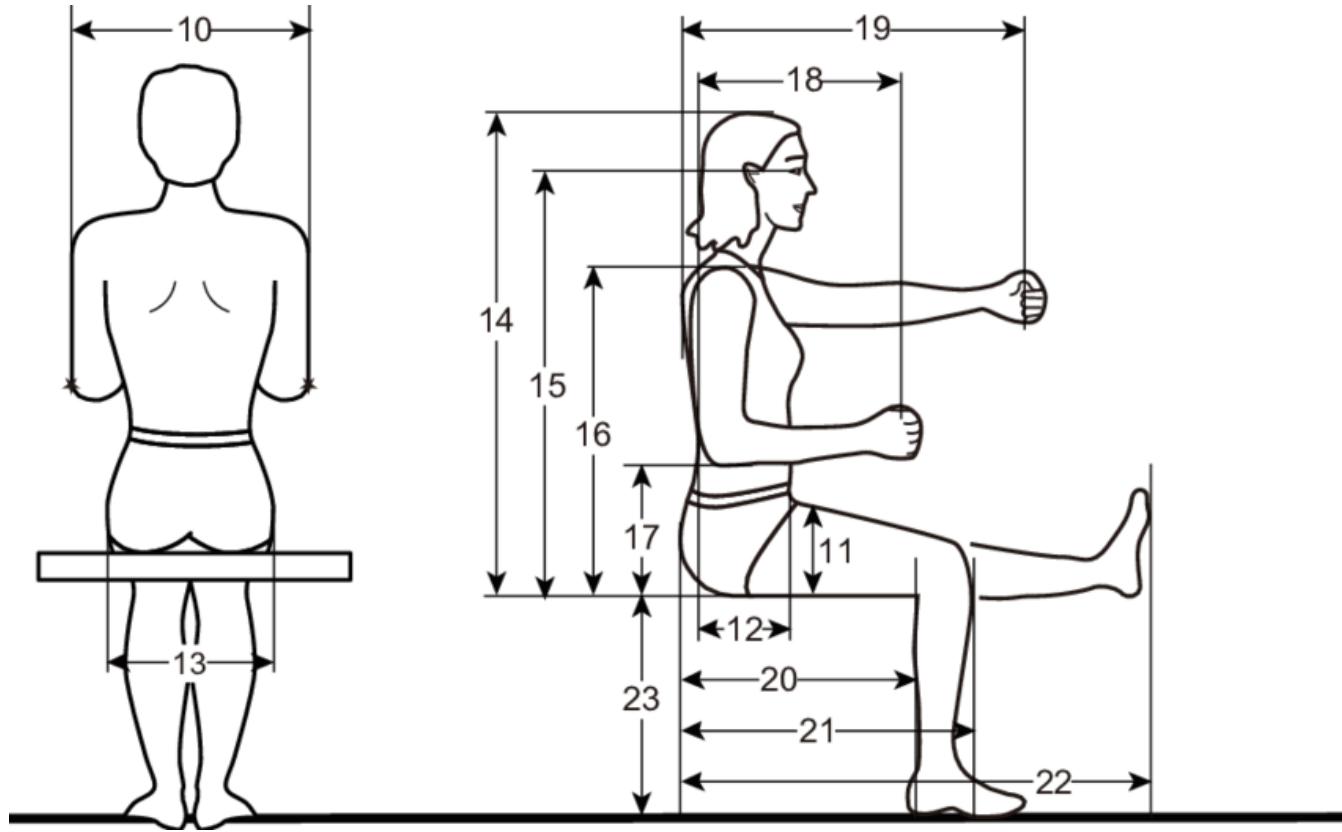
- ❖ **lecture 11** on Search Engines, Mis/Disinformation
- ❖ **lecture 12** on Information Architecture & Search
- ❖ no lab this week
- ❖ questions to bear in mind for the week:

Why is search so hard? (It is.)

What is search doing to us?

Accessible Design

Anastasia Schaadhardt
INFO 200



What happens we design for the “average” person?

Spectrum of ability

- People have varying degrees of ability in different areas--vision, hearing, mobility, cognitive, etc.
- Degree of ability can change due to temporary conditions
- Degree of ability often changes over time



If you design
without accounting
for variation in
ability, your design
will fail



Designs that
account for all
abilities are called
accessible designs

What is Disability?

Definitions of Disability

- Usually we consider someone disabled if they have a **long-term or permanent impairment** of an ability
- Some people fit this definition but do not identify as disabled
- The Americans with Disabilities Act (ADA) defines a person with a disability as:
 - Someone who has a physical or mental impairment that **substantially limits one or more major life activities**



Definitions of Disability

- United Nations Convention on the Rights of Persons with Disabilities:
 - “Persons with disabilities include those who have long-term physical, mental, intellectual or sensory impairments which **in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others.**”
 - In other words, a society and environment built for non-disabled people prevents them from participating in society as equals
- So, how do we overcome these barriers?



Models of Disability

Medical Model



- Focuses on lack of “normal” function
 - Solutions involve “restoring” function through medical interventions and cures
 - The onus is on the disabled person to adapt to a society built for “normal,” abled people
-

Social Model



- Focuses on inaccessible environments and ableist society
 - Solutions involve changing the environment to be accessible and inclusive
 - The onus is on society to remove access barriers and adapt to varying abilities
-

Bio-psycho-social Model of Functioning, Disability and Health

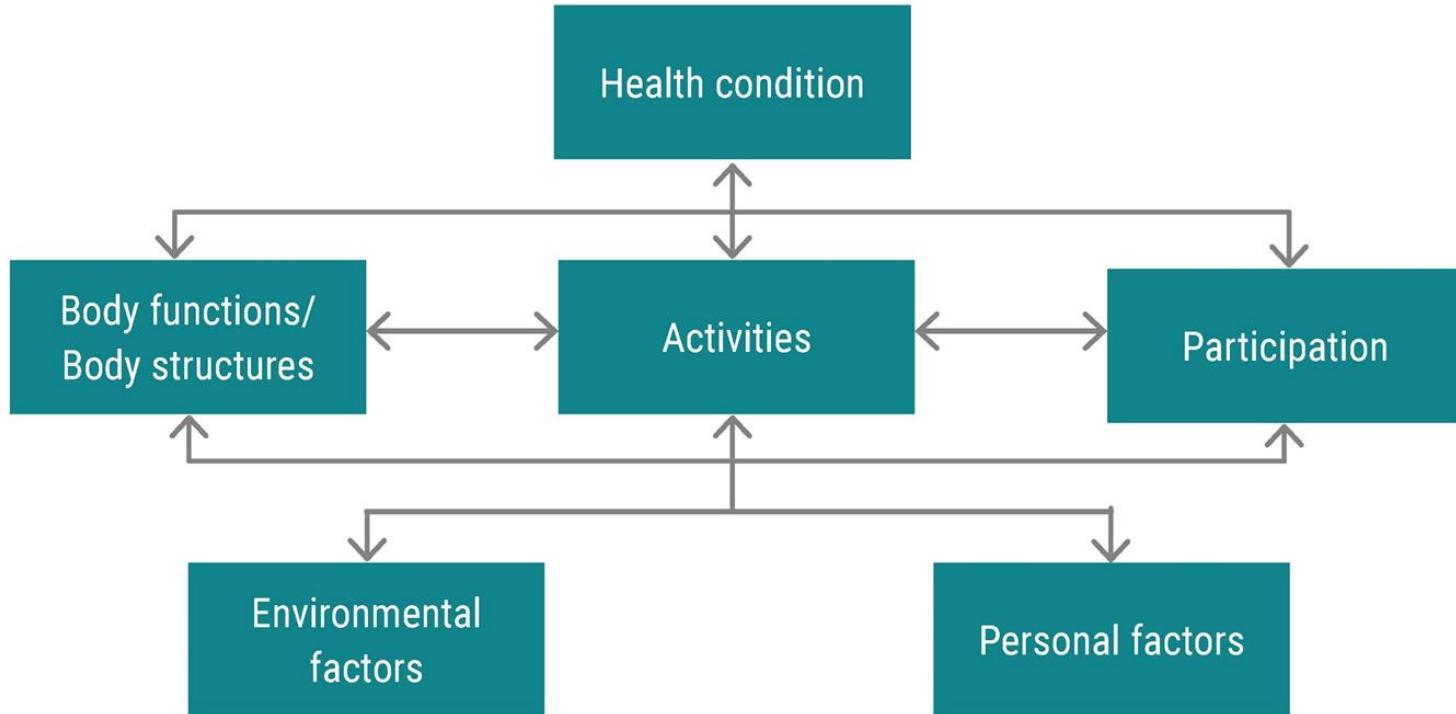


Figure 1: Bio-psycho-social model of the International Classification of Functioning, Disability and Health (ICF)

Prevalence of Disability

- 15% of the global population (WHO, 2011)
- US Census Bureau/Social Security (2014):
 - 27% have non-severe disability
 - 17.6% have severe disability

(Some) Types of Disability

- Vision
 - Blindness
 - Low vision
 - Colorblindness
- Hearing
 - Deafness
 - Hard of hearing
- Speech
 - Ability to speak
 - Speech impediments
- Mobility
 - Function of limbs
 - Spinal cord injury
 - Dexterity
- Cognitive
 - Learning disabilities
 - Dyslexia, dysgraphia, dyscalculia
 - ADHD
 - Memory loss
- Psychological
 - Mental illnesses
- Invisible
 - Chronic pain
 - Chronic fatigue
 - Epilepsy
 - Severe allergies

Universal Design

Universal Design

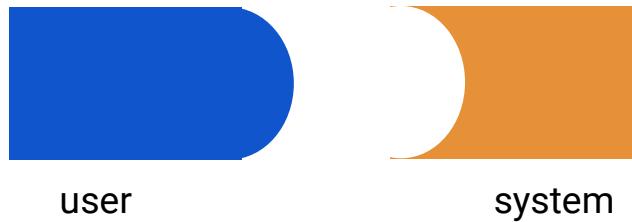
- Designing products to be usable by as many people as possible, not just the “average” user
- Examples:
 - Curb cuts
 - Automatic doors





Ability-Based Design

a)

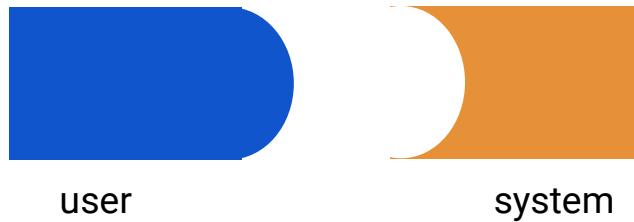


b)

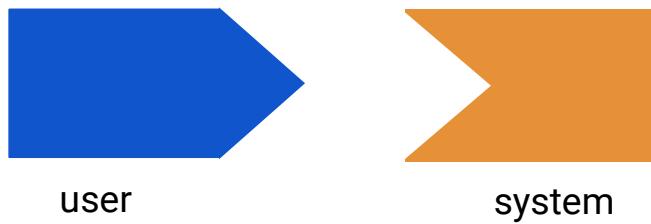


Ability-Based Design

a)

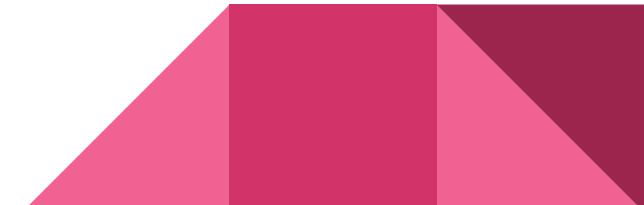


b)

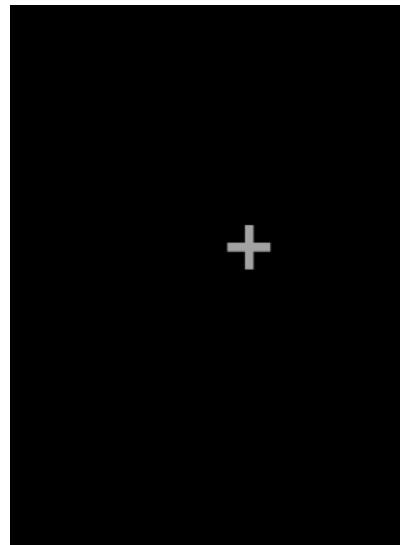
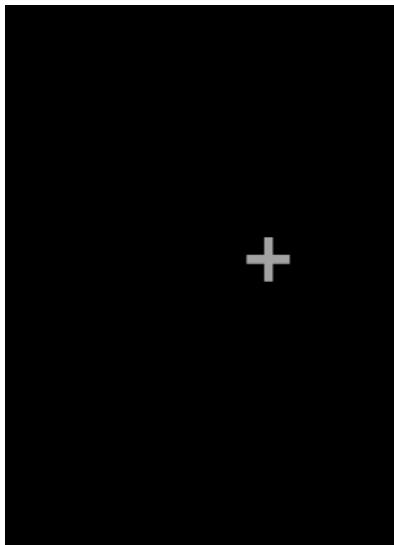


Ability-Based Design

- Systems should be more aware of the user's situation, context, and environment
- Systems should be designed for the users' current abilities ("come as you are")
- Many ABD solutions involve interface customizability and methods of determining the user's context/abilities



SmartTouch (Mott et al. 2016)



- Touchscreens assume users can tap a target with one finger in a clean landing + lift
- SmartTouch observes the user's touch patterns, and resolves their touch targets based off these observations

<https://www.washington.edu/boundless/ischool-accessibility/>

<http://faculty.washington.edu/wobbrock/pubs/chi-16.01.pdf>

Challenge: What if anyone,
anywhere, at any time,
could interact with
technologies that are
ideally suited to their
specific abilities?

[ORDER ONLINE](#)[MENU](#)[COUPONS](#)[TRACKER](#)[PIZZA PROFILE](#)[VIEW YOUR LOCAL DOMINO'S](#)[SIGN IN & EARN REWARDS](#)[START YOUR ORDER](#)[DELIVERY](#)*or*[CARRYOUT](#)

If you are using a screen reader and are having problems using this website, please call 800-252-4031 for assistance.





Why don't more
companies
embrace accessible
design?

Some perceive accessible design to be:

- Too hard
- Too expensive
- Not a large enough percentage of customers (therefore, not worth the time, effort, and cost)
- Only about ADA compliance
- A “favor” for disabled people

Major companies are becoming more dedicated to accessibility

- [Microsoft](#) has a Chief Accessibility Officer and is leading in many accessibility innovations
 - [Adobe](#), [Facebook](#), [Google](#), and [Apple](#) all have accessibility teams and initiatives
 - They all need more designers and engineers who understand accessibility
-



<https://www.microsoft.com/design/inclusive/>

Inclusive Design

Inclusive Design is a methodology, born out of digital environments, that enables and draws on the full range of human diversity. Most importantly, this means including and learning from people with a range of perspectives.



Getting Started

Accessibility should not be an afterthought; it should be part of your design!

Embrace existing recommendations and learn more:

UW IT Accessibility Guidelines**

<https://www.washington.edu/accessibility/checklist/>

W3C Web Accessibility

<https://www.w3.org/standards/webdesign/accessibility>

Web Content Accessibility Guidelines (WCAG)

<https://www.w3.org/TR/2018/REC-WCAG21-20180605/>



Contrast Checker

[Home](#) > [Resources](#) > Contrast Checker

Foreground Color

#2E2EFF



Lightness



Background Color

#FFFFFF



Lightness



Contrast Ratio

7.11:1

[permalink](#)

<https://webaim.org/resources/contrastchecker/>

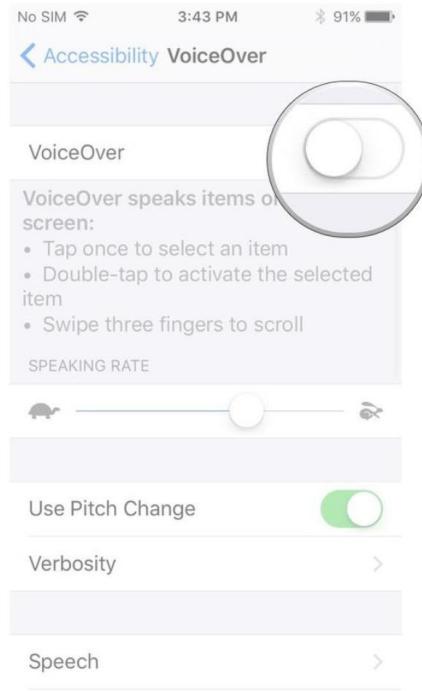
Experiencing Screen Readers

- A screen reader reads what is on the screen to the user, who navigates by gestures (phone) or on the keyboard (computer)
- What kinds of screen readers are there?
 - PC: JAWS, NVDA, Windows Narrator
 - iOS: VoiceOver
 - Android: TalkBack



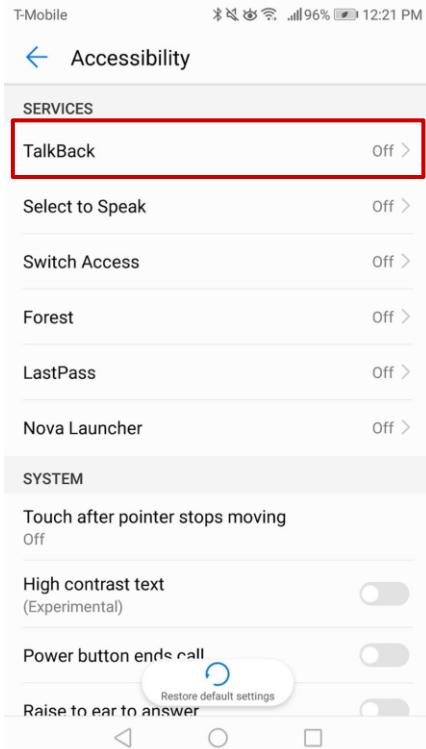
iOS

- Go to Settings > Accessibility > VoiceOver
- OR triple-click the side button (iPhone X and later) or triple-click the home button (other models)



Android

- Go to Settings > Accessibility > TalkBack
- OR press both volume keys for 3 seconds



Familiarize Yourself with Gestures

Common

Tap/Tap-Drag: describes/reads what's under your finger

Double-Tap: what single-tap normally does (select/activate)

iOS (<https://www.apple.com/accessibility/iphone/vision/>)

Two-Finger Swipe Down: read all

Three-Finger Swipe Up/Down: scroll

Android (<http://www.apps4android.org/?p=4147>)

Swipe Right-then-Left: scroll forward

Swipe Left-then-Right: scroll back

With your eyes open...

(and VoiceOver or TalkBack on)

- Open a web browser and navigate to a favorite web page
 - Experiment with reading the page and scrolling up or down
 - Try selecting a photo--what happens? Did you get useful information about the photo?
-

Now close your eyes

- Go to your home screen
 - Start your favorite social media app and try reading your feed
-

Keep your eyes closed

- Go to your home screen
 - Start your email app
 - Try sending yourself an email
-

Participation

Write a short paragraph describing your experience using a screen reader.

Final Thoughts

- Look up YouTubers like **Jessica Kellgren-Fozard** and **Molly Burke**
- Look up disability rights activists like **Alice Wong** (Disability Visibility podcast) and **Imani Barbarin**
- Watch **Crip Camp** on Netflix!



Intellectual Foundations of Informatics

Internet Intro

Scott Barker
INFO 200

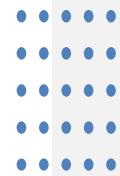


Today's agenda



- Brief History
- Basics of how the Internet works (protocols)
- Base knowledge of networking is very important since almost everything today relies on the Internet
- If you want to work in cyber security a DEEP knowledge of how the internet works is critical, because many security vulnerabilities are related to how internet technologies and protocols work.
- Also critical if you want to be a web or mobile developer

What is the Internet?



Are the Internet and the Web the same thing?

- The Internet is a world-wide set of communication networks that interoperate using the TCP/IP protocol suite
 - Think of “communication software” or “standards” when you see “protocol”
 - more on TCP/IP and other protocols later...
- A network of networks
- A loosely controlled anarchy
- Sometimes called “The Public Internet” to differentiate it from private internets or intranets
- The Internet and the Web are NOT the same!
- Questions like:

What does it look like?, How big is it? How many users are there? How much data is present? Are all exceedingly difficult to answer.

Why?

Brief History

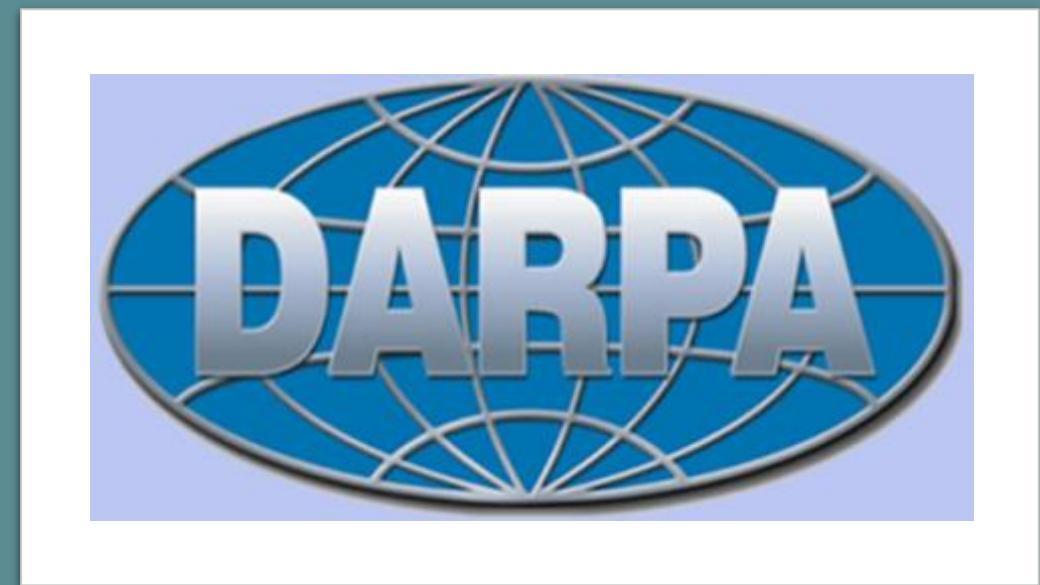
In the 1960's the Defense Advanced Research Projects Agency (DARPA) wanted to develop a network that would connect geographically diverse, heterogeneous computers

1968/69 -- 4 sites are connected in the original ARPAnet demonstration

To expand this network, standards were necessary, so

1974 --First TCP/IP protocols developed

1983, the use of TCP/IP had been mandated by the Secretary of Defense





Additional Design Considerations

- Network must scale well
- Must connect a very large number of nodes and different network types
- Should continue functioning even if a particular segment failed or if there were unreliable portions of the network
 - Why do you think this was important?

TCP/IP

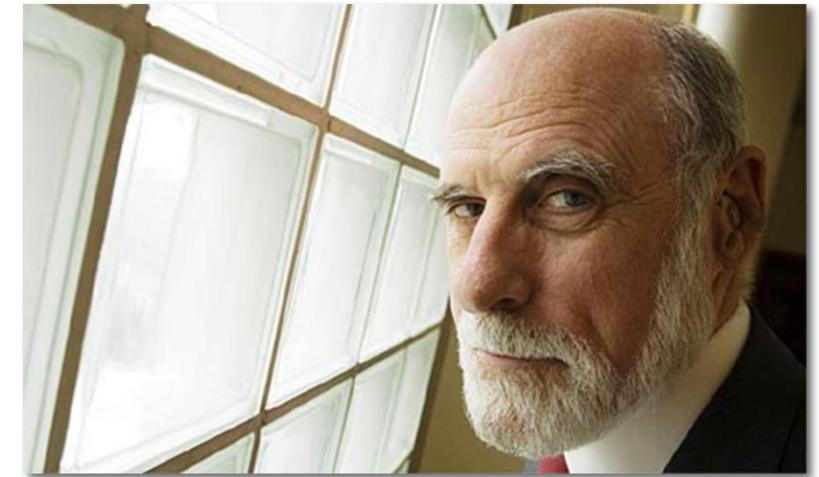
Transmission Control Protocol /Internet Protocol

Provides reliable, in-order, end-to-end transmission of data

All Internet communication is built on top of TCP/IP

Invention of TCP/IP credited to Vint Cerf, 1973

Cerf often considered the “Father of the Internet”

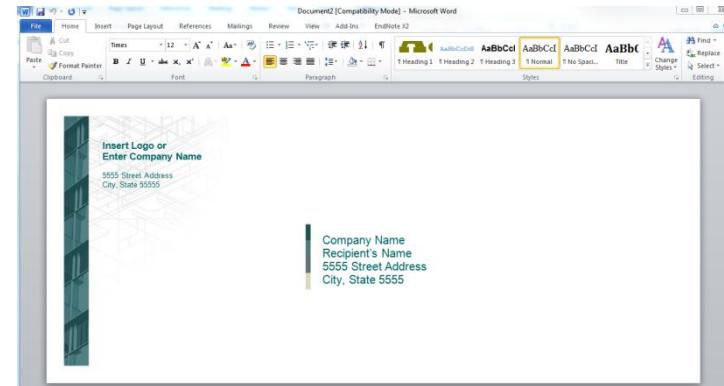


Vint Cerf video on
“What is the Internet”

Protocol

- An agreed upon way to communicate
- Protocols establish rules for the communication to be successful
 - We use protocols in everyday life as well as on the Internet
 - Protocols may exist for years, even when other parts of the process or other technologies change

Example: Sending a letter through the US Post Office



What protocols are in use here? What's missing or wrong in the two examples?



In addition to TCP/IP, do you know of any other protocols that exist on the Internet?

ftp – File Transfer Protocol

http – Hypertext Transfer Protocol

smtp – Simple Mail Transfer Protocol

Most “applications” are built upon standard protocols



**IMAP
POP3**



iCloud

Hotmail



Outlook.com

Aol.

- Defined in RFC's – Request for Comments
- Goal is interoperability, examples:
[HTTP](#) – Hypertext Transfer Protocol (1996)
Note: revisions may obsolete an older RFC
[SMTP](#) – Simple Mail Transfer Protocol (1982)
- But not everything is built on standards, e.g. instant messaging, FaceTime
- Why?
- Vendor may want to provide unique functionality that can't be done within the standard protocol
- Vendor may want to “lock” you into their tool/software

What and how fast?

Letters, words, sentences, pictures, graphics, sounds, videos are all things that we need to communicate over the Internet

Since the Internet is a digital communications network, everything must be encoded into a series of 1's and 0's



A single 1 or 0 is a bit

A sequence of eight 1's and 0's (for example 10010100) is a byte

A kilobyte is 1,000 bytes (or is it 1,024?)!

A megabyte is 1 million bytes

A gigabyte is 1,000 megabytes

Network bandwidth or speed is measured by how many bits per second can be transmitted and it is usually expressed in BITS per second (not bytes per second)

Note: the b is usually written in lower case for bits, as opposed to upper case for Bytes).

(56Kb/sec, 768Kb/sec, 10Mb/sec, 100Mb/sec, 1Gb/sec, 10Gb/sec)

Bandwidth varies depending on the type of technology used to connect to the Internet and your Internet provider (can also be a function of what you are willing to pay for). Fast.com one site to display your bandwidth.

Cellular data - 3G (~400kb/sec), 4G LTE (typical 5-20Mb/sec down, 2-10Mb/sec up), 5G (500Mb – 20Gb/sec)

Wifi data - 802.11g 54Mbps, 802.11n 450Mbps, 802.11ac Wifi 5 – 1-3Gb/sec, Wifi 6 – about 9Gb/sec

Video Wires, Cables, and WiFi

Physically getting these bits
where they need to go

How is information encoded into binary?

Letters and numbers – one standard is ASCII (American Standard Code for Information Interchange)

“A” has an “ASCII” value of 65 decimal or 1000001 in binary

“B” has an ASCII value of 66 decimal or 1000010

“a” has an ASCII value of 97, or 1100001

Today another encoding – UTF-8 (Unicode translation format 8 bit) is more widely used as it can represent additional characters (over 1 million!) that are present in other languages. Can use up to 4 bytes to encode one character.

Pictures, graphics, sounds, videos – standard binary file formats also are agreed upon (jpeg, mpeg, mp3, MANY more)

Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char
0	00	Null	32	20	Space	64	40	Ø	96	60	`
1	01	Start of heading	33	21	!	65	41	A	97	61	a
2	02	Start of text	34	22	"	66	42	B	98	62	b
3	03	End of text	35	23	#	67	43	C	99	63	c
4	04	End of transmit	36	24	\$	68	44	D	100	64	d
5	05	Enquiry	37	25	%	69	45	E	101	65	e
6	06	Acknowledge	38	26	&	70	46	F	102	66	f
7	07	Audible bell	39	27	'	71	47	G	103	67	g
8	08	Backspace	40	28	(72	48	H	104	68	h
9	09	Horizontal tab	41	29)	73	49	I	105	69	i
10	0A	Line feed	42	2A	*	74	4A	J	106	6A	j
11	0B	Vertical tab	43	2B	+	75	4B	K	107	6B	k
12	0C	Form feed	44	2C	,	76	4C	L	108	6C	l
13	0D	Carriage return	45	2D	-	77	4D	M	109	6D	m
14	0E	Shift out	46	2E	.	78	4E	N	110	6E	n
15	0F	Shift in	47	2F	/	79	4F	O	111	6F	o
16	10	Data link escape	48	30	0	80	50	P	112	70	p
17	11	Device control 1	49	31	1	81	51	Q	113	71	q
18	12	Device control 2	50	32	2	82	52	R	114	72	r
19	13	Device control 3	51	33	3	83	53	S	115	73	s
20	14	Device control 4	52	34	4	84	54	T	116	74	t
21	15	Neg. acknowledge	53	35	5	85	55	U	117	75	u
22	16	Synchronous idle	54	36	6	86	56	V	118	76	v
23	17	End trans. block	55	37	7	87	57	W	119	77	w
24	18	Cancel	56	38	8	88	58	X	120	78	x
25	19	End of medium	57	39	9	89	59	Y	121	79	y
26	1A	Substitution	58	3A	:	90	5A	Z	122	7A	z
27	1B	Escape	59	3B	:	91	5B	[123	7B	{
28	1C	File separator	60	3C	<	92	5C	\	124	7C	
29	1D	Group separator	61	3D	=	93	5D]	125	7D)
30	1E	Record separator	62	3E	>	94	5E	^	126	7E	~
31	1F	Unit separator	63	3F	?	95	5F	_	127	7F	□

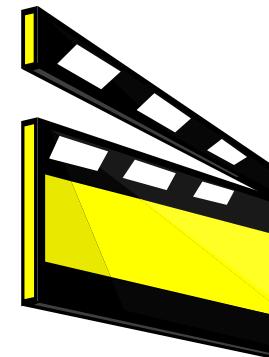
- Note: transmitting pictures is generally much more bandwidth intensive than transmitting text, and videos are generally much more bandwidth intensive than pictures. Why?

The number of bits required to encode pictures and video are huge compared to encoding text.

Consider a 1920x1080 photo

Consider a video

- But the continuing desire to do so has resulted in a strong push and demand for faster and faster Internet connections for all such as 5G



Getting those 1's and 0's someplace...

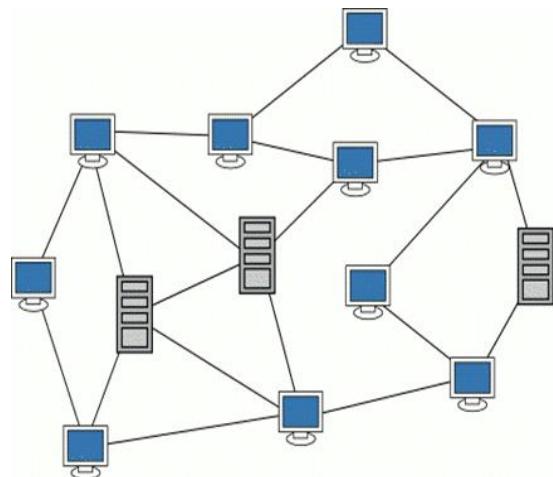
Packet Switching vs. Circuit Switching



t1830 www.fotosearch.com

Communication technologies are typically based on two approaches:

Circuit switch approach - dedicated connection between two devices



Packet switch approach - bandwidth is shared and all data is “packetized” or turned into little pieces. There may be many possible connections between devices.

Most computer networks (including the Internet) use this packet approach

Why?

Network Packets



Having the data to communicate (“the payload”) isn’t enough

Addressing information is necessary so packets are delivered to the correct device

When you combine this addressing type information with real data, you have a “packet”

A network packet includes source, destination, data, reassembly info, error checking etc.

In the case of Ethernet (the most widely deployed type of local area network), ethernet frames can be up to 1500 bytes in size.



Remember each box in the above diagram represents a series of 1's and 0's

Given the 1500 byte max size, a single web page for example may be broken into dozens or even thousands of packets sent across the Internet

A “packet sniffer” (such as Wireshark) can be used to look at packets and potentially decode them if they are sent unencrypted or “in the clear”

Packets, routers, and reliability

Video

End Lecture

Intellectual Foundations of Informatics

IP Addressing and DNS

Scott Barker
INFO 200



IP Addressing



Each device on the public internet has a unique numeric IP Address

- One way to quickly see your public IP address: whatismyip.com

IP addresses ranges are assigned to ISP's or large organizations (like UW) by IANA (Internet Assigned Names and Numbers Authority).

Those organizations manage how they are allocated and assigned to their users/groups

If you have a mobile device, your IP address typically changes as you move from place to place (for example building to building on campus, if you connect to wifi in different locations, or as you switch between wifi and cell connectivity)

Some servers, which frequently are located in data centers have “static” addresses

IP (Internet Protocol) Addressing

In the current/most commonly used version of IP (IPv4), addresses are 4 bytes long or 32 bits.

1001100000000100101000100000001

Can support 2^{32} addresses or 4,294,967,296 devices

To make them easy for humans to remember, the 32 bit sequence is divided into 4 pieces (each 8 bits long) and then converted to a decimal number. Each piece of the address is then separated by a “.”

10011000 00000010 01010001 00000001

152 2 81 1

For example: 152.2.81.1

Note: with 8 bits you can represent 256 different possibilities (2^8), so each decimal number will be between 0 and 255

0 and 255 are also reserved for special purposes so in practice, you will only see devices assigned IP address that have numbers between 1-254

IP Addresses are running low, new version of IP (IPv6) is on the horizon where

Addresses are 128 bits.

Can support 2^{128} addresses (340 undecillion addresses).

Private Addresses

A portion of the Internet address space has been reserved for “private” IP addresses

192.168.x.x

172.16.0.0 – 172.31.255.255

10.0.0.0 – 10.255.255.255

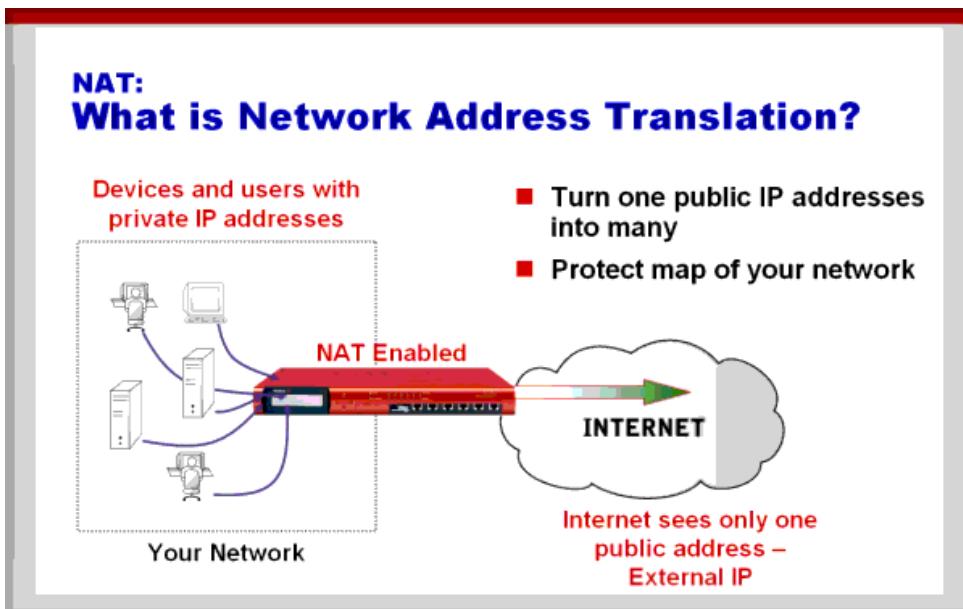
Private addresses may be used within a home network or on corporate/organizational networks.

This allows those machines to use TCP/IP for communication but not have those devices accessible publicly.

Why would you want to do that?



A bit of complexity...NAT



Most home routers are configured with a feature called Network Address Translation (NAT) such that all the devices in your home have a “private” address, and all traffic that goes out appears to come from a single “public” IP address (the address of the router)

You can check this if you go to: whatismyip.com on your desktop/laptop and on your phone, and see the same public IP address displayed

Done to preserve IPv4 address space, and also provides some protection of your home network devices from outside access

Assigning Numbers to Machines

Statically

A network administrator decides how to allocate those numbers on their local network and each device is setup manually

Typically used with servers, not end-user devices

Dynamically

Device requests an IP address from a pool of shared addresses on boot

The address assigned is “leased” for a particular time of use

On subsequent occasions your machine may get a different IP address

Done using a protocol called DHCP (dynamic host configuration protocol)

Companies will setup a DHCP server on their network to hand-out these addresses, or a home router may be setup as a DHCP server as well





More ways to find your IP address

- ipconfig and ipconfig /all - Windows command line
- On Mac – System Preferences/Network
- On iOS – Settings, Wifi, click the “i” next to the wifi network you are connected to
- On Android – Setting, About Device, Status

Notice our IP address displayed

Ping

Can be used to test connectivity to an internet host, returns the round trip time a packet takes to get from your host to there and back



Back to ipconfig /all

What we saw...

- Our IP address or addresses (wired address and wifi address)
- Our MAC address(es) – Media Access Control, the unique address of our network interface card(s)
- How we got our IP address (statically or DHCP)
- But some other things we haven't talked about yet like:
 - Default Gateway
 - DNS Server

Default Gateway/Routers

- The Internet is HUGE and would not scale if all packets to/from all destinations appeared everywhere or if every device had to know how to get to every other device
- Instead, specialized devices called “routers” segment the Internet into pieces
- A router is a traffic cop, responsible for keeping data that is on your network on your network only, and passing it on when it needs to go elsewhere
- The “default router” or “default gateway” tells your computer where data is sent when it isn’t on your network
- Routers themselves have default routers, so to get from one place to another a packet may traverse many routers before arriving at the destination



Traceroute
or
tracert

Can be used to display the “route”, or which routers your packet traverses from one location to another

C:\Users\barker>tracert ischool.syr.edu

Tracing route to exp-prod-web1.syr.edu [128.230.18.191]
over a maximum of 30 hops:

1	<1 ms	<1 ms	<1 ms	gateway.home [192.168.254.254]
2	2 ms	2 ms	2 ms	fdr01.sllk.wa.nwestnet.net [50.46.181.23]
3	3 ms	3 ms	3 ms	50.46.176.68
4	4 ms	4 ms	4 ms	50.46.178.49
5	5 ms	5 ms	6 ms	cr2-sttlwawb-b-be500.bb.as20055.net [64.52.96.10]
6	4 ms	4 ms	4 ms	cr2-sttlwawb-a-be18.bb.as20055.net [107.191.236.126]
7	4 ms	5 ms	4 ms	cr2-sttlwawb-a-be10.bb.as20055.net [107.191.236.19]
8	3 ms	4 ms	3 ms	hu0-5-0-4.ccr21.sea02.atlas.cogentco.com [38.142.50.57]
9	24 ms	24 ms	25 ms	be2042.ccr32.slc01.atlas.cogentco.com [154.54.89.102]
10	35 ms	34 ms	34 ms	be3038.ccr22.den01.atlas.cogentco.com [154.54.42.98]
11	46 ms	46 ms	54 ms	be3036.ccr22.mci01.atlas.cogentco.com [154.54.31.90]
12	58 ms	58 ms	58 ms	be2832.ccr42.ord01.atlas.cogentco.com [154.54.44.170]
13	65 ms	65 ms	64 ms	be2718.ccr22.cle04.atlas.cogentco.com [154.54.7.130]
14	69 ms	69 ms	69 ms	be3157.rcr21.buf02.atlas.cogentco.com [154.54.47.126]
15	72 ms	73 ms	72 ms	be3174.rcr21.syr01.atlas.cogentco.com [154.54.30.146]
16	73 ms	73 ms	71 ms	38.122.120.10
17	72 ms	75 ms	73 ms	core2-cst-61-193.syr.edu [128.230.61.193]
18	73 ms	74 ms	73 ms	gdc-40leaf1b-061-171.syr.edu [128.230.61.171]
19	73 ms	73 ms	72 ms	ivmf.org [128.230.18.191]

Trace complete.

Test from My Computer http:// ischool.syr.edu

80 Trace Plot Analysis More Tools...

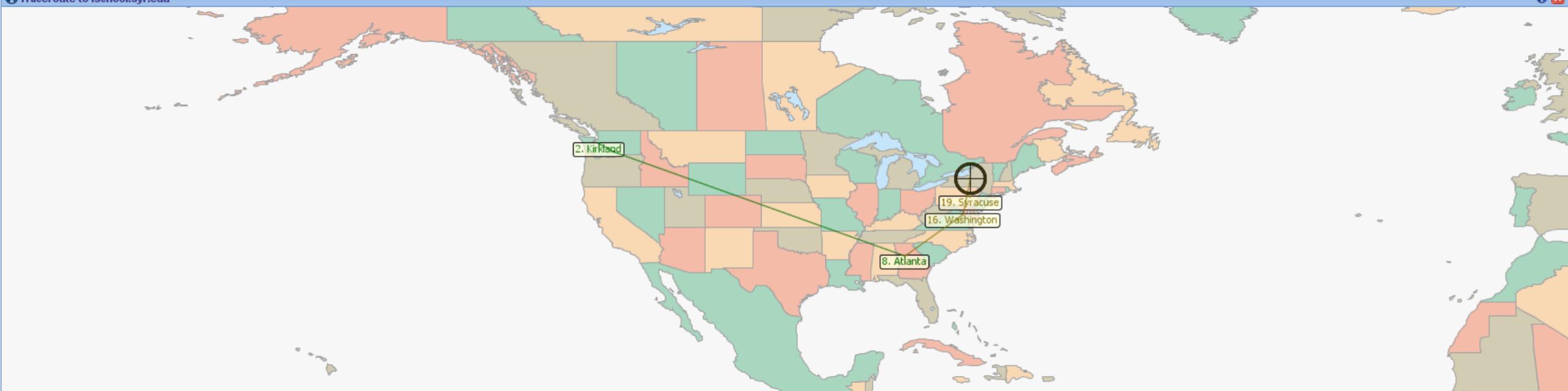
Server is stopped

ischool.syr.edu (128.230.18.191) XStart Tools Run once Views: T A W C D More

Traceroute to ischool.syr.edu



Traceroute to ischool.syr.edu



Domain Name Service (DNS)

- Most users don't see or use numerical IP addresses often. They use names instead

www.uw.edu

www.facebook.com

but it is possible to enter the IP number in a web browser

- The use of names rather than numbers is made possible by DNS, the Domain Name Service
 - the DNS server is essentially a distributed database that stores name/address pairs so that you can enter a name and it will lookup the number and give that information to the lower level protocol (TCP/IP)



DNS Continued

DNS is a hierarchical system that includes .com, .org, .edu, .mil, and country based addresses like .ca or .nz top level domains

A couple years ago new and several controversial domains were added

[Wikipedia list of top level domains](#)

You can query DNS manually using “nslookup” at the command line

You can also find out some details about who owns a particular DNS name by doing a “whois” lookup. DNS names can potentially be valuable.

<https://godaddy.com/whois>

DNS names are registered through DNS registrar's such as “GoDaddy”- godaddy.com or your organization's networking group if they provide DNS services



“iSchool” DNS story



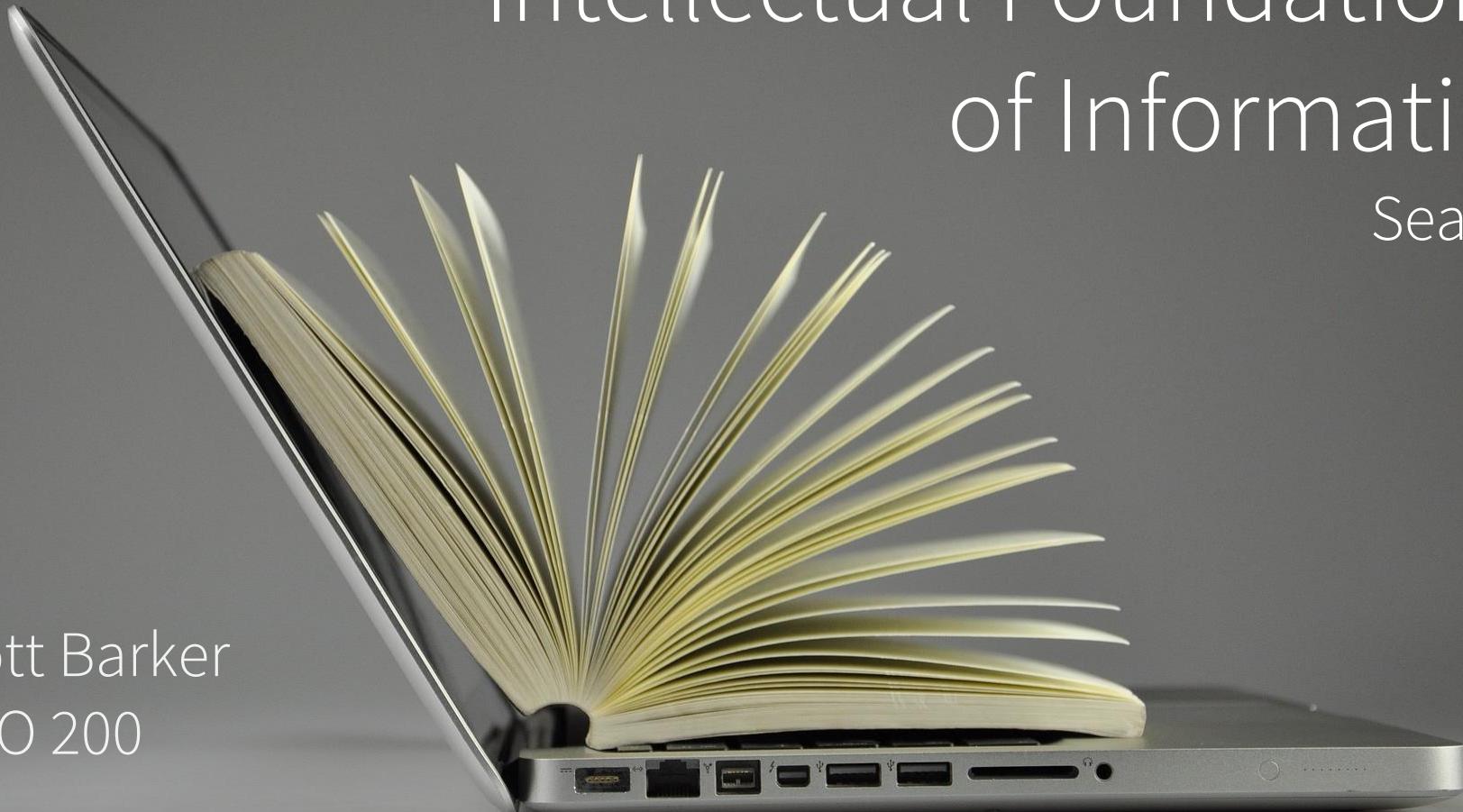
Review Video IP Addresses and DNS

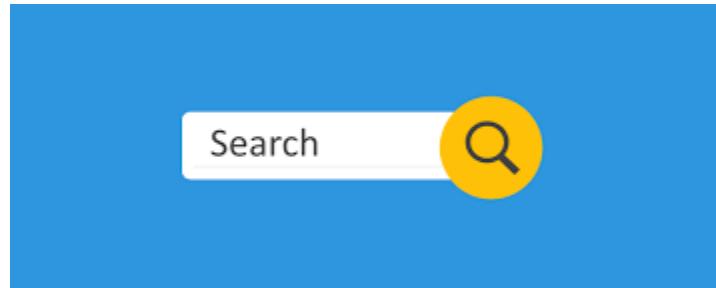
End Lecture

Intellectual Foundations of Informatics

Search

Scott Barker
INFO 200





Sometimes called
Information Retrieval or IR
by academic researchers

What is “Search”
and why is it so important?

Search Engines like Google, Bing, Baidu can help us to...



- Information to help us make a decision
- Information we want/need (e.g. how to do something, how to get somewhere)
- Information to verify facts or claims we hear
- Entertainment (music, videos, sports scores)
- Other people (friends, family, similar interest/social network, employees)
- Overall they facilitate “Information Seeking” behavior

Search results and ranking may inform (rightly or wrongly) our

- Choices – what we do, what we buy, what/who we like, or how we act
- Politics – who we vote for, who we trust
- Assumptions or biases, what we believe or want to believe

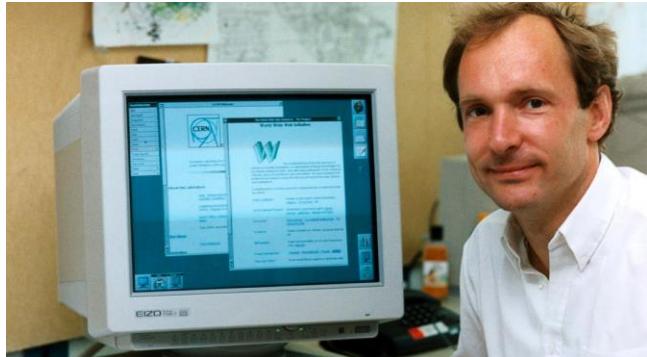
Search Engines and the algorithm's behind them are not perfect

- Not all information is available through them
- Some countries censor content or ban certain search engines or specific content completely
- Results can be manipulated for commercial, political, or personal gain

A bit of history

In the beginning the web was small, not many sites/pages

Aside...who “invented” the web and around when?



(Sir) Tim Berners-Lee
While working at CERN in
Switzerland
1989
Built on a NeXT computer



The first web page was at info.cern.ch

Main idea was to use “hypertext” to make access to documents/information stored on different systems easier/simpler

It wasn't the only idea – there were other competing things first, like “[Gopher](#)”

Finding stuff...

- Since number of sites was small you could keep addresses in your head or write them down
- As sites increased CERN began to keep a list, did some basic categorization of them – list was managed manually
- <http://info.cern.ch/hypertext/DataSources/bySubject/Overview.html>
- Many sites started using the convention of www..... at the beginning of their name so people could see that they were a “world wide web site” vs. something else (such as a Gopher site)
- Librarians and others had initiatives to “catalog the web”, to make things easier to find by topic area
- Some books were published with Internet Resources listed, e.g. “The Whole Internet Catalog”
- Old school Yahoo! Is a good example of a “browsing” type of approach that was used

[Yahoo! Games](#) - play online chess, backgammon, bridge, blackjack and more...

[Yellow Pages](#) · [White Pages / People Search](#) · [Maps](#) · [Classifieds](#) · [Personals](#) · [Chat](#) · [Email Shopping](#) · [My Yahoo!](#) · [News](#) · [Sports](#) · [Weather](#) · [Stock Quotes](#) · [more...](#)

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[Companies](#), [Finance](#), [Employment](#)...
- [Computers and Internet \[Xtra!\]](#)
[Internet](#), [WWW](#), [Software](#), [Multimedia](#)...
- [Education](#)
[Universities](#), [K-12](#), [College Entrance](#)...
- [Entertainment \[Xtra!\]](#)
[Cool Links](#), [Movies](#), [Music](#), [Humor](#)...
- [Government](#)
[Military](#), [Politics \[Xtra!\]](#), [Law](#), [Taxes](#)...
- [Health \[Xtra!\]](#)
[Medicine](#), [Drugs](#), [Diseases](#), [Fitness](#)...
- [News and Media \[Xtra!\]](#)
[Current Events](#), [Magazines](#), [TV](#), [Newspapers](#)...
- [Recreation and Sports \[Xtra!\]](#)
[Sports](#), [Games](#), [Travel](#), [Autos](#), [Outdoors](#)...
- [Reference](#)
[Libraries](#), [Dictionaries](#), [Phone Numbers](#)...
- [Regional](#)
[Countries](#), [Regions](#), [U.S. States](#)...
- [Science](#)
[CS](#), [Biology](#), [Astronomy](#), [Engineering](#)...
- [Social Science](#)
[Anthropology](#), [Sociology](#), [Economics](#)...
- [Society and Culture](#)
[People](#), [Environment](#), [Religion](#)...

[What's New](#) · [Weekly Picks](#) · [Today's Web Events](#) · [Yahoo! Internet Life](#) · [Message Boards](#)
[Yahooligans! for kids](#) · [Seniors' Guide](#) · [Games](#) · [Yahoo! Paper](#) · [Yahoo! Gear](#)

Sites manually put into categories

Were good and bad aspects to using directories to “browse” and find information:

Good – you might find things you didn’t know you were looking for

Bad – If you know exactly what you wanted it could be a challenge to find

What category will you find your item under?

Approach not scalable

Enter the “Web crawler” and text search



WebCrawler Search Results

The query "Ed Lazowska" found 9 documents and returned 9:

100 [Lazowska/Downs Family](#)
100 [Lazowska/Downs Family](#)
068 [Adam Lazowska](#)
061 [Ed Lazowska](#)
011 [HPCC GROUP PARTICIPANTS](#)
007 [1994-1995 OGI Catalog: CSE Department Faculty](#)
006 [dylan's ramblings](#)
006 [John Dockstader's Amazing Homepage](#)
000 [Available C++ libraries FAQ](#)

info@webcrawler.com

Figure 5.1: WebCrawler search results circa 1995.

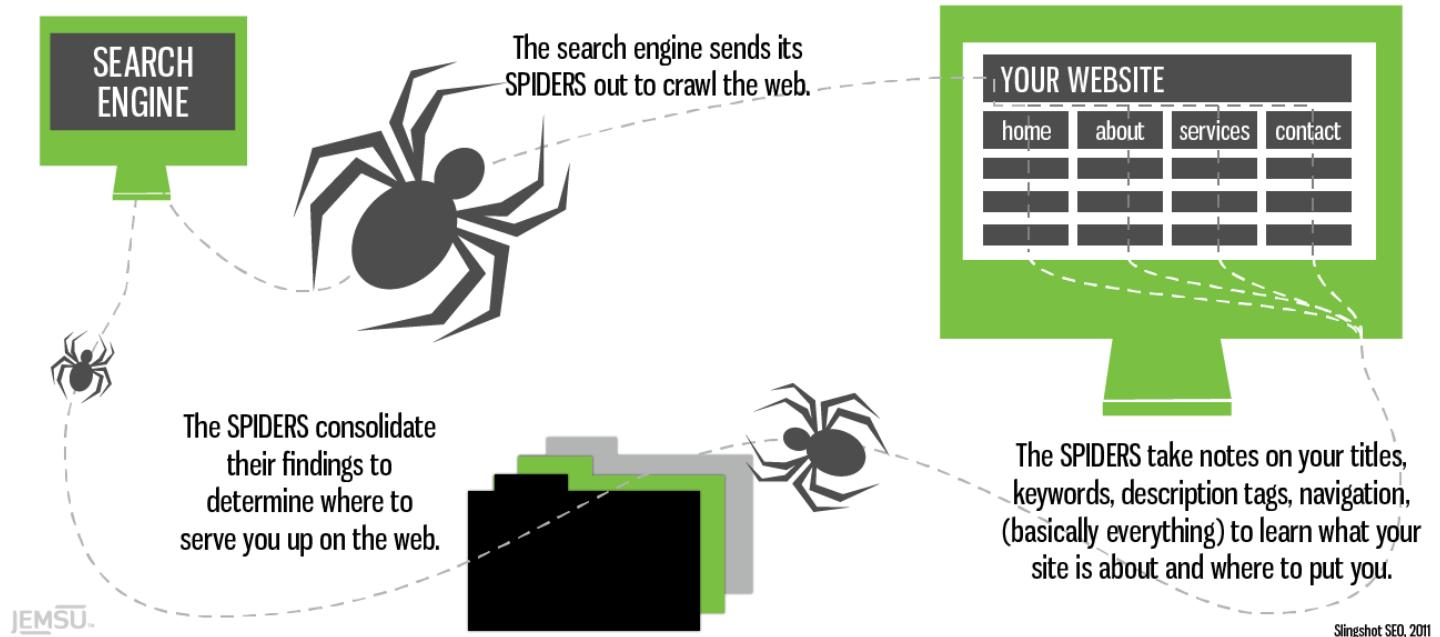
One of the first “web crawlers” created was named “WebCrawler” and developed by Brian Pinkerton, here at UW! Went live in 1994

Web Crawler Basic Concept



- Piece of software that would continually visit web pages
- It would note what text was on the page and add it to an index
- Once all the terms on that page were indexed it would look for links to other pages, and follow them to index those pages
- Users could search the index by entering their search term(s) and get a list back of pages that matched
- The software that did the crawling, that provided a UI for users to search, and that found results was termed a “search engine”

How search engines work (nutshell version).



(Graphic by Neil Patel)



Do spiders visit all sites on the Internet, or just a portion?

Just some. A very large percentage of sites on the Internet are not indexed or findable through a search engine

Some sites are not accessible for security reasons (require a login, behind a firewall or on a corporate **intranet**)

Some website owners/developers may instruct spiders to not crawl certain pages or folders via a “robots.txt” file or other mechanism

Some sites may pull data from a database, they aren’t static, so indexing is more difficult

Also note that not all information is on the Internet to begin with, so those items obviously can’t be indexed

When returning results back to users, Search Engines need to consider....

Relevance: how well a retrieved document or set of documents meets the needs of the user (matches what they are looking for, e.g. “jaguar”)



Ranking: The process through which a retrieved item is “ranked” so that the “best” results appear at the top of the list

Why is a site’s ranking so important?

What search engines are most widely used today?



93% market share world-wide, market cap over \$1 trillion
Parent company is “Alphabet”



Default search in Windows, 2.4% share world-wide



DuckDuckGo.

Google in China



- In 2009, one third of all searches in China were on Google
- By 2013, 1.7% of all searched in China were on Google
- Why?
- 2012 China blocked access to Google, Gmail, and all other Google services such as YouTube. China had asked Google to remove certain items from search results and Google refused.
- According to some, this was an effort to censor/control information that the government did not agree with or information that might paint the government in a bad light.
- The Chinese government says this was done to protect citizens from harm
- China also blocked Facebook, Twitter, Instagram, many others, again in the name of protecting citizens
- Today often referred to as the “Great Chinese Firewall”
- Some Chinese citizens use a VPN (Virtual Private Network) to bypass the “Great Chinese Firewall”, some report that China has now made VPN use illegal although I can't find a specific law for sure

Who are these guys?



Sergey Brin
Co-founder of Google
Net worth: \$52 billion



Larry Page
Co-founder, Google
Net worth: \$53 billion

Google founded when Brin and Page were PhD students at Stanford University in 1998

Google Wasn't the first but...

- They had “special sauce” in terms of how they “ranked” results
- This allowed users to have a better experience and get the results they were looking for easier (at or near the top of the list)
- What is that “special sauce”?
- [Page Rank](#) – an algorithm that took into account a site’s popularity, it didn’t just look at the terms on the page

“The genius of Google is that its creators didn't come up with a great organizational scheme for the web.

Instead, they got everyone else to do it for them.”

~James Grimmelmann, law professor

Let's watch this video on
“How Internet Search Works”

Demo – ranking difference

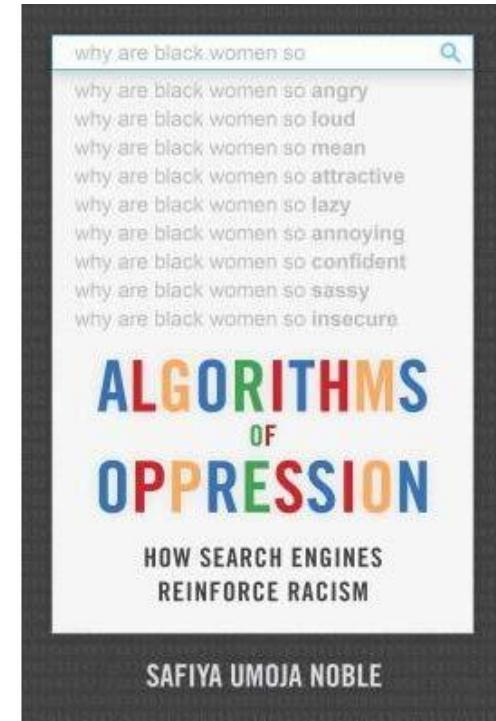
- Search for “iSchool” using Google – where does UW land in the ranking?
- Search for “iSchool” using Bing – where does UW land?
- While on Bing – look at the right side of the page...
- Why are those things listed there and in the order they are listed?
- Go back to Google and search “tires”
- Notice results at the top – what are these?

Ranking algorithm questions

- Let's search for images of Nurses and Programmers
- Approximately 90% of Nurses are female, 80% of Programmers are male
- Should a ranking algorithm take these statistics into account when returning results?
- Could it perpetuate stereotypes by the images that are shown or not shown?
- Let's search for "librarian", any stereotype in those images?

While Google typically produces great results, it isn't perfect

- At one time Googling images of Black women presented users with racial stereotypes, up to and including images of apes.
- For a long time Googling “Martin Luther King” (sans Jr.) produced a top rank result to a Stormfront-hosted (white supremacist) website.



Advertising revenue and Sponsored Links

- If you want to promote your site even more, you can pay
 - ads.google.com
 - bingads.microsoft.com
- Typically you pay more to be listed higher in the ranking, and pay per click
- Google made \$133 billion dollars in 2019 from sponsored ads! Most [expensive adwords/keywords?](#)
- That is another reason why “search” is so important, search is **big business**

Search Engine Optimization (SEO)

Because a site's ranking is so critical to being found, a whole field has emerged to help sites appear "higher" on search engine result lists, called SEO



Some advanced Google search options

- Putting your search in quotes, (e.g. “this search string”) will search for that exact phrase, in that order.
- You can use + in lieu of the word “and” to tell Google to connect two search terms. (default is “or”)
- You can use - to remove certain words from consideration in Google’s search. (e.g. Jaguar -vehicle).
- Use DEFINE: x to define a word (including slang!)
- Search images from your computer by dragging them into the search bar of Google image search. Google will show you similar images.
- Use the Google Advanced Search page: https://google.com/advanced_search
- Go to images.google.com and Google Atari Breakout (without quotes). Have fun!
- Fun – sometimes “Easter Eggs” are present, search “Wizard of Oz” and click the slippers!

Other Search options...

- In addition to Google/Bing etc. search, there are other resources for finding information
- [UW Library Databases](#) on many topics – sources are high-quality, many are peer reviewed (so information is likely to be more accurate), many of these resources are part of the “deep web” that we referred to earlier
- These are targeted sources of information, you are not searching the whole web but typically well-known/trusted sources of information
- Remember – not everything available through Google or other search engines!
- Be sure to use these databases when working on papers for this class or others!

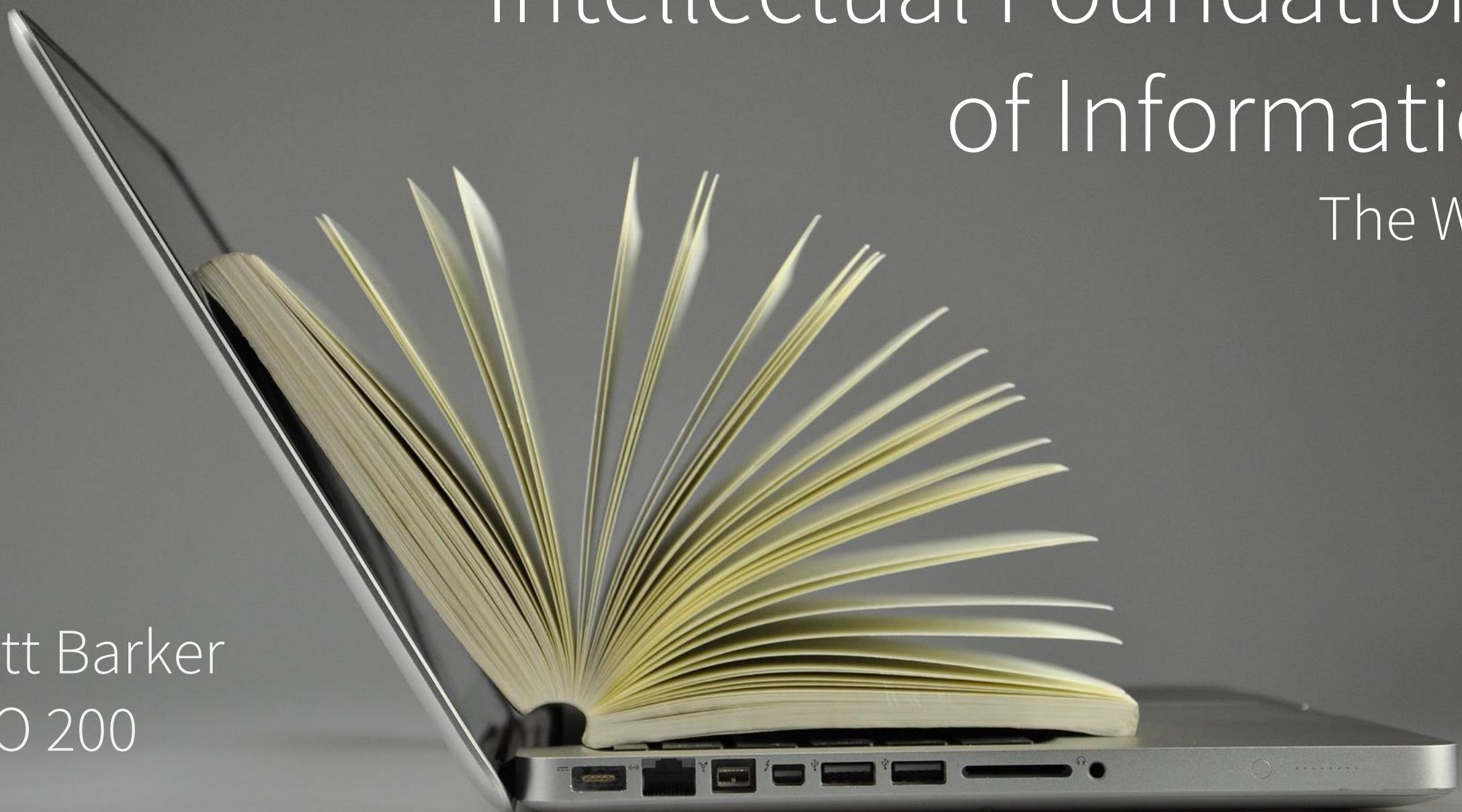
End



Intellectual Foundations of Informatics

The Web

Scott Barker
INFO 200





The Web

- What is the web?
- Is the web the same as the Internet or are they different?
- What are the main components that make-up the web?
 - web pages
 - web browsers (web client)
 - web servers
 - The web protocol (http)

Web pages

- Provide content of value to some set of users – e.g. text, images, videos
- May include hyper-links to other locations on that same page or other sites/pages elsewhere on the Internet
- May include scripts/programs or connections to databases to make them more interactive and not just “static”
- Typically consist of a “plain text” file that is “marked-up” with special instructions using HTML (Hyper-text Mark-up Language), may also including styling/formatting instructions using CSS (cascading style sheets), or Javascript code



Web browsers
“render” web pages

They provide an end-user interface for viewing the content that was “marked-up”, allowing users to scroll, click on links, and interact with content on the page



Does anyone know the name of the first popular Web browser and who/where it was created?

NCSA Mosaic – Mark Andresen, University of Illinois Urbana Champaign, 1993

Mark Andresen took much of that work and co-founded Netscape

Netscape eventually became FireFox

What about IE (Internet Explorer) or Edge?

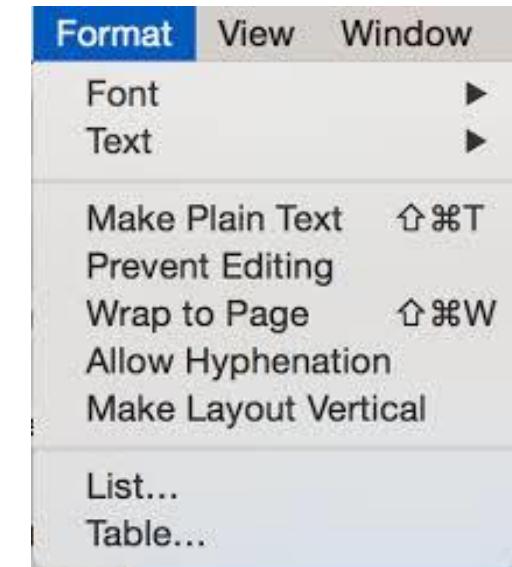
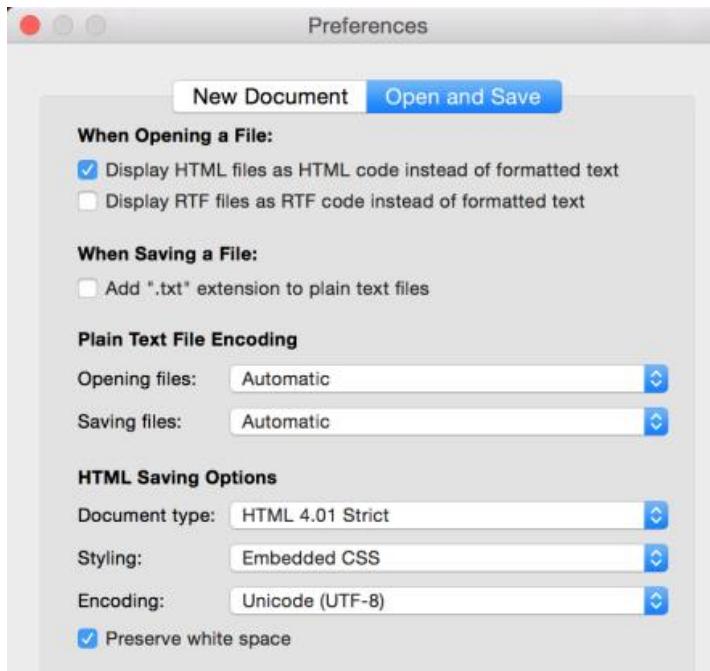
Chrome (2008)

Initially each browser had a different “rendering engine” which was a problem, recently that has changed. Chrome’s rendering engine, originally known as “webkit” and later forked to “blink” is now used by not just Chrome but also Firefox, Opera, and Edge



Demo

- Let's create a web page using some simple HTML mark-up
- On Windows we'll use "notepad"
- On Mac you'll use "TextEdit"
- Why these editors and not Word?



Quick notes onTextEdit Settings

Basic HTML Demo

Web Lecture Activity

Find a photo of “Harry the Husky” and add that photo to your web page.

Find a video of Harry the Husky and make it so when people click on the photo,
they are taken to the video

Take a screen shot of your “raw” HTML code in Notepad or TextEdit and
A screen shot with that page being rendered in a browser.

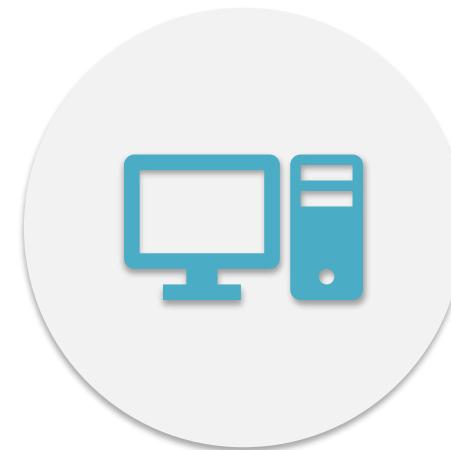
Submit both to Canvas for this lecture activity

OK but...



IS THAT PAGE WE JUST CREATED “ON THE INTERNET”?

COULD I SEE WHAT YOU JUST CREATED ON YOUR LAPTOP?



NO – WE CREATED AN HTML FILE LOCALLY, THERE IS NO MECHANISM FOR SOMEONE ELSEWHERE TO SEE THAT FILE YET, EVEN THOUGH MY LAPTOP MAY BE “CONNECTED” TO THE INTERNET

End Lecture

Intellectual Foundations of Informatics

Web Servers, Apps, Cloud

Scott Barker
INFO 200





IS THAT PAGE WE JUST CREATED “ON THE
INTERNET”?

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“CONNECTED” TO THE INTERNET

Web Servers

- Web servers are computers that run special software which allows them to make web pages available to others over a protocol (http or https)
- Apache and IIS (Internet Information Services) are the most popular
- IIS is included in Windows, but not installed by default, Apache usually runs on Unix/Linux, but also is available on MacOS – not enabled by default
- Typically have static IP assignments and have their IP name registered in DNS. Why?



[Data Center Video](#)

What makes a computer a “server”?

Fundamentally the software it runs

- Operating System (eg. Linux, Windows Server)

- Web server – Apache, IIS

- Database server – SQL Server, Oracle, MySQL, Postgres

- Email Server – Exchange, IMAP, POP

- Each servers runs on a particular “port” - 80 http, 443 https, 25 SMTP etc.

Typically have redundant or “hot swappable” hardware

- Power supplies

- Disk drives (often in a RAID configuration) or SAN

- Multiple CPU's/cores

- Significant amount of memory

- Multiple network connections

- Accessed remotely over the network, no need for a dedicated monitor/keyboard/mouse

Typically put in a “rack” in a datacenter with added redundancy (power, network)

That said, you can run a “server” on a standard laptop or desktop computer – but typically not “in production” (might be done for testing or to learn instead)

Often run multiple “virtual machines” or VMs on a single physical server, using hypervisor software such as VMWare, VirtualBox, Hyper-V, Xen.

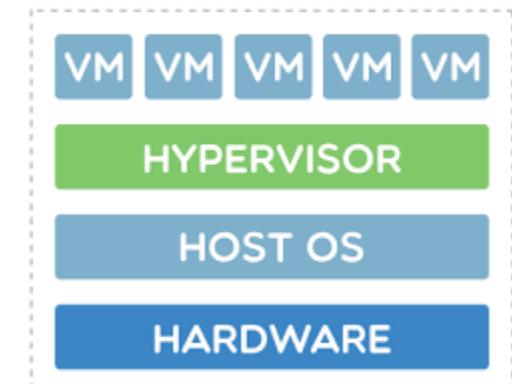
Each VM might be setup with varying amounts of CPU/memory/storage, a different OS, might run different server software, or even be “owned” by a different group or company who has purchased this VM from a cloud provider like AWS or Azure

Using a cloud console an IT admin can potentially “spin up” a new VM very quickly



VectorStock®

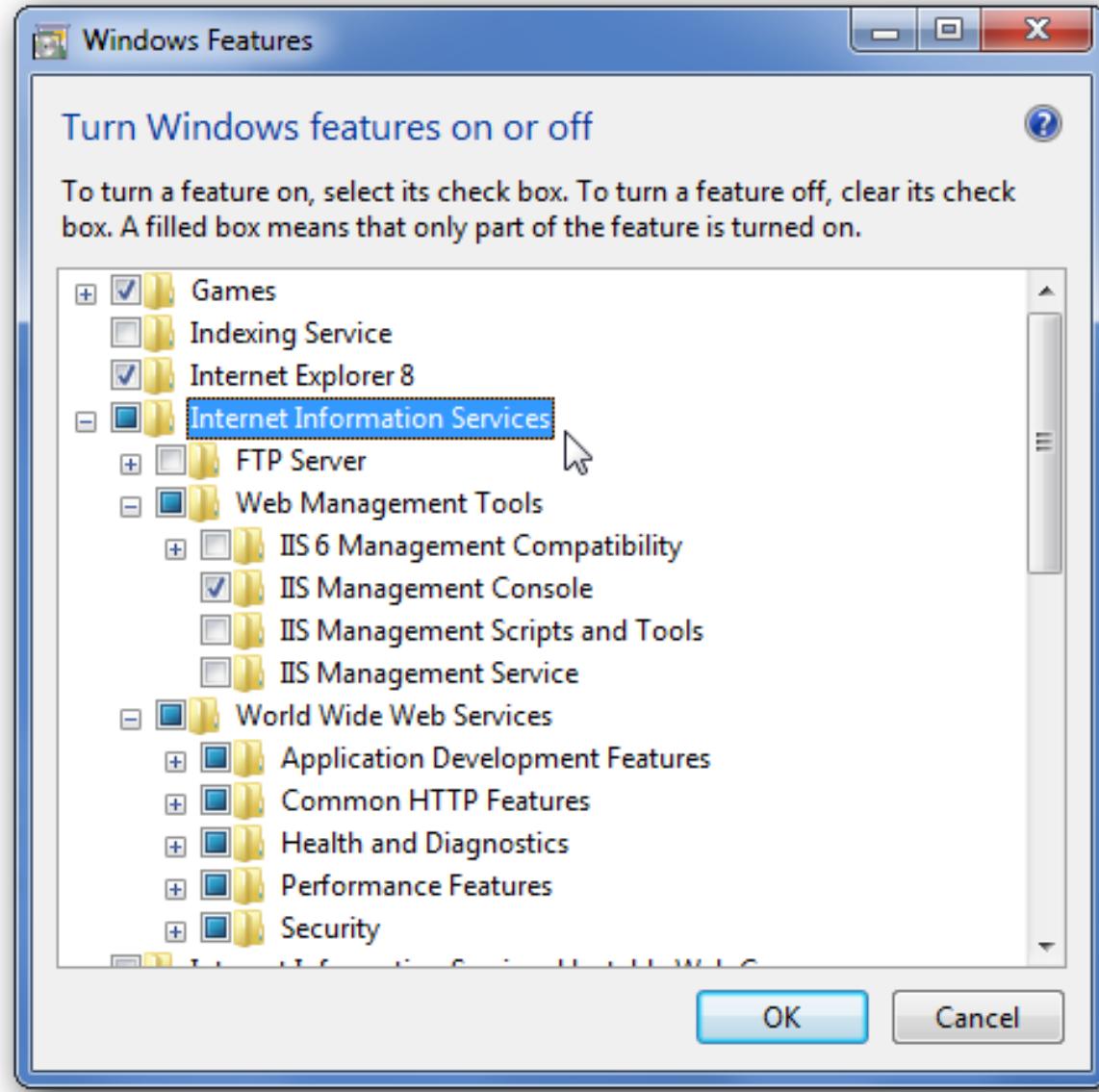
VectorStock.com/7523922



Demo

IIS Setup/Use

- Me only, watch
- Need to turn on the IIS feature and Management Console in Windows





Now that I have a web server running on my laptop, can you see my site over the Internet?

It depends, lots of “gotchas”

- Is my laptop on, always?
- Have I registered my laptop's IP address in DNS?
- What if my laptop moves to another location?
- What if my laptop is on my home network using NAT or a “firewall” is present?
- Is my laptop fast enough to handle thousands of users, does it have enough bandwidth?

As a result, a “real” website is not likely to run from a laptop, it needs a more robust “infrastructure”

Many commercial website hosts/builders for consumers and small business

Allow you to create a website without writing HTML/code

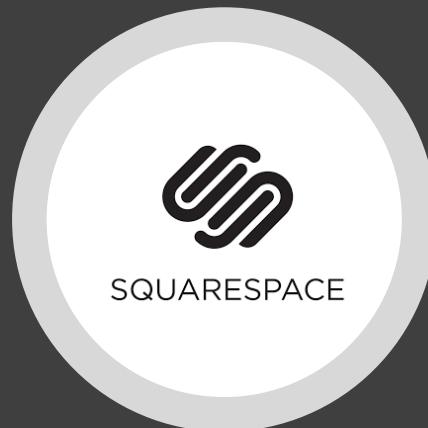
Typically include many design templates to select your “look” and base functionality

Allow you to add your own logo, images, content

Often take care of DNS registration for you

Provide a reliable server for your content. Always on, public IP address, robust network connectivity, backup options

Larger organizations or people that need more capability likely will run their own web server either “on prem” or in the cloud



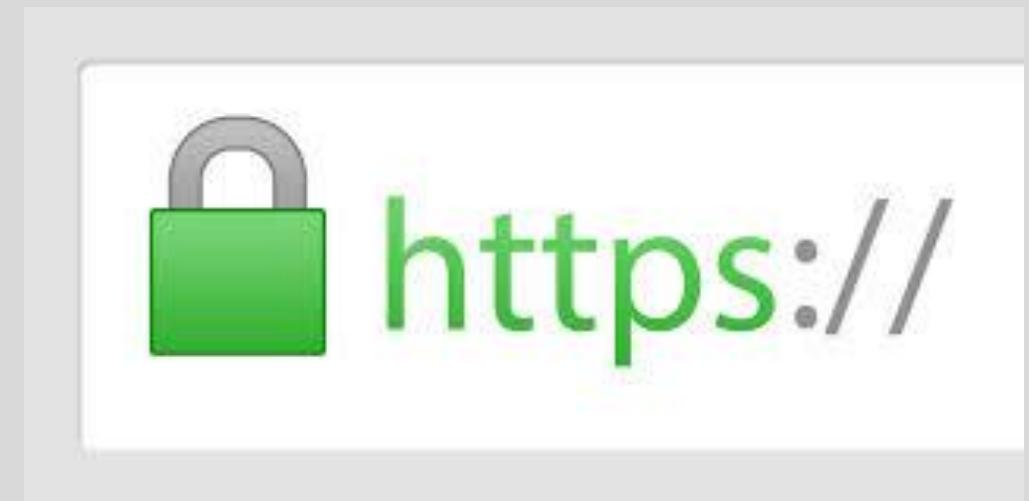
http – hypertext transfer protocol

- An agreed upon way for web clients (typically browsers) to “talk” to web servers
- Mostly a series of “get” or “put” requests (i.e. get this page, get this image)
- Information is sent in packets “in the clear”
- https (http secure – over SSL or TLS) encrypts the data in the packets, offering much better security

To use https, a digital certificate or “cert” must be purchased and installed on your web server

Companies like Thawte, Verisign, Comodo sell certs.

- Within past couple years many sites have moved to using https all the time





The Cloud

What is it?

Are the cloud and the Internet the same thing?

Yes and No.

The Internet is more generic – a communications network. While “the cloud” typically implies association with a “service” or specific piece of functionality, often with servers providing these services located in global datacenters. Two types of cloud services are:

- **SAAS, Software as a Service**

example Google Apps, Microsoft Office 365

Email, word processing, presentations, spreadsheets all hosted by some provider, and available to users through a browser or app.

The servers behind the scenes that make things work are “in the cloud”.



- **IAAS, Infrastructure as a Service**

example Amazon AWS or Microsoft Azure

Allow IT to run infrastructure/servers/databases and “Virtual Machines or VM’s” “in the cloud” rather than “on-prem”. Typically provide compute and storage functionality.



Some Cloud Advantages and Disadvantages

Advantages:

Apps can be available through just a web browser from anywhere and on every platform (Windows, Mac, Linux, mobile devices)

Can utilize storage and compute resources that may exceed those of your own device

May allow IT to scale or adapt to changing needs more quickly than with “on prem” hardware.

Potentially more cost effective

Disadvantages:

Offline use, bandwidth/quality of connection varies – very slow to no availability

Legal, compliance, ownership and loss-of-control concerns

Cloud company could go out of business, raise prices radically, now “on the hook”

May have less certainty of your costs as pricing is often based upon utilization and anticipating that can be difficult



Native vs. Web Applications

Traditionally, most applications (software that people use to do work) such as word processors, email, spreadsheets were written as “native” or “desktop” applications. They were:

Specific to a particular operating system
separate Windows, Mac, iOS, Android
versions

Used local CPU and local storage/disk to run

Since written for that specific device, best
able to leverage the power and capabilities of
the device (high speed graphics, storage, CPU
power)

Updates and changes required a new install

Examples include:

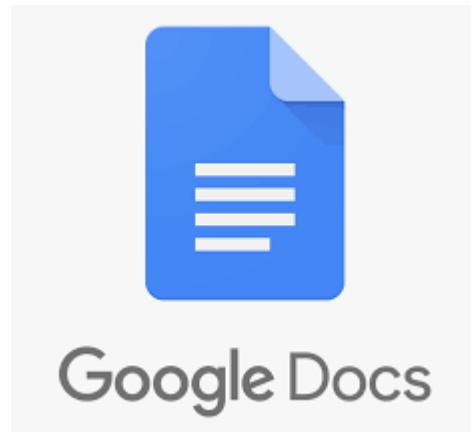
Microsoft Word

Adobe Photoshop

Most Games (why?)

Any mobile “app” from an “App Store”

Today many apps are “Web Apps”



Delivered to users via a web browser

Google Docs, Gmail, Office 365 Online (e.g. Word Online), Slack, Trello, Facebook

In early days web pages were “static” HTML pages

Didn’t allow for sophisticated user interaction

Few options for storing data, mostly informational content

Today with new web standards and JavaScript libraries/frameworks web developers can build upon, most limitations around user interaction are gone

Web developers now able to deliver applications to users with a similar experience as native apps

Running in a browser can simplify, features can be updated without a new install, collaboration may be simplified due to cloud stored data

There are some tradeoffs however (UI, performance)

As a result there may be both web and native apps available for the same thing, e.g. Facebook, Word, Teams.

In some categories, native apps still dominate (such as games).

End Lecture