

Introduction to Information Retrieval

<http://informationretrieval.org>

IIR 19: Web Search Basics

Hinrich Schütze

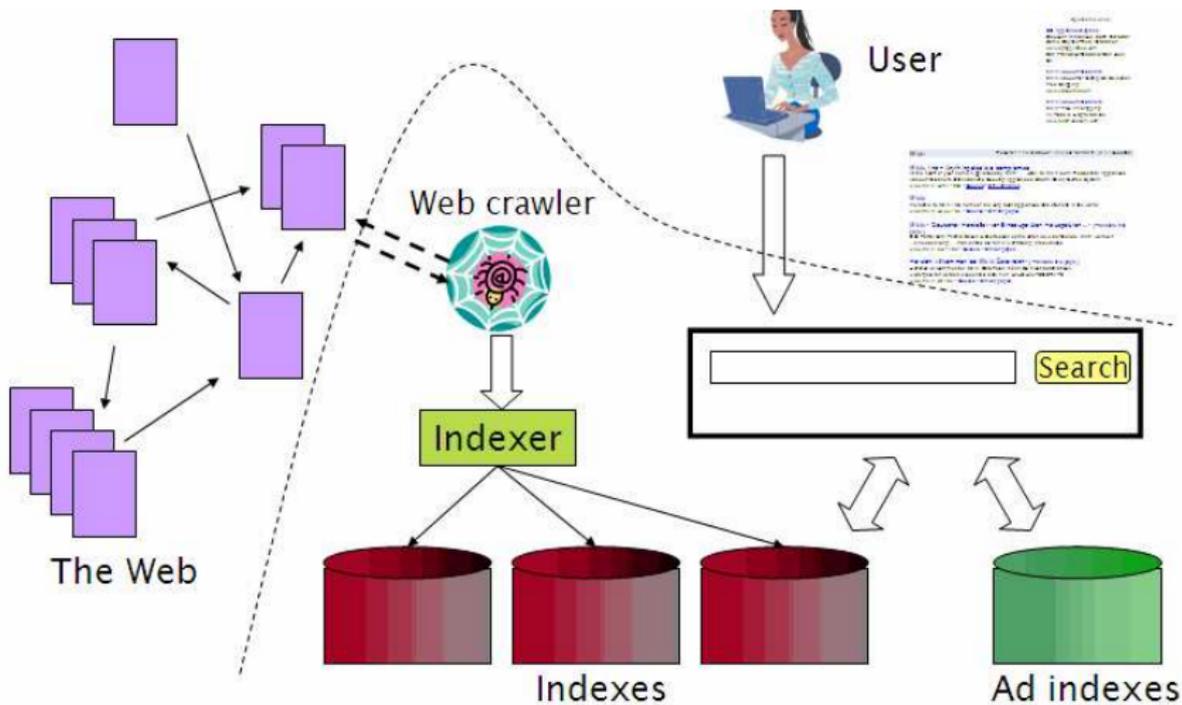
Institute for Natural Language Processing, Universität Stuttgart

2008.07.07

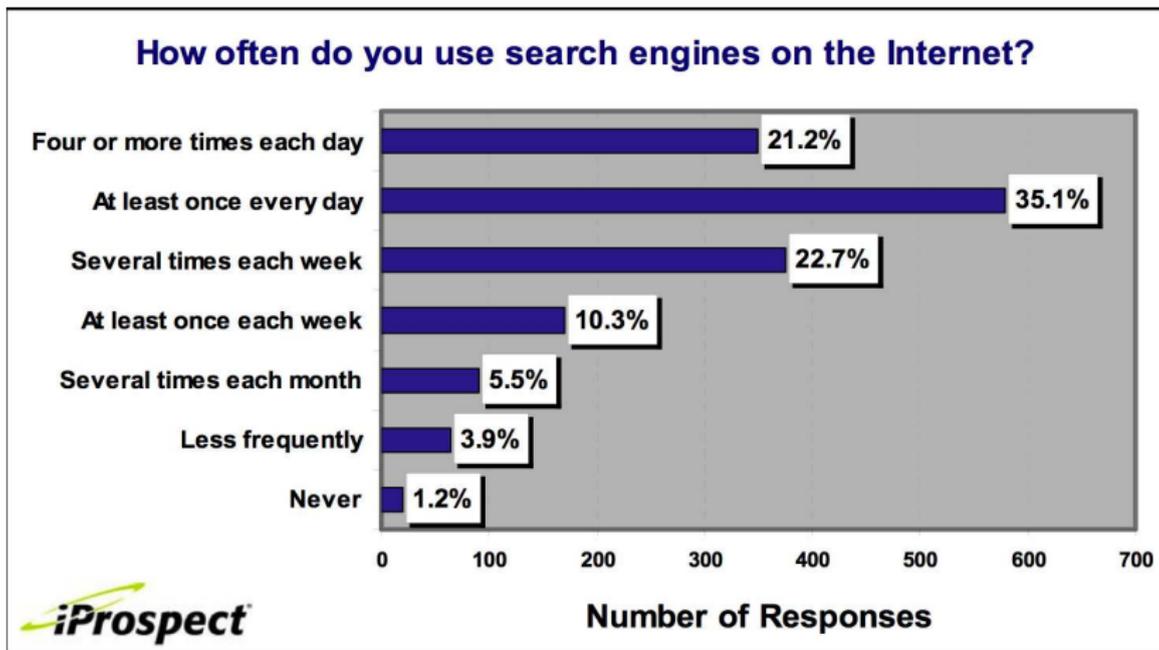
Overview

- 1 Web IR
 - Links
 - Queries
 - Context
 - Users
 - Documents
 - Size
- 2 Ads & Spam
 - Ads
 - Spam

Web search overview



Search is a top activity on the web



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 - A large part today is paid by search ads.

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- Links: The web is a hyperlinked document collection.
- Queries: Web queries are different, more varied and there are a lot of them. How many? 10^8 every day, approaching 10^9
- Users: Users are different, more varied and there are a lot of them. How many? 10^9
- Documents: Documents are different, more varied and there are a lot of them. How many? $\approx 10^{11}$. Indexed: 10^{10}
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- ... i.e., with following links.
- Different from most other IR collections

Kinds of behaviors we see in the data

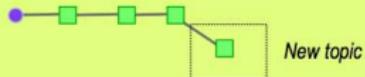
Short / Nav



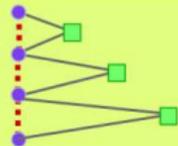
Topic exploration



Topic switch



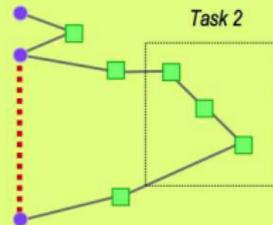
Methodical results exploration



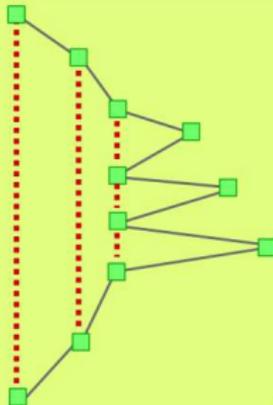
Query reform



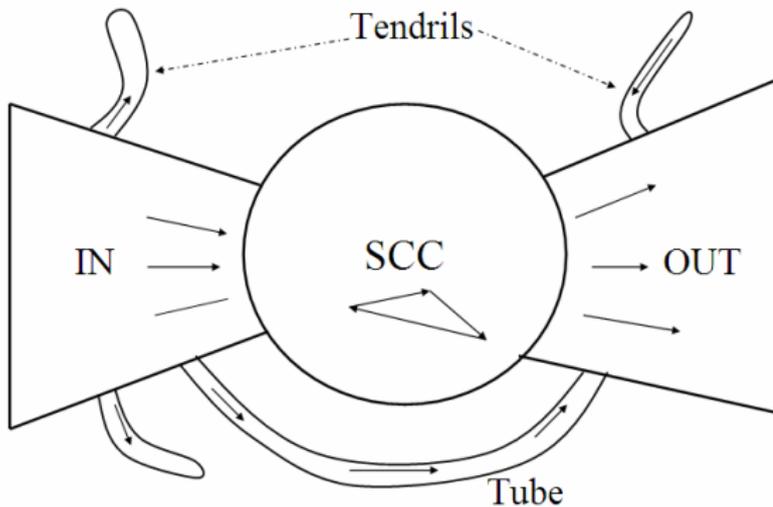
Multitasking



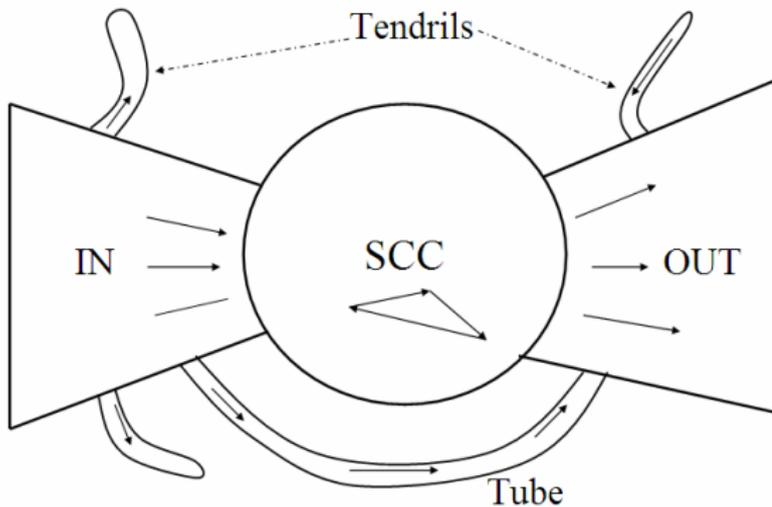
Stacking behavior



Bowtie structure of the web

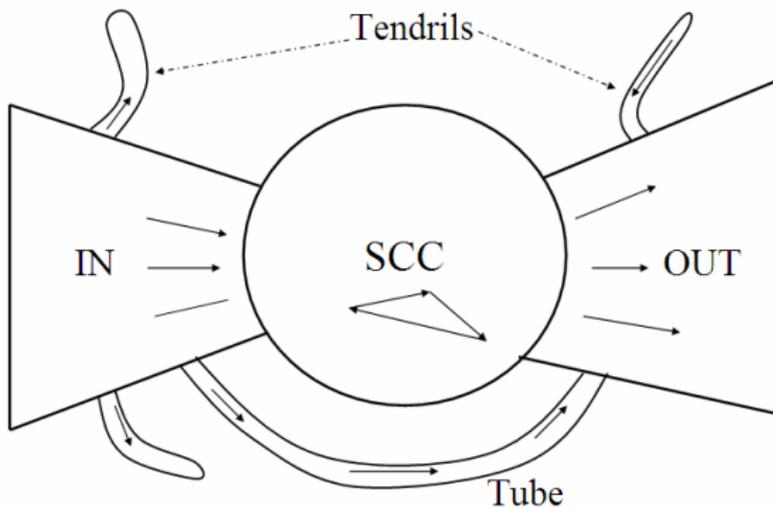


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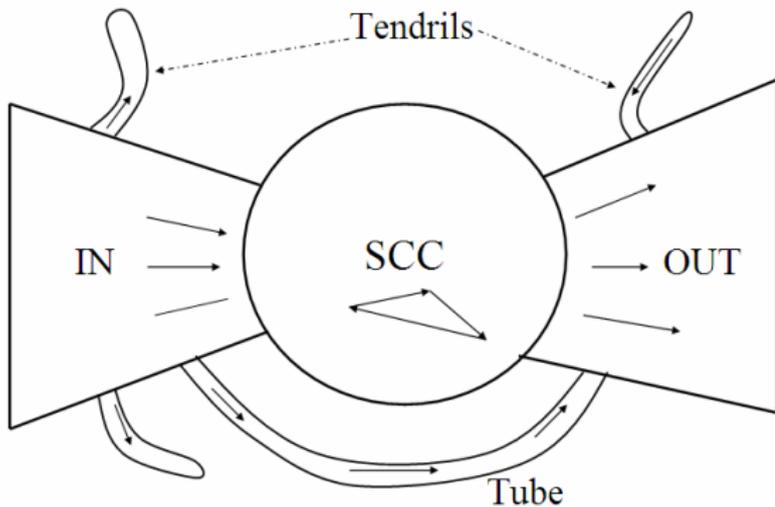
- Strongly connected component (SCC) in the center

Bowtie structure of the web



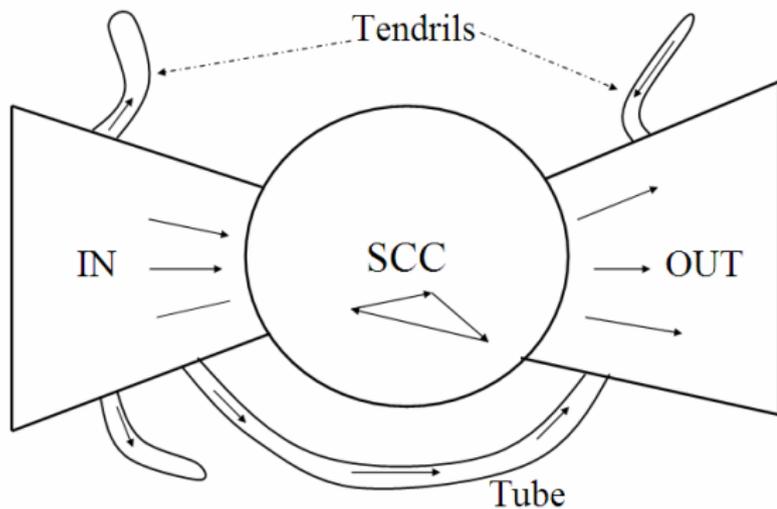
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- Lots of pages that get linked to, but don't link (OUT)

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- Tendrils, tubes, islands

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Query distribution (1)

Most frequent queries on a large search engine on 2002.10.26.

1	sex	16	crack	31	juegos	46	Caramail
2	(artifact)	17	games	32	nude	47	msn
3	(artifact)	18	pussy	33	music	48	jennifer lopez
4	porno	19	cracks	34	musica	49	tits
5	mp3	20	lolita	35	anal	50	free porn
6	Halloween	21	britney spears	36	free6	51	cheats
7	sexo	22	ebay	37	avril lavigne	52	yahoo.com
8	chat	23	sexe	38	www.hotmail.com	53	eminem
9	porn	24	Pamela Anderson	39	winzip	54	Christina Aguilera
10	yahoo	25	warez	40	fuck	55	incest
11	KaZaA	26	divx	41	wallpaper	56	letras de canciones
12	xxx	27	gay	42	hotmail.com	57	hardcore
13	Hentai	28	harry potter	43	postales	58	weather
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6	Halloween	21	britney spears	36	free6	51	cheats
7	sexo	22	ebay	37	avril lavigne	52	yahoo.com
8	chat	23	sexe	38	www.hotmail.com	53	eminem
9	porn	24	Pamela Anderson	39	winzip	54	Christina Aguilera
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7	sexo	22	ebay	37	avril lavigne	52	yahoo.com
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- The proportion of adult queries is much lower than $1/3$

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- **Difficult problem:** How can the search engine tell what the user need or intent for a particular query is?

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 - Context provided by personal profile (Yahoo/MSN do this, Google claims it doesn't)

Guessing of user intent by “typing” queries

- Calculation: 5+4
- Unit conversion: 1 kg in pounds
- Currency conversion: 1 euro in kronor
- Tracking number: 8167 2278 6764
- Flight info: LH 454
- Area code: 650
- Map: columbus oh
- Stock price: msft
- Albums/movies etc: coldplay

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 - Important NLP problem

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 - ... only show .fr results
- Ranking modulation: use a rough generic ranking, rerank based on personal context
- Contextualization / personalization is an area of search with a lot of potential for improvement.

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- Want a simple UI, not a search engine start page overloaded with graphics
- Extreme variability in terms of user needs, user expectations, experience, knowledge, . . .

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 - Industrial/developing world, English/Estonian, old/young, rich/poor, differences in culture and class

Users of web search

- Use short queries (average < 3)
- Rarely use operators
- Don't want to spend a lot of time on composing a query
- Only look at the first couple of results
- Want a simple UI, not a search engine start page overloaded with graphics
- Extreme variability in terms of user needs, user expectations, experience, knowledge, . . .
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- One interface for hugely divergent needs

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 - Precision at 1, precision at 10, precision on the first 2-3 pages
 - But there is a subset of queries where recall matters.

Web information needs that require high recall?



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- ?
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Web documents: different from other IR collections

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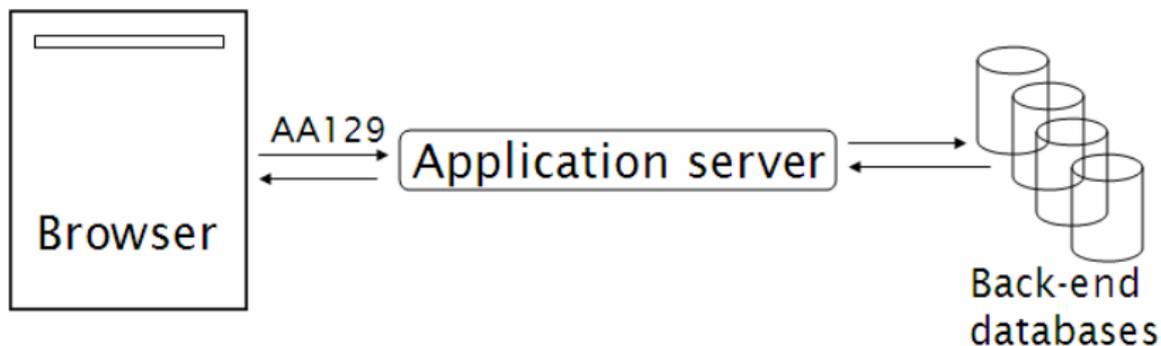
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- Example: current status of flight LH 454

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- Most (truly) dynamic content is ignored by web spiders.

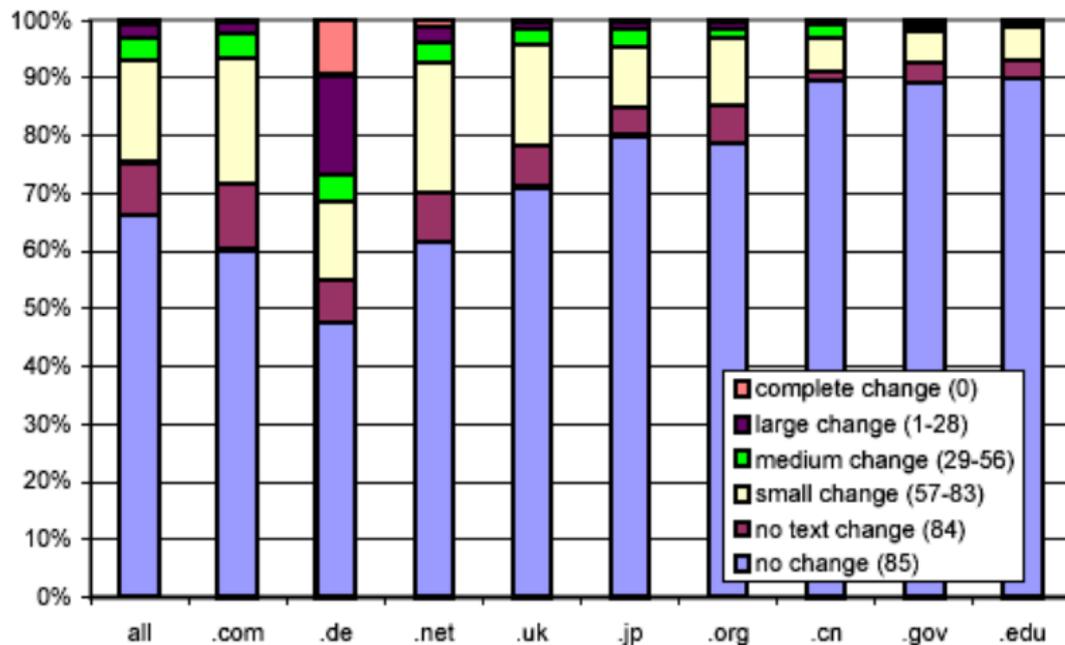
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- Most (truly) dynamic content is ignored by web spiders.
 - It's too much to index it all.
- Actually, a lot of “static” content is also assembled on the fly (asp, php etc.: headers, date, ads etc)

Web pages change frequently (Fetterly 1997)



Multilinguality

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- Google example: "Beaujolais Nouveau -wine"

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- Today's search engines eliminate duplicates very effectively.
- Key for high user satisfaction

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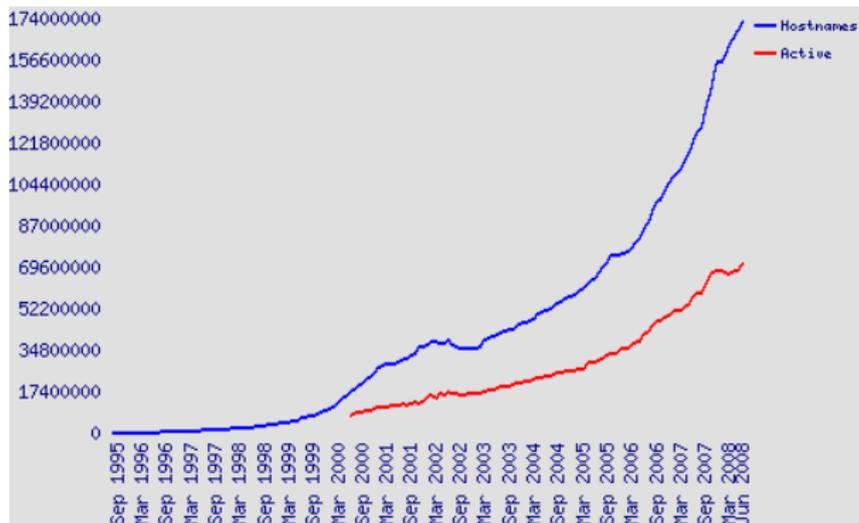
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- Hoaxes abound.

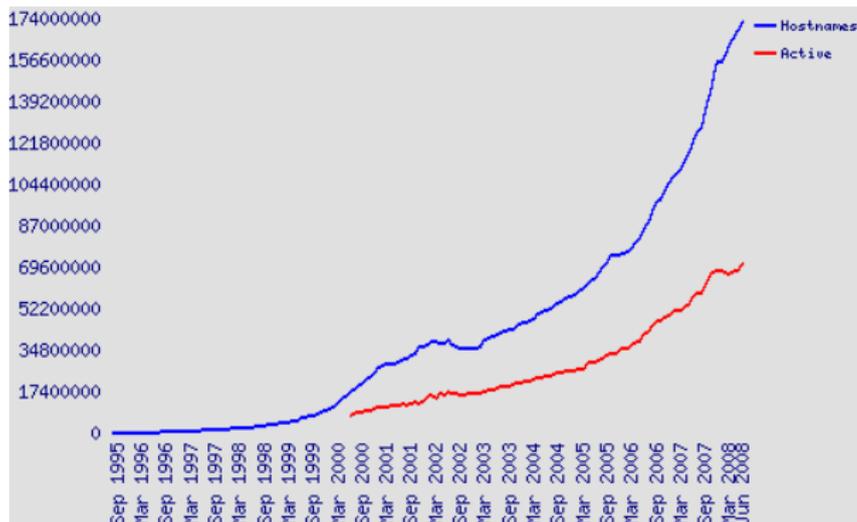
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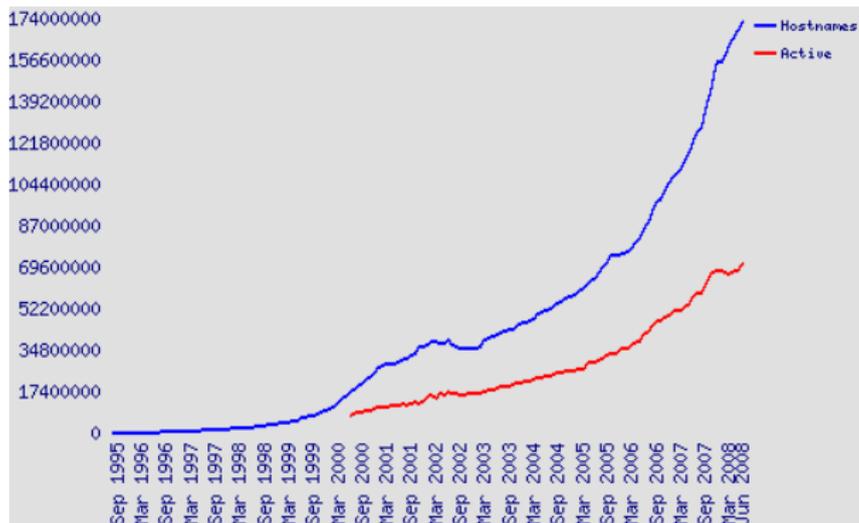


Growth of the web



- The web keeps growing.

Growth of the web



- The web keeps growing.
- But growth is no longer exponential?

Size of the web: Issues

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- Some servers are seldom connected.
 - Example: Your laptop running a web server
 - Is it part of the web?
- The “dynamic” web is infinite.
 - Any sum of two numbers is its own dynamic page on Google.
(Example: “2+4”)

“Search engine index contains N pages”: Issues

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“Search engine index contains N pages”: Issues

- Can I claim a page is in the index if I only index the first 4000 bytes?
- Can I claim a page is in the index if I only index anchor text pointing to the page?
 - There used to be (and still are?) billions of pages that are only indexed by anchor text.

How would you estimate the number of pages indexed by a web search engine?

Simple method for determining a lower bound

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- But page counts of google search results are only rough estimates.

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First generation of search ads: Goto (1996)

www.goto.com/d/search/?sessionid=AAQ4214AAA0R50F0F3C6U0?type=home&time=18&keywords=Wilmington

Wilmington real estate.

Access 75% of all users now!
Premium Listings reach 75% of all
Internet users. [Go to](#) for Premium
Listings today!

1. [Wilmington Real Estate - Buddy Blake](#)
Wilmington's information and real estate guide. This is your on
anything to do with Wilmington.
[www.buddyblake.com](#) (Cost to advertiser: **\$0.25**)
2. [Coldwell Banker Sea Coast Realty](#)
Wilmington's number one real estate company.
[www.cbseacoast.com](#) (Cost to advertiser: [\\$0.22](#))
3. [Wilmington, NC Real Estate Becky Bullard](#)
Everything you need to know about buying or selling a home c
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The screenshot shows a search results page from Goto.com. The search query is 'Wilmington real estate'. The results list three items, but only the first one is visible as a search result:

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The bid price for the first result, \$0.38, is circled in red in the original image.

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- He paid \$0.38 to Goto every time somebody clicked on the link.

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- Upfront and honest. No relevance ranking, but Goto did not pretend there was any.

Second generation of search ads: Google (2000/2001)

- Strict separation of search results and search ads

Ranking of advertisers in search results

Web Images Maps News Shopping Gmail more

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Google discount broker

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[Preferences](#)

Web Results 1 - 10 of about 807,000 for discount broker [\[definition\]](#). (0.12 seconds)

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Research. Start Trading Online Now!

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INGDIRECT | ShareBuilder

SogoTrade appears in search results.

SogoTrade appears in ads.

Do search engines rank advertisers higher than non-advertisers?

Ranking of advertisers in search results

Web Images Maps News Shopping Gmail more

Sign in



discount broker

Search

Advanced Search
Preferences

Web

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All major search engines claim no.

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- The line often gets blurred at newspapers / on TV.
- No known case of this happening with search engines yet?

How are ads placed?

- Advertisers bid for keywords.

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 - Many interesting jobs in this area

Keywords with high bids

According to <http://www.cwire.org/highest-paying-search-terms/>

\$69.1	mesothelioma treatment options	\$35.86	pennsylvania medical malpractice attorney
\$65.85	personal injury lawyer michigan	\$35.86	medical malpractice ohio
\$62.59	student loans consolidation	\$35.71	automobile insurance quote
\$61.44	car accident attorney los angeles	\$35.4	loan consolidating
\$59.44	online car insurance quotes	\$35.34	commercial insurance quote
\$59.39	arizona dui lawyer	\$35.33	tax attorney
\$57.87	michigan car accident attorney	\$35.15	home equity loans
\$56.59	free auto insurance quote	\$34.81	instant auto insurance quotes
\$53.17	personal injury lawyers los angeles	\$34.8	home equity loan rates
\$52.31	free online auto insurance quote	\$34.79	home owners insurance quotes
\$50.4	accident attorney michigan	\$34.71	home equity line
\$50.35	michigan auto accident attorney	\$34.53	compensation solicitors
\$49.25	accident helpline	\$34.38	automobile insurance quotes
\$47.74	automobile accident lawyers	\$34.37	term insurance quotes
\$47.49	dui defense attorneys	\$34.26	instant car insurance quotes
\$46.44	asbestos cancer	\$34.02	auto insurance online quote
\$46.34	arizona dui	\$33.49	new york criminal attorney
\$45.8	business liability insurance quote	\$33.45	secured loan
\$43.86	loan consolidation	\$33.44	equity lines
\$42.98	student loan consolidation	\$33.41	criminal lawyer new york
\$40.7	dui defense lawyers	\$33.36	refinance mortgage
\$40.1	home equity line of credit	\$33.12	equity loan rates
\$39.81	life insurance quotes	\$33.07	manhattan mini storage
\$39.78	criminal lawyers new york	\$32.46	equity line
\$39.32	loan federal consolidation	\$32.45	home equity credit
\$39.23	refinancing	\$32.02	loan consolidate
\$38.72	equity line of credit	\$31.98	secured loan consolidation
\$37.96	lasik eye surgery new york city	\$31.93	laser hair removal new york city
\$37	2nd mortgage	\$31.51	home equity rates
\$35.9	free car insurance quote	\$31.37	free credit report com

Google AdWords demo

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- The main factor of course is the query – and possibly earlier queries in the same session.

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 - Being willing to pay for ads on a search engine is a quality signal (one of many) that users take into account.
- The **advertiser** finds new customers in a cost-effective way.

The appeal of search ads to advertisers

- Why is web search potentially more attractive for advertisers than TV spots, newspaper ads or radio spots?

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- Someone who just searched for “Saturn Aura Sport Sedan” is infinitely more likely to buy one than a random person watching TV.

The appeal of search ads to advertisers

- Why is web search potentially more attractive for advertisers than TV spots, newspaper ads or radio spots?
- Someone who just searched for “Saturn Aura Sport Sedan” is infinitely more likely to buy one than a random person watching TV.
- Most importantly, the advertiser only pays if the customer took an action indicating interest (i.e., clicking on the ad).

But frequently it's not a win-win-win

- Example: keyword arbitrage

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 - Buy a keyword at Google

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- Example: keyword arbitrage
 - Buy a keyword at Google
 - Then redirect traffic to a third party that is paying much more than you had to pay to Google
 - This rarely makes sense for the user.
- Ad spammers keep inventing new tricks.
- The search engines need time to catch up with them.

Who owns a search term?

- Example: geico

Who owns a search term?

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- During part of 2005: The search term “geico” on Google was bought by competitors.

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- See http://google.com/tm_complaint.html

Outline

- 1 Web IR
 - Links
 - Queries
 - Context
 - Users
 - Documents
 - Size
- 2 Ads & Spam
 - Ads
 - Spam

The goal of spamming on the web

- You have a page that will generate lots of revenue for you if people visit it.

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- Therefore, you would like to direct visitors to this page.
- One way of doing this: get your page ranked highly in search results.
- How can I get my page ranked highly?

Spam technique: Keyword stuffing / Hidden text

- Misleading meta-tags, excessive repetition

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- Misleading meta-tags, excessive repetition
- Hidden text with colors, style sheet tricks etc.

Spam technique: Keyword stuffing / Hidden text

- Misleading meta-tags, excessive repetition
- Hidden text with colors, style sheet tricks etc.
- Used to be very effective, most search engines now catch these

Spam technique: Doorway and lander pages

- Doorway page: optimized for a single keyword, redirects to the real target page

Spam technique: Doorway and lander pages

- Doorway page: optimized for a single keyword, redirects to the real target page
- Lander page: optimized for a single keyword or a misspelled domain name, designed to attract surfers who will then click on ads

Lander page

Weitere Links: [Wild Yam Root](#) | [Mexican Appetizers](#) | [Yam](#) | [Gambar Skodeng Ulu Yam](#) | [Wild Eyes](#) | [The Yam Yams](#) | [Amica Cream](#) | [Chickweed Cream](#) | [Colloidal Silver Cream](#) | [Witch Hazel Cream](#) |

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- Number one hit on Google for the search “composita”

Lander page

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- Number one hit on Google for the search “composita”
- The only purpose of this page: get people to click on the ads and make money for the page owner

Spam technique: Duplication

- Get good content from somewhere (steal it or produce it yourself)

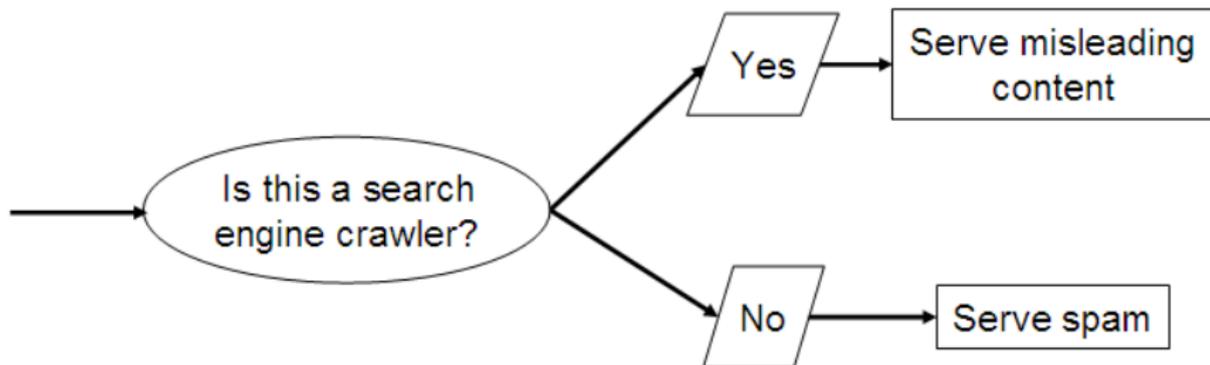
Spam technique: Duplication

- Get good content from somewhere (steal it or produce it yourself)
- Publish a large number of slight variations of it

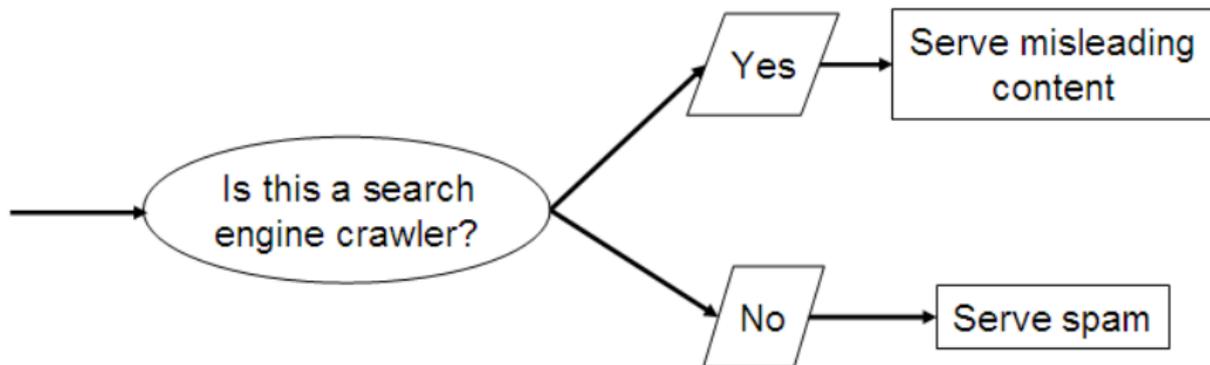
Spam technique: Duplication

- Get good content from somewhere (steal it or produce it yourself)
- Publish a large number of slight variations of it
- For example, publish the answer to a tax question with the spelling variations of “tax deferred” on the previous slide

Spam technique: Cloaking

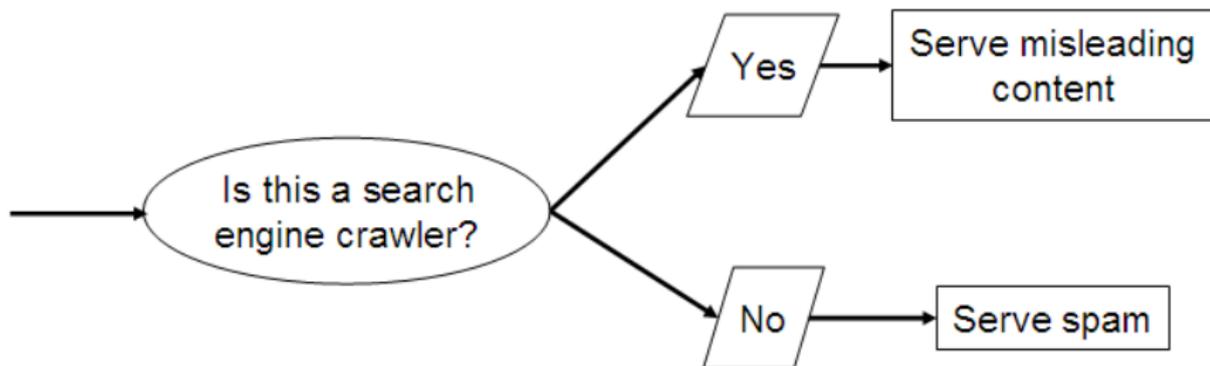


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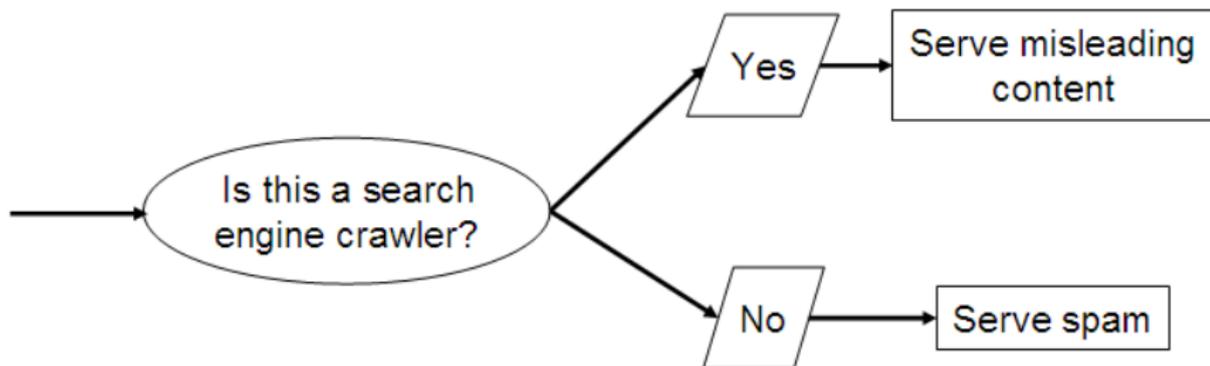
- Serve fake content to search engine spider

Spam technique: Cloaking



- Serve fake content to search engine spider
- So do we just penalize this always?

Spam technique: Cloaking



- Serve fake content to search engine spider
- So do we just penalize this always?
- No: legitimate uses (e.g., different content to US vs. European users)

Spam technique: Link spam

- Create lots of links pointing to the page you want to promote

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 - Newly registered domains (domain flooding)

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 - Leave comments that include the link on blogs

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 - Add more interesting and original content

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- Scientific study of fighting spam on the web: *adversarial information retrieval*

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- Adversarial IR site at Lehigh