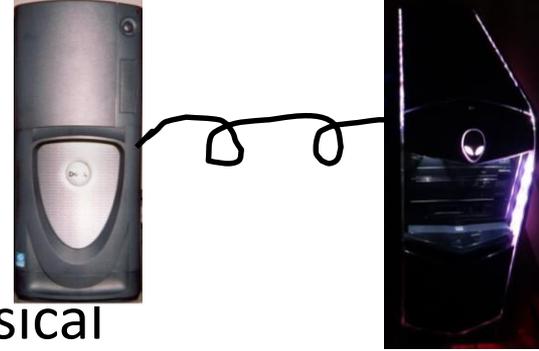# The Internet

You would learn about the basics of how the Internet works, how to effectively search for information online as well as how to evaluate the quality of online sources.

Computer Networks

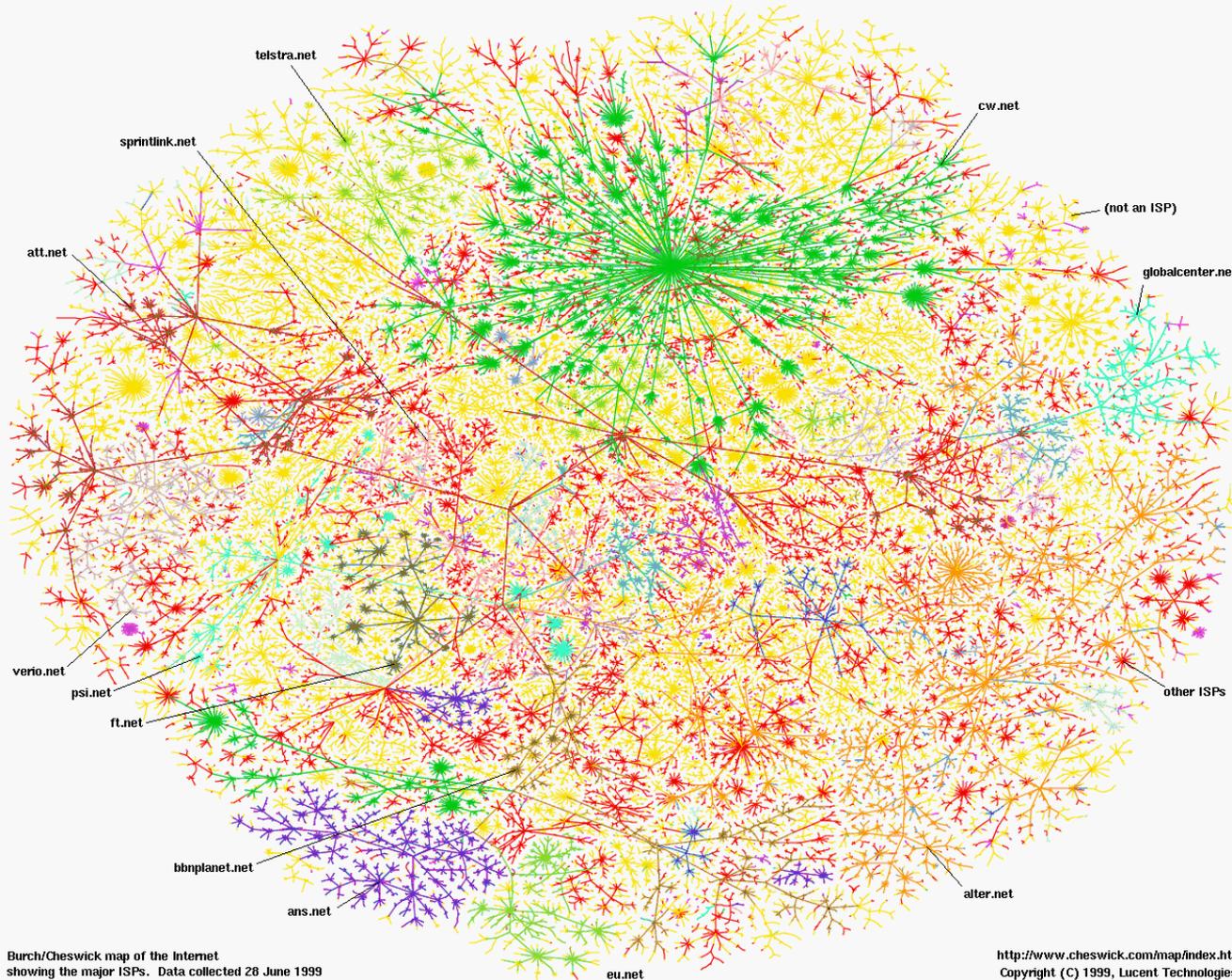- Networks can of course be wired (requires physical connections) or wireless.

- Computers (and now other devices such as mobile phones) that are connected via special hardware and a specific means of communication ("network protocol").

  - Hardware: a wired or wireless Network interface card/controller (NIC)

- Modern computers and many devices automatically have the hardware and knowledge of the necessary protocol included by default (it's 'built-in').
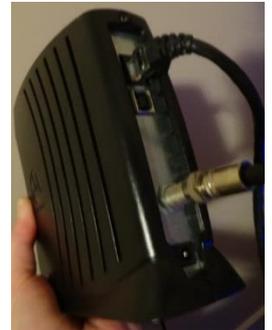
The Internet

- It can be viewed as a large collection of networks

Burch/Cheswick map of the Internet showing the major ISPs. Data collected 28 June 1999

http://www.cheswick.com/map/index.html
Copyright (C) 1999, Lucent Technologies

What's Required For An Internet Connection

- Network hardware (NIC) and the software to run it (driver software) – as mentioned it's typically included.

- An internet 'provider'

- Hardware to connect to the Internet service Provider (ISP):
  - A 'modem':
    - Allows computer information to be transmitted to the Internet
    - Allows information from the Internet to be received by the computer

Internet modem: James Tam

ISP

Internet modem: James Tam
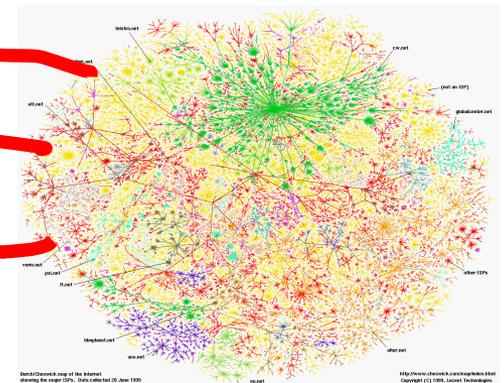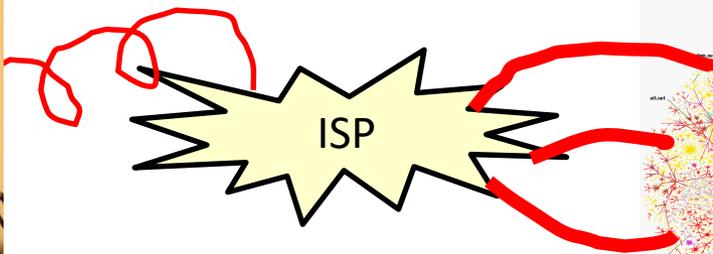
Bandwidth

- It's the speed at which information can be transmitted along a network or online.

- Example maximum transmission speed of a NIC (based on info from Fall 2015)
  - Intel's Reliable PCI Express Gigabit CT Network Interface Card: Max speed (CAT6 network cable) 1000 Mbps (1,000 Mega bits per second)
  - Recall: 1 byte = 8 bits
  - 1000 Mbps = 1000/8 = 125 MB per second
  - Also recall M = Mega (1,000,000)

Bandwidth	4 MB image	(Standard def. movie) 70 MB / 1 hour movie	(Hi-def. movie) 2.4 GB / 1 hour
125 MB per second (1000 mbps)	0.032 second	0.56 seconds	19.2 seconds

  - …so why is my 'Internet [connection]' so slow??!! (Your speed is ~3 – 100 Mbps)

Example Speeds Provided By Calgary ISP's

Shaw cable

- 5 – 100 Mbps (625,000 bytes to 12.5 MB per second)

Telus

- 3 – 100 Mbps (375,000 bytes to 12.5 MB per second)

Info last accessed Fall 2015

Bottleneck

- Information traveling along different media is constrained by the speed of the slowest medium.
- Traveling from south to north Calgary may include Deerfoot trail (100 km)
  - But traveling through school or playground zones will slow travel (30 km)

Realty Check: Actual Bandwidth

- Speed of the NIC hardware (max hardware speed from a previous slide)

Bandwidth	4 MB image	(Standard def. movie) 70 MB / 1 hour movie	(Hi-def. movie) 2.4 GB / 1 hour
125 MB per second (1000 mbps)	0.032 seconds	0.56 seconds	19.2 seconds

- Speed of your Internet connection provided by the ISP (bottlenecked speed)

Bandwidth	4 MB image	(Standard def. movie) 70 MB / 1 hour movie	(Hi-def. movie) 2.4 GB / 1 hour
0.625 MB per second (5 Mbps)	6.4 seconds	112 seconds	3,840 seconds (64 minutes)
12.5 MB per second (100 Mbps)	0.32 second	5.6 seconds	192 seconds (3 minutes, 12 seconds)

Final Reality Check

- These speeds specify *download* speeds (getting information *down from* the Internet).
  - E.g., downloads: watching a streaming video, going to a web page, viewing or saving an email attachment.
- *Upload* speeds (putting information *up on the Internet* is significantly slower)
  - E.g., uploads: sending an email with an attachment, putting content such as images or videos online.
  - Upload speeds range from 1/10 to 1/20 the listed speeds for advertisements for various Internet packages (time is x10 to x20)

Bandwidth	4 MB image	Standard def. movie 70 MB	Hi-def. movie 2.4 GB
0.0625 MB per second (0.5 Mbps)	60.4 seconds	1120 seconds (over 18 minutes)	38,400 seconds (over 10 hours)
1.25 MB per second (10 Mbps)	3.2 seconds	56 seconds	1,920 seconds (over half an hour)

"Who" Of The Internet

- Who invented the Internet:
  - Because the Internet runs on protocols (rules of communication) it can be argued that the developers (several people) of the protocols played a major role in it's invention.
    - Students: Steve Crocker, Vint Cerf, Bob Kahn
    - Prof: Leonard Kleinrock
- Who owns the Internet:
  - Not the US government (although it still has some influence).
  - The networks that make up the Internet are owned by companies, non-profit organizations, governments and individuals.
- Who funds the Internet:
  - Originally it was a research project funded by the US government.
  - Now it's the owners of the networks that make up the Internet.

The Internet

- The impetus for it's creation came out of the Cold War

NATO
- USA
- Great Britain
- France
- West Germany
- Canada
- Etc.

Warsaw pact
- USSR
- East Germany
- Poland
- Etc.

- Some of the original goals
  - Develop a common means of communication among computers through a standard protocol
  - Allow the network to operate in the event of partial failure

Allowing The Internet To Survive Disasters
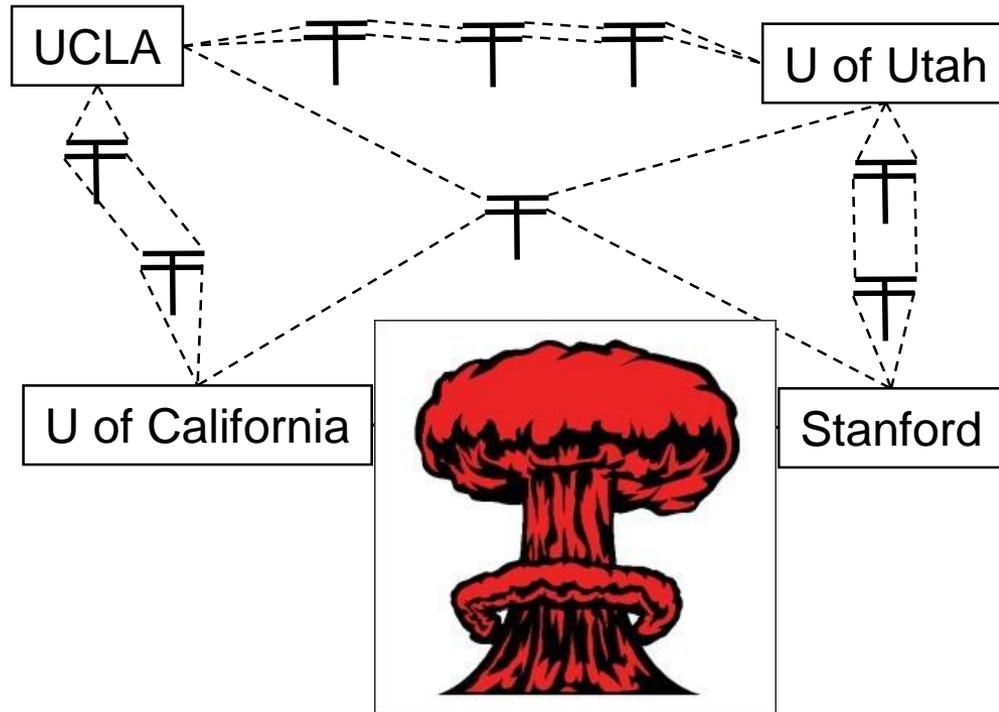
From www.clipartbest.com

Modern Consequence Of Historical Roots

- Information is typically routed among several computers and may take multiple paths even in one 'session' e.g., one session could = the viewing of a single video or even a single financial transaction.
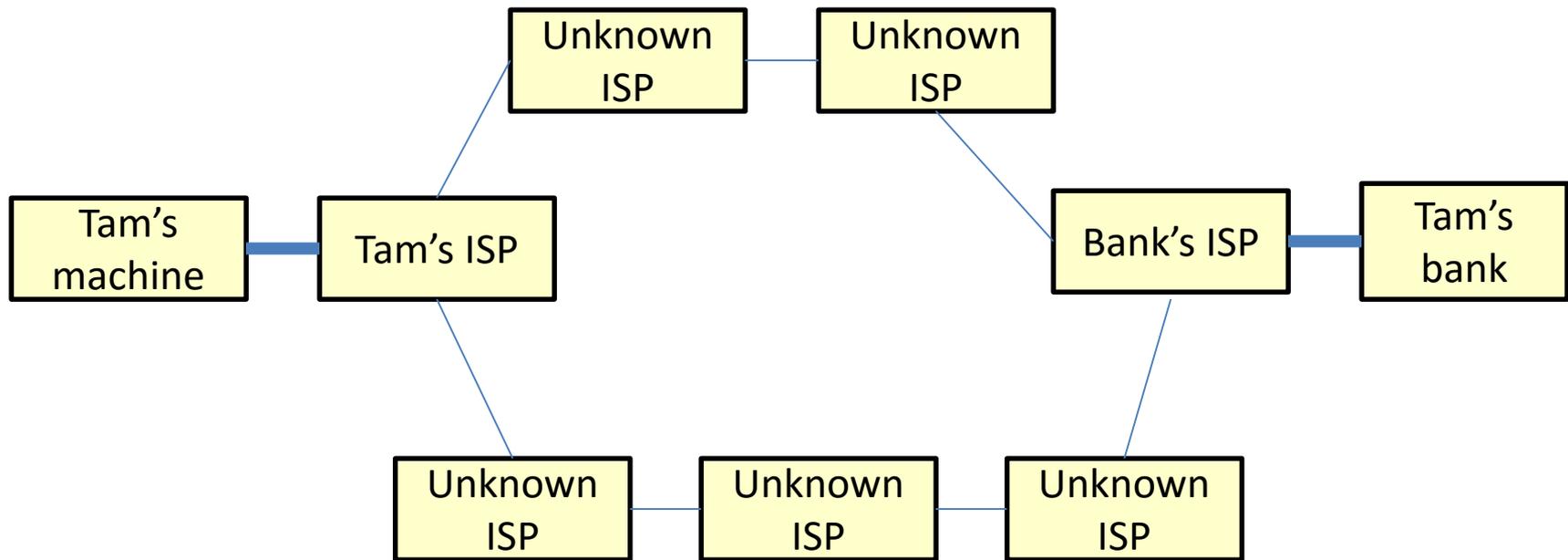
━━ Always

── Sometimes

Reasons For Multiple Paths Along The Internet
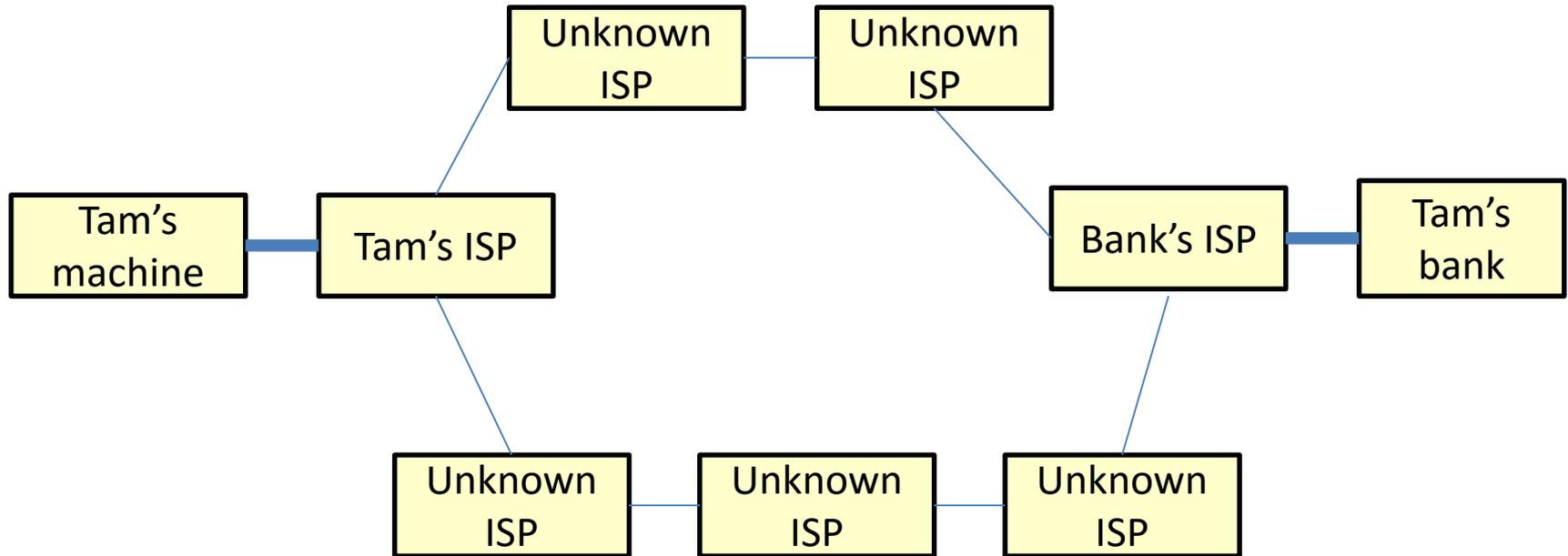
- Stability
- Speed

How Do Search Engines Work

- When you search, you employ the search engine of a website.
  - Using a search engine involves searching the library of pages built up by that engine.

Image from: www.clipartbest.com

- The library is built up by the search engine's spiders (web)

Popular web site
- Link1
- Link2
- Etc.

Linked page (1st level)
- Link1
- Link2
- Etc.

Linked page (2nd level)
- Link1
- Link2
- Etc.

Search Engine Database

Popular web site

Linked page (1st level)

Linked page (2nd level)

Linked page (1st level)
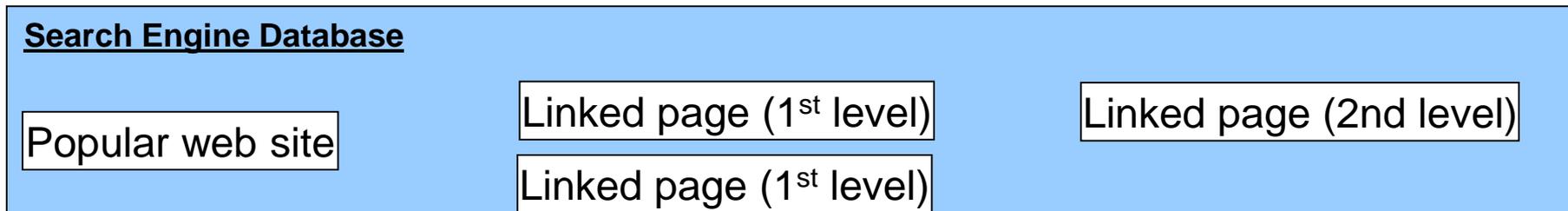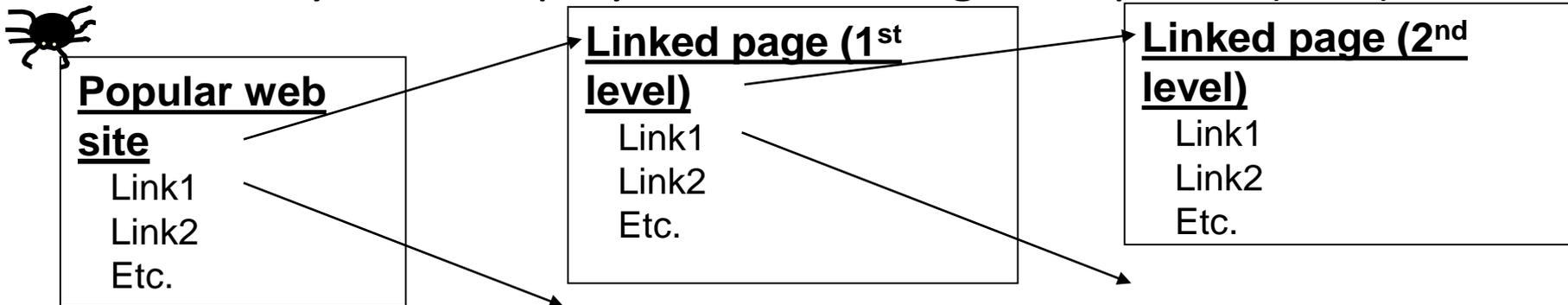
Some Search Engines Use People Instead Of Technology

- Rather than using automated search programs to build the database some search engines organize results based on human scrutiny.

Person submits page

Yahoo librarian

Yahoo database

Person searching for info

Database is organized by Yahoo librarians (a person not automated)
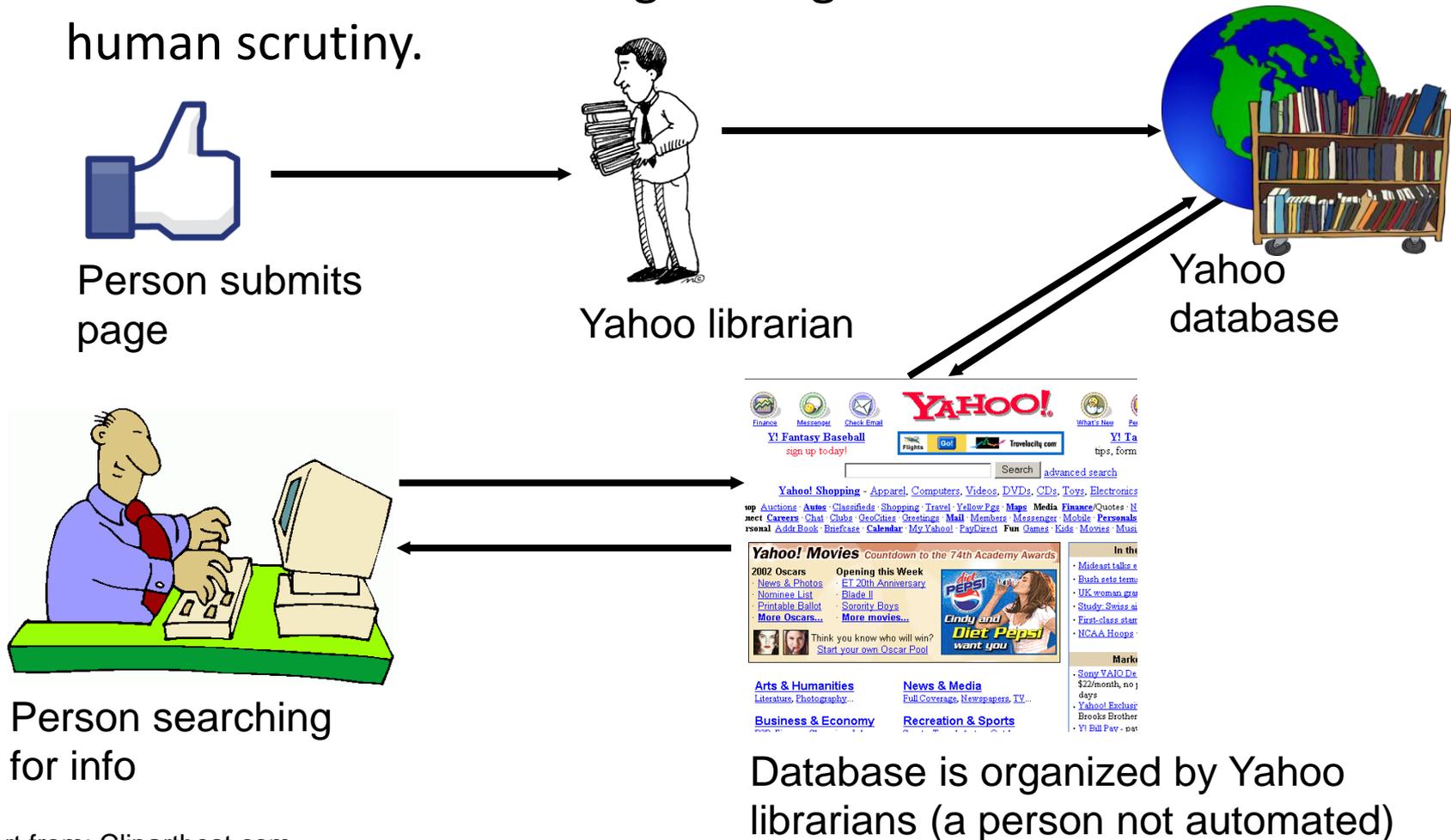
Examples Of Human Created Search Databases

- Yahoo! (click on the 'library' link not when you type in search terms)

- Open Directory

- Another source providing information about other 'human' search engines as well as a good discussion about their pros and cons:

    - http://www.ariadne.ac.uk/issue54/search-engines

Search Engines Rank Results According To Relevance

Making A Site More Noticeable (Higher Rank)

- Search database built via search spiders (e.g., Google):
  - Add relevant keywords to your page.
  - The frequency and location of keywords may play a role in determining relevance.
  - Links (to your site) also affect ranking
  - Trying to artificially rank your page higher in search results may result in a page being put at the bottom of the list e.g., adding celebrity 'gossip' to my CPSC page may rank it higher but not relevant info for most visitors.

- Search databases built via human researchers (e.g., Yahoo):
  - Make sure that your site is examined by the people who build the database.
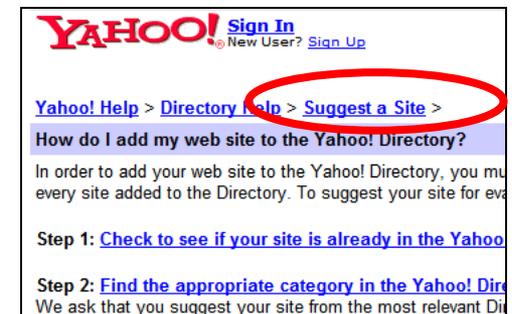
Searching For Information On The Internet: Google

- Easy? Just type in what you're searching for...
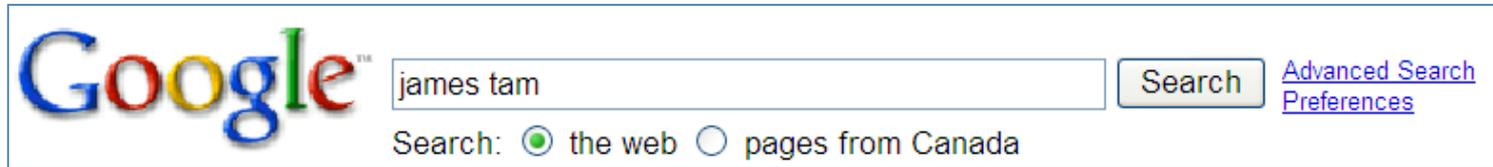
- ...you may get the information that you were looking for plus much more!

You Will Learn Strategies For Narrowing Your Search Results (For Google But Applies To Others):

1. Reducing the number of unrelated results.

2. Explicitly avoiding pages with certain words.

3. Searching for information from select pages.

Employing These Search Strategies

- Many (but not all) of the features can be found through an "Advanced Search" subpage of the Google site.
  - http://www.google.com/advanced_search
- This leads you to a page with several options (to be covered shortly):
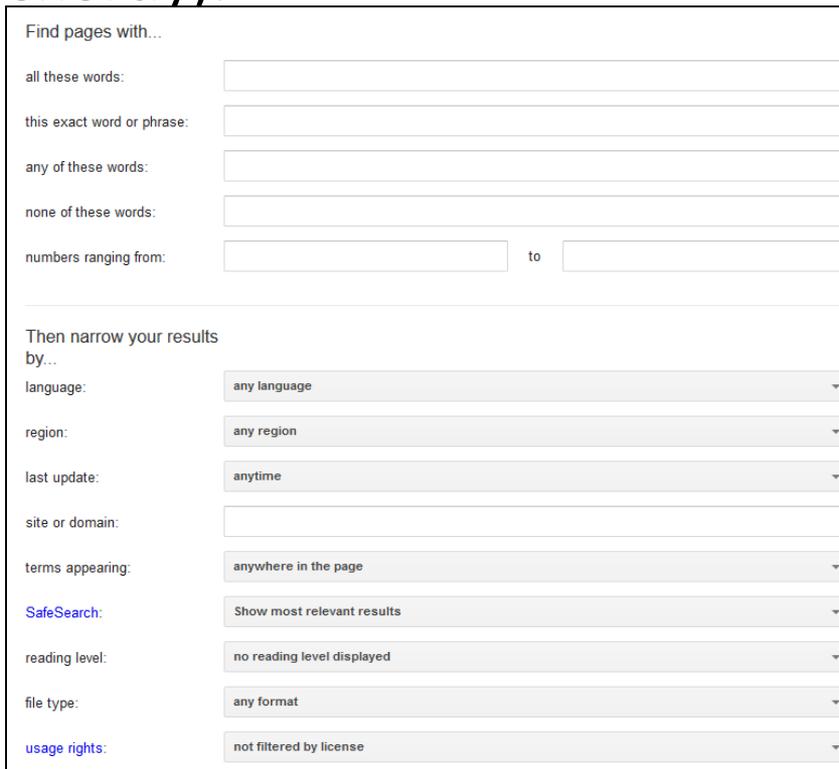
Find pages with...	
all these words:	
this exact word or phrase:	
any of these words:	
none of these words:	
numbers ranging from:	to

Then narrow your results by...	
language:	any language
region:	any region
last update:	anytime
site or domain:	
terms appearing:	anywhere in the page
SafeSearch:	Show most relevant results
reading level:	no reading level displayed
file type:	any format
usage rights:	not filtered by license

Searching For Exact Phrases

- Sometimes you may be looking for information about a famous quote.
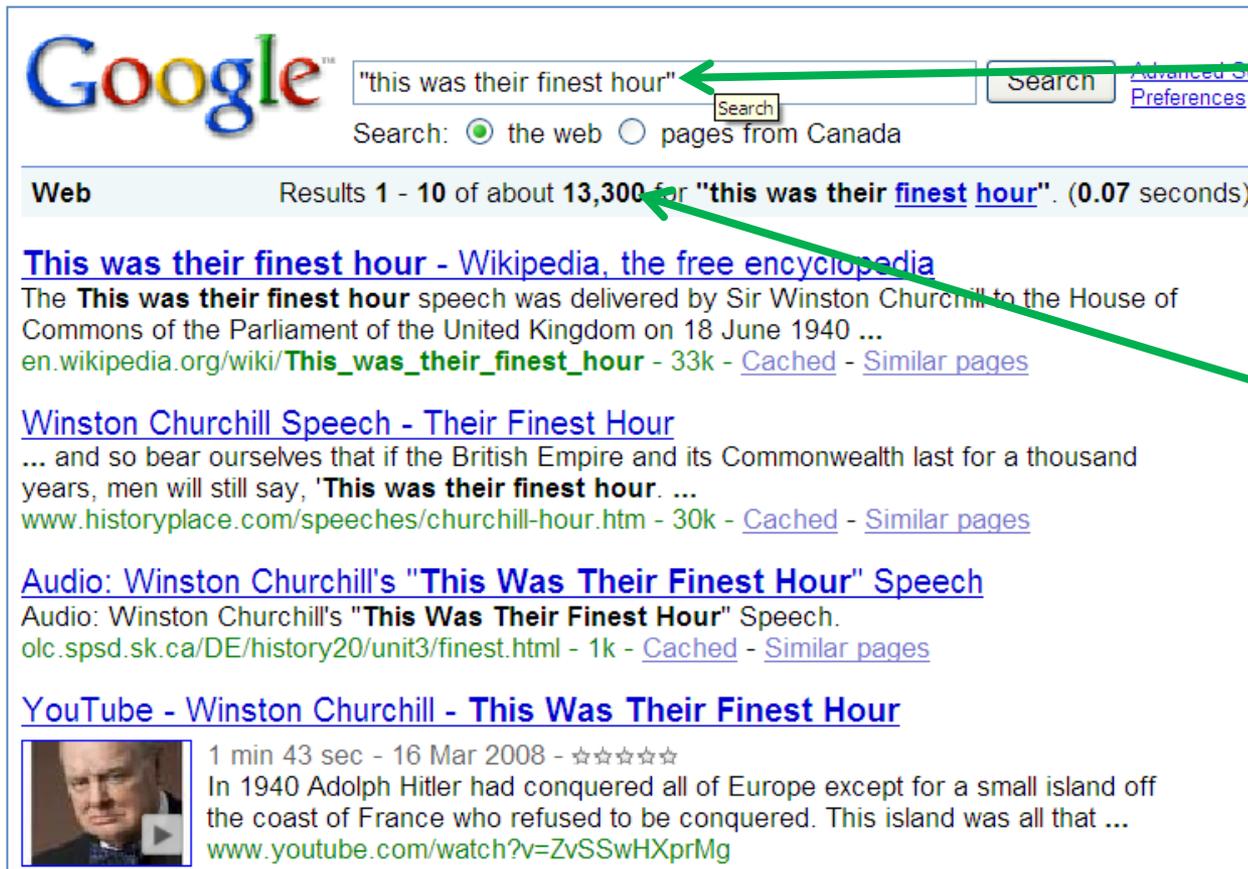   - "This was their finest hour!" – Winston Churchill

Many results must be reviewed.

Unrelated websites show up: *Their finest hour*

Searching For **Exact Phrases** (2)

- Enclosing the phrase that you are searching for in **quotes** will search for pages that contain only that specific phrase.

The desired phrased enclosed quotation marks.

Fewer but more relevant results show up

Searching **Exact Phrases**: Advanced Search

No other combinations are possible

Advanced Search

Find pages with...

all these words:

this exact word or phrase: james tam

any of these words:

none of these words:

numbers ranging from: to

Words That Are Commonly **Ignored By Google**

- **Stop words** are ignored by search engines such as Google:
  - **Common** words
  - **Reserved** words

- The search engine can be forced to **include the stop words**:

  1. Use **quotes**

  `best places to eat in Calgary`

  Vs.

  `"best places to eat in Calgary"`

  2. Use the **'plus' operator**.

  `Star Wars I`

  Vs.

  `Star Wars +I`

What If **More Than One Word** Can Be Used?

- Some concepts can be represented by using different words.
- The '**~**' operator includes synonyms in the search.
- Example:

  ~cheap computers

The Search Criteria Is Incomplete/Partially Unknown

- For example, searching for information on this person:

Image: Koch/Munich Security Conference

Image: www.cnn.com (2015)

- How is his name spelled?
  - Arnold Scwartzengger?
  - Arnold Schwartzenger?
  - Arnald Scwartzencker?
- FYI it's "Arnold Schwarzenegger"

- **Note: many search engines try to 'guess' what you are thinking but sometimes software guesses wrong ("auto correct" on mobiles)**
- **Also handy for less common words and phrases e.g., technical terms, foreign languages translated to English**

Using The Wildcard In Searches

Using The Wildcard

- Search engines such as Google have been refined to reduce but not entirely remove the need for wildcards.

- Google may not provide useful alternatives when searching for technical terms or foreign words translated into English

- Example: "Lei Sui, Lung" (English translation of the Chinese name of the famous martial artist/movie star: Bruce Lee)
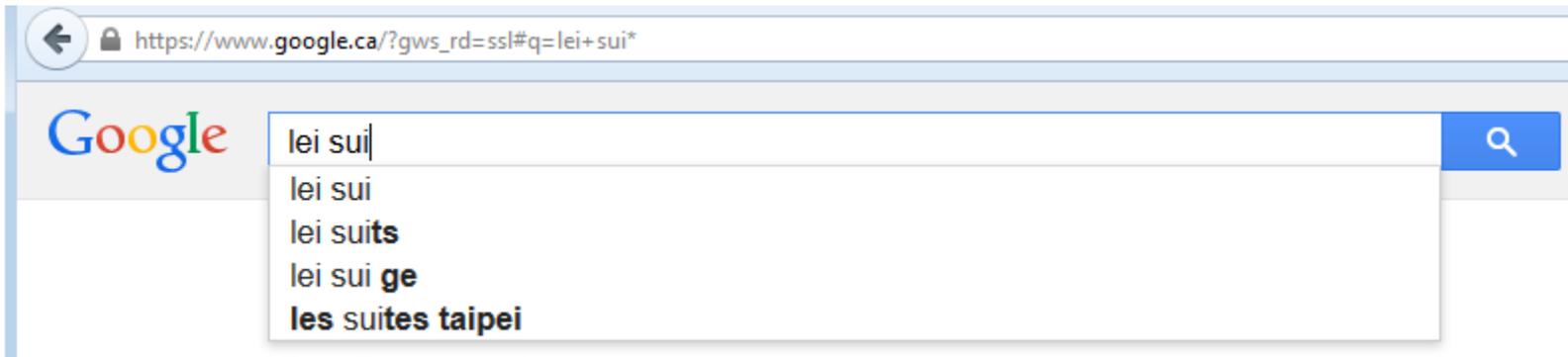
Searching A Range

- Searching numerical values within a certain min – max range
- Range operator **..** (multiple dots)
- Example:

```
Qatar History 2000..2009
computer 2000 QR..5000 QR
```

Range Searching: Advanced Search

Search criteria

Numerical range

Find pages with...

all these words: qatar history
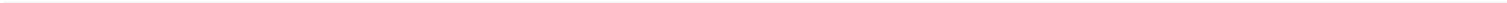
this exact word or phrase:

any of these words:

none of these words:

numbers ranging from: 2000   to   2009

Searching Among Alternatives

- Normally when a word is included in the search box Google will try to find web pages that include **all** those words.

- Example:

    cute wallpapers cats dogs

    Vs.

    cute wallpapers cat OR dogs

Example:

    "Bruce Lee" OR "Little Dragon" OR "Lee Siu Lung"

    "Wayne Gretzky" OR "The Great One" OR Number 99" Or "Number ninety nine"

Searching Among **Alternatives** (2)

Note: Google is case sensitive in this situation! (OR must be upper case in order to search for alternatives).

To be or not to be

Vs.

To be **OR** not to be

Example: Multiple Search Terms (Default)

Example: Multiple Search Terms ("OR")

Example: Multiple Search Terms, OR - No Caps

Searching **Alternatives**: Advanced Search

All words that must appear

One of more of these words can appear

Using 'OR': Exceptions[1]

- Google was designed to approximate how people think and behave when searching for information.

- Consequently exceptions to the rules are sometimes made.

- Example:

  What you tell the search engine: For better **OR** for worse

  What the search engine looks for: For better **or** for worse

Excluding Words

- There may be times when you want Google to exclude sites with certain words or phrases.

- This can be done with the **subtraction operator** (subtract the words that follow the operator from search results).

- Example:

  "James Tam"

  Vs.

  "James Tam" **-**calgary

Excluding Words: Advanced Search

Find pages with...

all these words:

this exact word or phrase: james tam

any of these words:

none of these words: calgary

numbers ranging from: to

Exact search phrase

Excluded word

Site Specific Searches

- Useful when a webpage is large and/or not well organized:
  - Searching the current webpage
  - Searching the entire site (and only that site)

Searching The Currently Viewed Web Page

Searching One Website

- Involves searching one entire site (and not just the page from the site that is currently loaded into the web browser). Results from other sites will not be shown.
  - Use the '**site**' keyword

- Example:

Search only the University of Calgary website for the desired text

`"vba" site:www.ucalgary.ca`

Results are only from the University of Calgary website

MSOffice update | News & Events | University of Calgary
www.ucalgary.ca/news/utoday/jan20-09/MSOffice
Jan 20, 2009 - These include: Excel Levels 1,2,3, and Excel Macros and VBA; Word 1, 2, and 3;
PowerPoint 1 and 2; Access 1, 2, and Access Macros and VBA ...

University of Calgary Continuing Education
www.ucalgary.ca/cted/campaign2013/201501-newsletter.html ▾
Microsoft Macros and VBA Level 1. Feb 4 ICT 427. Main Campus. Sketching Interiors Feb 4 INT 114.
Main Campus. Procurement and Contract Management

Co-op & Internship Employer Testimonials | Faculty of Science ...
www.ucalgary.ca/science/undergraduate/co_op_internship/employer_testimonials ▾
In return the students gain an enormous amount of knowledge in Oil & Gas, data management, learn
many technologies that we use such as C\C++, VBA, ...

Searching One Website: Advanced Search

Finding And Evaluating Information

- This section is crafted for students who need to conduct research for an undergraduate course e.g., writing a paper
  - But the principles can be applied when researching information for personal reasons because it may improve the quality of the results (e.g., "Are there technical reasons why a MAC is any more or less secure than a Windows-PC?")
- Finding: Where to look for information
- Evaluating: Determining the quality of information?

Finding Information

- When conducting formal research information sources should be evaluated for quality
  - Not all sources of information are equal in terms quality.
  - Contrast: a private individual's personal blog vs. a website containing the current research being conducted by the experts in a particular field.
- Where to start?
  - Check with your course instructor: what level of research is expected?
  - Journals and conference proceedings
  - Books
  - Online: websites

Journals And Conference Proceedings

- Publications that describe the latest theories and research produced by domain experts
- The quality of publications can vary
  - First tier publications:
  - Second tier "average" publications:
  - However in terms of undergraduate research the quality of papers produced at either category should be sufficient (check with your course instructor)
  - Which ones are at least reasonably good ones? Check the instructor's publication list and look at the journals and conferences in which this person has published.
- Overall the quality of the information is generally good
- Since it is written by 'experts' for 'experts' it may be difficult for the typical student to read and understand

Journals And Conference Proceedings (2)

- Examples (in case you're curious):
  - http://www.sigchi.org/conferences/   "User-friendly technology"
  - http://cscw.acm.org/2015/   "Technology to support groups"

Books

- Books: First look at the intended audience
  - General population: with no background knowledge in the domain?
    - e.g., "A brief history of time" by Stephen Hawking
    - Probably too rudimentary for use in post-secondary courses.
  - Students: high school or post-secondary
    - May be at an appropriate level of detail (for the latter category) if you just want general knowledge of a topic (e.g., instead of taking a course)
    - Probably not specialized enough if you need to write a paper for a course
    - e.g., you are taking CPSC 203 there is a brief hardware introduction but the introduction is probably not sufficient if you need to write a paper on the specific hardware needed for high-end gaming computers

Online: Websites

- Even more than the other sources, websites vary greatly in quality
  - The publishers of conference may host websites describing the latest research conducted by the experts
  - On the other hand: anyone can make their own website about a particular topic
- Some things to keep in mind when evaluating the quality of a website:
  - Who is the author:
    - Widely regarded expert in the field
    - Industry expert (which field, is it similar to the one described in the website)
    - Does the person have any apparent conflicts or agendas e.g., a CEO of a computer manufacturing company writing a review of laptops (sometimes not so obvious)
    - Are points backed by facts? Are those facts citing reputable sources?
      - Some present opinions as facts.

Online: Websites (2)

- Who is the intended audience of the website:
  - Expert researchers?
  - General population?
  - Combination? E.g., www.mayoclinic.org, http://www.hopkinsmedicine.org

- If the content is produced by a university or reputable research group then it's probably correct
  - E.g., Mayo clinic, Johns Hopkins
  - But may or may not be targeted specifically to a 'general' audience and be of insufficient depth for your research

- In general use websites with a strong degree of a caution.

Wikipedia

- "**Wikipedia** is a collaboratively edited, multilingual, free Internet encyclopedia…" – from www.wikipedia.org
- "Many eyes view it"
- Q: Is this a good quality source of information when researching a topic?

Wikipedia (2)

- Many 'eyes' view but are those the 'right eyes'
  - Some topics require expert knowledge e.g., 'Rocket science'
- There is no guarantee that the experts in the area will be viewing, let alone actively editing Wikipedia documents
- Furthermore the document that you view one day may not be the same one that you view on another day
  - Actively study the history of changes of a document and compare differences?
- Subject to bias - extreme cases of "vandalism" has lead to "lock downs"
 - What's the point of a wiki (anyone on the web can edit)

Using Wikipedia

- Similar to regular paper encyclopedia or perhaps a newspaper article it's a distillation of different sources of information.

  - Generally it is not accepted as a direct primary source (don't directly cite a Wikipedia article in your research paper).

- It may be a starting point to find good sources of information that can directly be cited.

- Example: "Human-Computer interaction"

Footnotes [edit]

1. ^ Card, Stuart K.; Thomas P. Moran; Allen Newell (July 1980). "The keystroke-level model for user performance time with interactive systems". *Communications of the ACM* **23** (7): 396–410. doi:10.1145/358886.358895 .

2. ^ Carlisle, James H. (June 1976). "Evaluating the impact of office automation on top management communication". *Proceedings of the June 7–10, 1976, National Computer Conference and Exposition*. pp. 611–616. doi:10.1145/1499799.1499885 . "Use of 'human-computer interaction' appears in references"

3. ^ *a b c* Hewett; Baecker; Card; Carey; Gasen; Mantei; Perlman; Strong; Verplank. "ACM SIGCHI Curricula for Human-Computer Interaction" . ACM SIGCHI. Retrieved 15 July 2014.

Wikipedia cites a good research conference (usability "user friendly" technology)
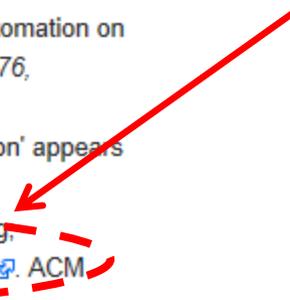
Using The University Library

- Services provided for students:
  - From http://library.ucalgary.ca/student-support)
    - "As a student attending the University of Calgary, you have access to the books, journals and online resources of a major research institution. Your subject librarians are available for research assistance as well.
    - Your University of Calgary ONEcard is your library card, and gives students the following privileges:
      - Borrowing books with a loan period of two weeks for undergraduate students and a term loan for graduate students
      - Interlibrary loan
      - Off-campus access to Library Research Databases"

The University Library: Online Resources

- The publications of many journals and conference proceedings can be accessed "for free" (licensed) through the university portal:
  - Requires login with the UC login credentials.
  - Combine it with an online web search:
- Use the search to find the relevant paper.
  - E.g., "Direct Stimulation of Angiotensin II Type 2 Receptor Initiated After Stroke Ameliorates Ischemic Brain Damage" – found via Google scholar
- Then access the content of the paper through the university portal
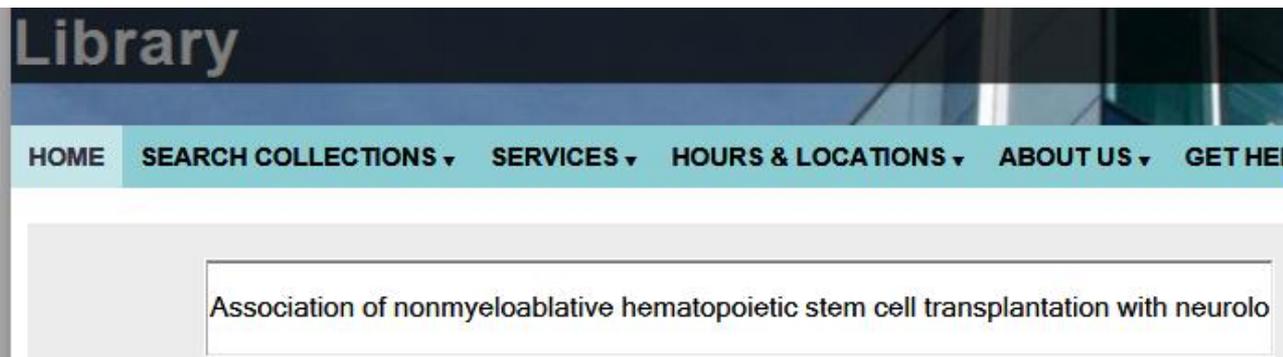
Authentication Is Require To Access The Article

Online Web Search Without The Library

- The general Internet user does not have a license to access many good online resources.
- After finding the publisher of the article: Journal of American Medical Association

After This Section You Should Now Know

- The requirements for a computer or device to be connected to a network
- How the Internet can be viewed as a large network of networks
- The requirements for a computer to be connected to the Internet
- What is 'bandwidth'
  - How to determine transmission times of files with a known size and a given bandwidths
- The "Who's" behind the Internet
- The original goals for the Internet and how it affects its current design
- How do search engines build up a database of websites using spiders
- Some factors that can determine the ranking of search results

After This Section You Should Now Know (2)

- Techniques for more effective web searches:
  - Searching for exact phrases: using quotes
  - How to include "stop words" in searches: quotes and the plus operator +
  - How to search for synonyms: ~
  - How to use the wildcard: *
  - Benefits of the wildcard vs. relying on "suggested searches"
  - Searching ranges: ..
  - Searching for alternates: OR
  - Excluding words and phrases: - (subtraction operator)
  - Conducting site specific searches:
    - Finding content within the webpage currently viewed: 'find in page'
    - Searching for content within a particular website: site

After This Section You Should Now Know (3)

- Sources for researching information (journals/conferences, books, websites)
    - Strengths and weaknesses
    - How to evaluated their value
- How a website such as Wikipedia can and should not be used when conducting research
- How the university library can complement a web search (licensed access to online resources)