funnelback

Internet & Enterprise Search

The evolution of IR

(Part 2 – The Electronic Era)

1960 - 2010

David Hawking

IRF Conference, Vienna 31 May 2010

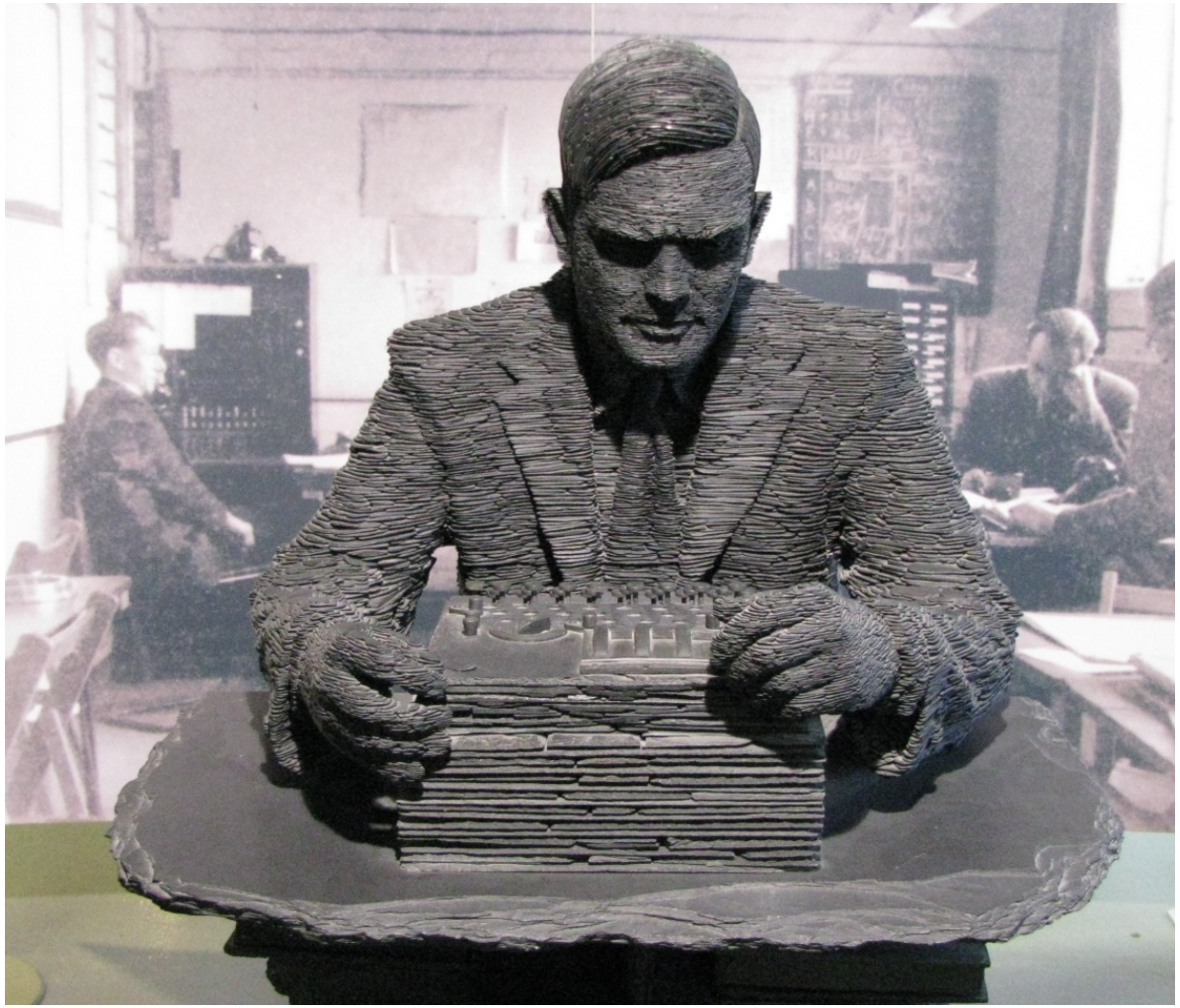

ASX
AUSTRALIAN STOCK EXCHANGE
Westpac
BT Financial Group
clive peeters
So easy
ninemsn
Queensland Government
Bank of Queensland
National Research Council Canada
Conseil national de recherches Canada
NRC·CNRC
Canada
HARGREAVES LANSDOWN
Australian Competition & Consumer Commission
Australian Government
medibank PRIVATE
STAFFORDSHIRE UNIVERSITY
CSIRO
Australian Government
Department of Immigration and Citizenship
Australian Government
Department of Health and Ageing
Australian Government
Department of Transport and Regional Services
Australian Government
Australian Institute of Criminology
Hydro Tasmania
the renewable energy business
Australian Government
Department of Human Services
NEW SOUTH WALES GOVERNMENT
PREMIER'S DEPARTMENT
Victoria The Place To Be
Centre for Asia Pacific Aviation
Health
WESTERN AUSTRALIA
The University of Sydney
Australian Government
Antarctic Division
Australian Government
Grains Research and Development Corporation
Australian Government
Fisheries Research and Development Corporation
Australian Capital Territory
Welcome to Ngunnawal Country
Home to Canberra, Australia's National Capital

"One never notices what has been done; one can only see what remains to be done"

Marie Curie, 1894
(in a letter to her brother)


A golden era of
information retrieval

Why not start at 1940?



Why start at all?

"Those who cannot remember the past are condemned to repeat it"

George Santayana, *the Life of Reason*, 1906

Sixties

21 Oct 1959 – IBM 1620

- Punched card, paper tape, and keyboard
- Simultaneous read, compute and punch
- Large capacity core storage – up to 60,000 digits
- High internal processing speeds.
- Access time – 20 microseconds
- Multiplication (5 digits by 5 digits) - 4.96 msec.
- Solid state!!

IBM 1620 page

Cranfield Experiments

e.g Cleverdon & Mills, 1963

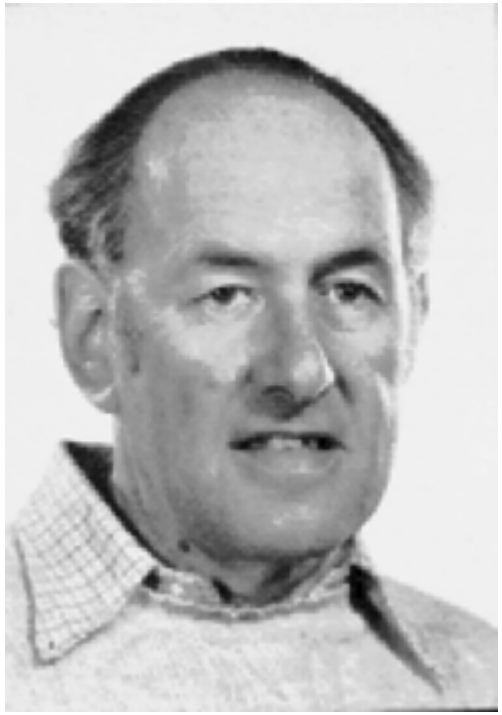
- Test collection created from “In-situ” judgments in a real retrieval task
- 5-point relevance scale.
- 400 searchers surveyed
- 1500 papers fully judged.

Cleverdon '64 Evaluation Criteria

- Coverage
- Recall
- Precision
- Response time
- User effort
- Form of output

➔ Automatic indexing outperforms manually assigned terms. (Cranfield II report, 1966)

Gerard Salton



F. Wilfrid Lancaster

- The term “hypertext” coined and the Xanadu idea of universal interlinking (Ted Nelson, 1965)
- The Mother of All Demos (Doug Engelbart,1968) – “NLS” – mouse, interactive text, video conferencing, email, hypertext and collaborative real-time editing.

Seventies

c. 1970 – Univac 1108

Storage prices (2009 USD Per gigabyte)

RAM: $893M
Drum: $65M

- Typical cost (1968 dollars): >$2M
- 131 kWords (36-bit) core memory: $823k
- 2 Mword magnetic drum, 92 msec ave latency: $96k
- Approximately 1 MIPS

Information Retrieval in 1971

- Relevance feedback (Rocchio, 1971)
- Bibliographic co-citation (Small, 1973)
- Relevance and utility (Cooper)
- IP protocols (Kahn & Cerf, 1973)
- Ethernet (Metcalfe et al, 1975)
- Idf, Probabilistic ranking (Harter, Robertson, Sparck Jones, Maron)
- Vector space model (Salton et al)
- Porter stemmer (1979)
- Wordplex, Troff, Scribe,TeX
- Multi-processing operating systems.
- The WIMP interface (Alan Kay, 1972)

Eighties

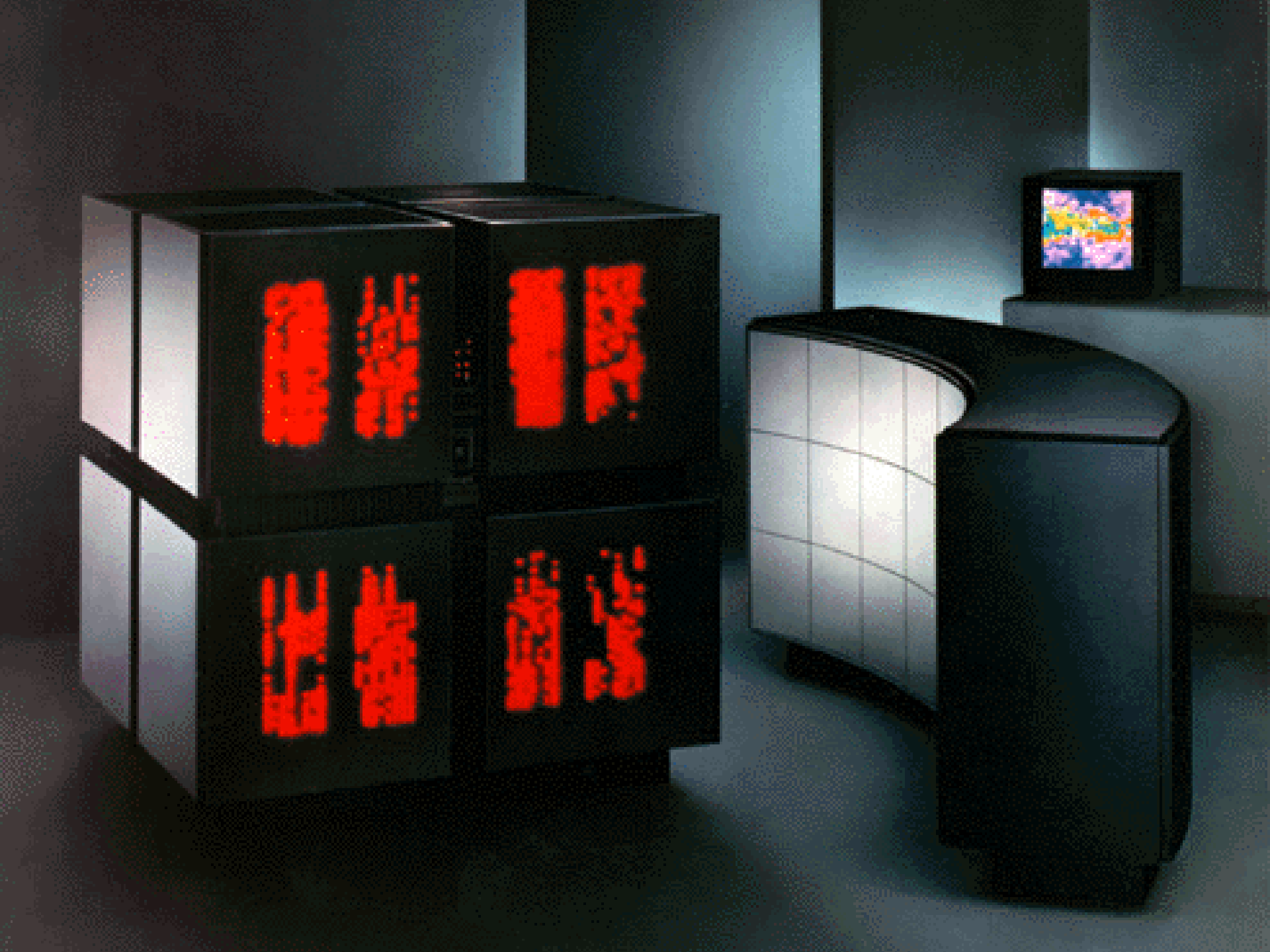
c. 1980 – DECSYSTEM-10

- Deployment of Ethernet and laser printers
- SMTP (Jon Postel, 1982)
- The concept of the ideal machine for computer science: the 3M machine
- Personal computers
- WordStar, WordPerfect, MSWord
- WYSIMOLWYG DTP (Apple Mac)
- Unicode (Joe Becker, 1988)
- Archie (1989)
- World Wide Web (Tim Berners-Lee 1989)

Nineties

Remember 1991?

- Berners-Lee invented WWW two years ago
- Lycos web search was still 2 years off
- Harman and Candela – ranking over 1GB
- FreeWAIS took a week to index 1GB (Brewster Kahle)
- TREC-1 next year
- BM25 three years away
- ANU had the fastest computers in the world – *outside countries starting with U or J!*



c.1990 – Sun 3/80

- Up to 16MB RAM
- 104MB disk
- 25 MHz M68030
- c. $5k

1990s – What else?

- TREC (Donna Harman, 1992 –)
- UTF-8 (Ken Thompson, 1993)
- Mosaic browser (Andreessen, Bina, 1993)
- Lycos (Mauldin, 1993)
  - Alta Vista (Monier, Burrows …, 1995)
  - Infoseek (Kirsch, Li, Chang)
  - DirectHit (Culliss, Cassidy, 1998)
  - Google (Brin, Page, 1998)
- Query-driven advertising (Open Text, 1996)
- Effective e-commerce (Amazon, 1994)
- Recommender systems

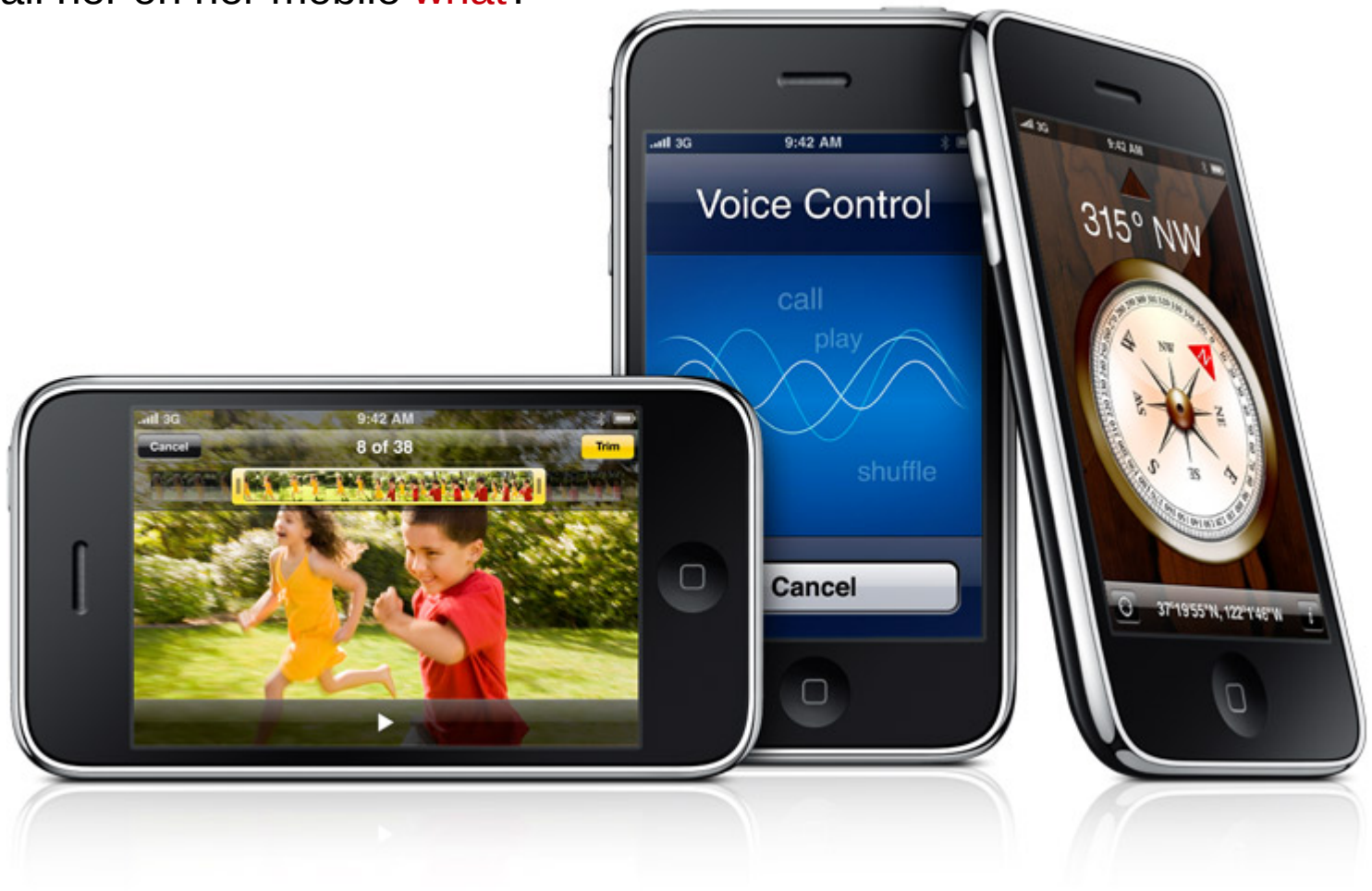
Noughties

- The verb “to blog” coined (c. 2000)
- Wikipedia (Wales/Sanger, 2001)
- Flickr (Butterfield & Fake, 2004)
- Facebook (Zuckerberg,2004)
- YouTube (Hurley, Chen, Karib, 2005)
- Twitter (Dorsey, Williams, Stone, 2006)
- Evaluation (in general)
  - NDCG (Jarvelin & Kekkalainen, 2002)
- Geographical context in retrieval
- Continued Moore's law
- Expansion of network connectivity & bandwidth

Mobile devices

From “Life on Mars”:

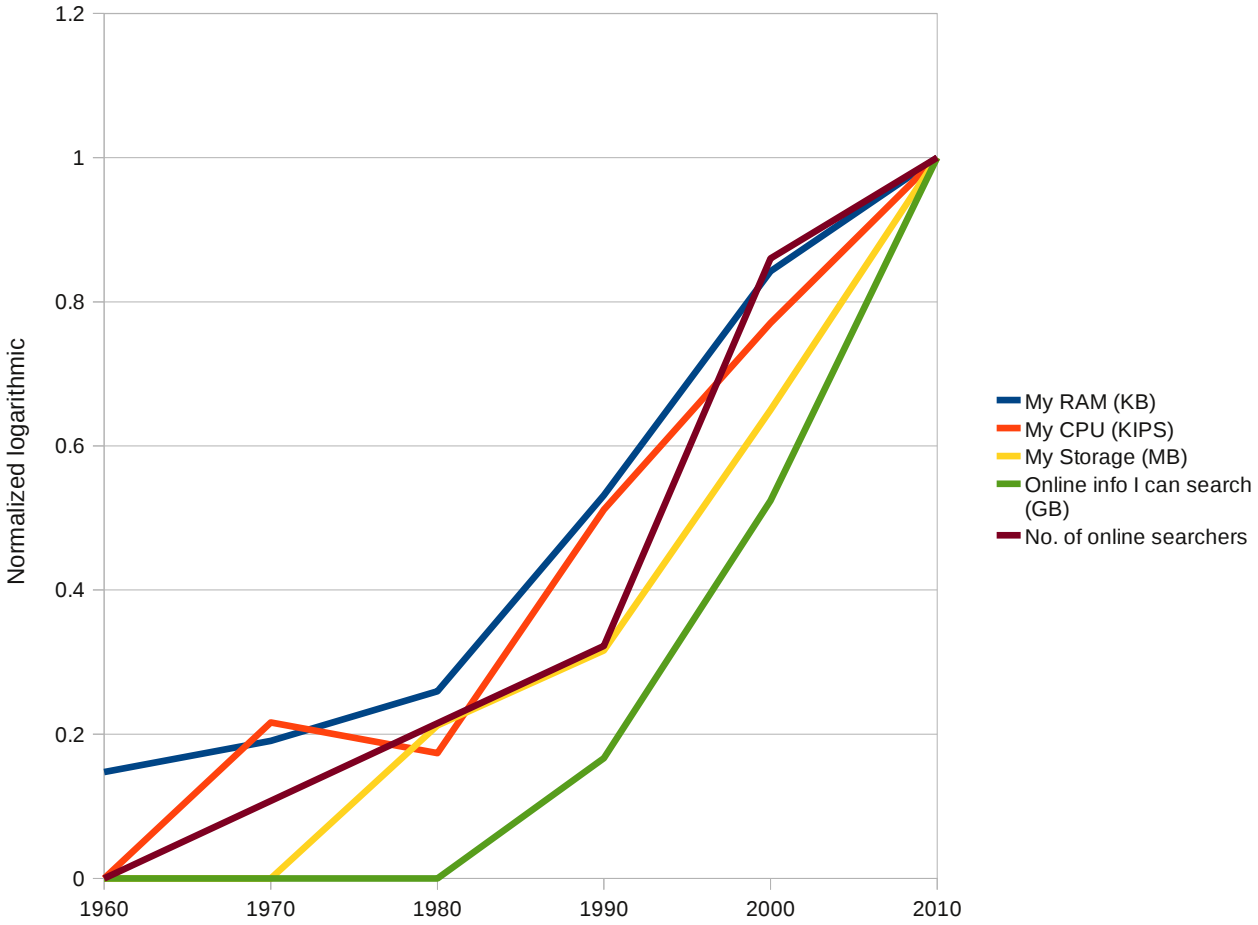
- “Call her on her mobile.”
- “Call her on her mobile what?”



from the apple.com gallery

In the last 50 years ...

What's grown?


1.2
1
0.8
0.6
0.4
0.2
0
Normalized logarithmic
1960
1970
1980
1990
2000
2010
My RAM (KB)
My CPU (KIPS)
My Storage (MB)
Online info I can search (GB)
No. of online searchers

What's shrunk?

What?	From (1970)	To (2010)
CPU cost (USD / MIPS)	1	10^{-7}
RAM cost (USD / GB)	1	10^{-10}
Online storage cost (USD / GB)	1	10^{-9}
Prevalence of manual indexing		

What are the breakthroughs of the
last 50 years
which most strongly underpin
the present golden age
of
information retrieval?

Hardware

- Cheap, capacious online storage
- Cheap, powerful CPUs
- Ubiquitous networking (late seventies on)

Standards

- TCP/IP etc.
- Ethernet
- Markup languages: SGML, HTML, XML
- Unicode / UTF-8
- HTTP
- URIs
- robots.txt, sitemap.xml
- ISO date formats

Software

- Word processing (hundreds)
- Webserver (httpd, apache ...)
- Web browsers (Mosaic, Netscape, ...)

Efficient IR Algorithms

- Crawling
- Indexing
- Query evaluation
- Summarisation
- Spelling suggestions

Traditional IR

- Automatic indexing (Cranfield)
- Text-based relevance ranking – probabilistic, vector space, inference networks, language model.
- (Query-biased) summarisation
- Evaluation / tuning by test collection.
- Understanding searchers

Web IR

- Crawling (Lycos, 1993?)
- SPAM rejection
- Static + Dynamic ranking
- Anchortext and other annotations
- Building on user interaction data
  - spelling suggestions
  - related queries
  - learning to rank
  - evaluation by flights

Where are we now in IR?

“tree climbing with one's eyes on the moon”

Hubert Dreyfus, *What computers can't do*, 1972

"Fanaticism consists in redoubling your efforts when you have forgotten your aim"

George Santayana, *the Life of Reason*, 1906

“search is a solved problem”

My boss, CSIRO , 2000

- Searching isn't a problem – just type words into a search box and hit 'go'! Everytime you do it, a search happens – what more do you want?
- Unfortunately, depending upon who you are, what you are searching, what you want, and what words you type, you may decide that finding isn't quite as well solved as searching!

“Unsolved” Search Areas

1. Contextualised search from mobile devices
2. Specialised professional search – e.g. patent search
3. Workplace / Enterprise search

Needed: More machine-friendly users!

(or tools to help them become
more considerate of the
limitations of systems)

e.g. Spelling suggestion tools

- Suggestions may be useful even if words are correctly spelled:
  - Manchester Untied → Manchester United
- Suggestions based on whole query, not word-by-word
- Don't suggest queries which make no sense in the collection being searched
- Autocompletion: Guide users to the best query
- Context is king

e.g. Query expansion tools

- Manual rules:
  - Rego → [registration rego]
  - MOPEM →[“manually operated personnel egress mechanism” door]
- Related queries (automatic)
  - Based on co-clicking
- Contextual navigation (on-the-fly)
  - Finding superphrases in a deep result set
- Faceting (semi-automatic)

Related Search

Institution

- ANU (1499)

FOR

- 039904 (204)
- 030701 (149)
- 030606 (139)
- 030206 (128)
- 030499 (107)
- 030799 (105)
- 030503 (93)
- 030603 (93)

more...

Go8 Quick Search

Other search options: **People** | **Projects** | **Publications**

Search for: Any University: Any SEARCH POWERED BY funnelback

Search term/s: chemistry search search help

1 - 10 of **1,499** search results

Search results

Local crystal chemistry, structured diffuse scattering and inherently flexible framework structures
Publication type: Book chapter University: The Australian National University

Chemistry in Stringland: One-Dimensional Complexes of Main-Group Metal Ions with the Ligands NC₂_nX (X=N, CH; n = 0,1,2,3)
Publication type: Journal Article University: The Australian National University

A coupled electron diffraction and rigid unit mode (RUM) study of the crystal chemistry of some zeotypic AlPO4 compounds
Publication type: Journal Article University: The Australian National University

Polyazolyl chelate chemistry. 13. An osmaboratrane
Publication type: Journal Article
University: The Australian National University

Currently browsing...

Search Terms

chemistry

Have you tried...

Chemistry By Type

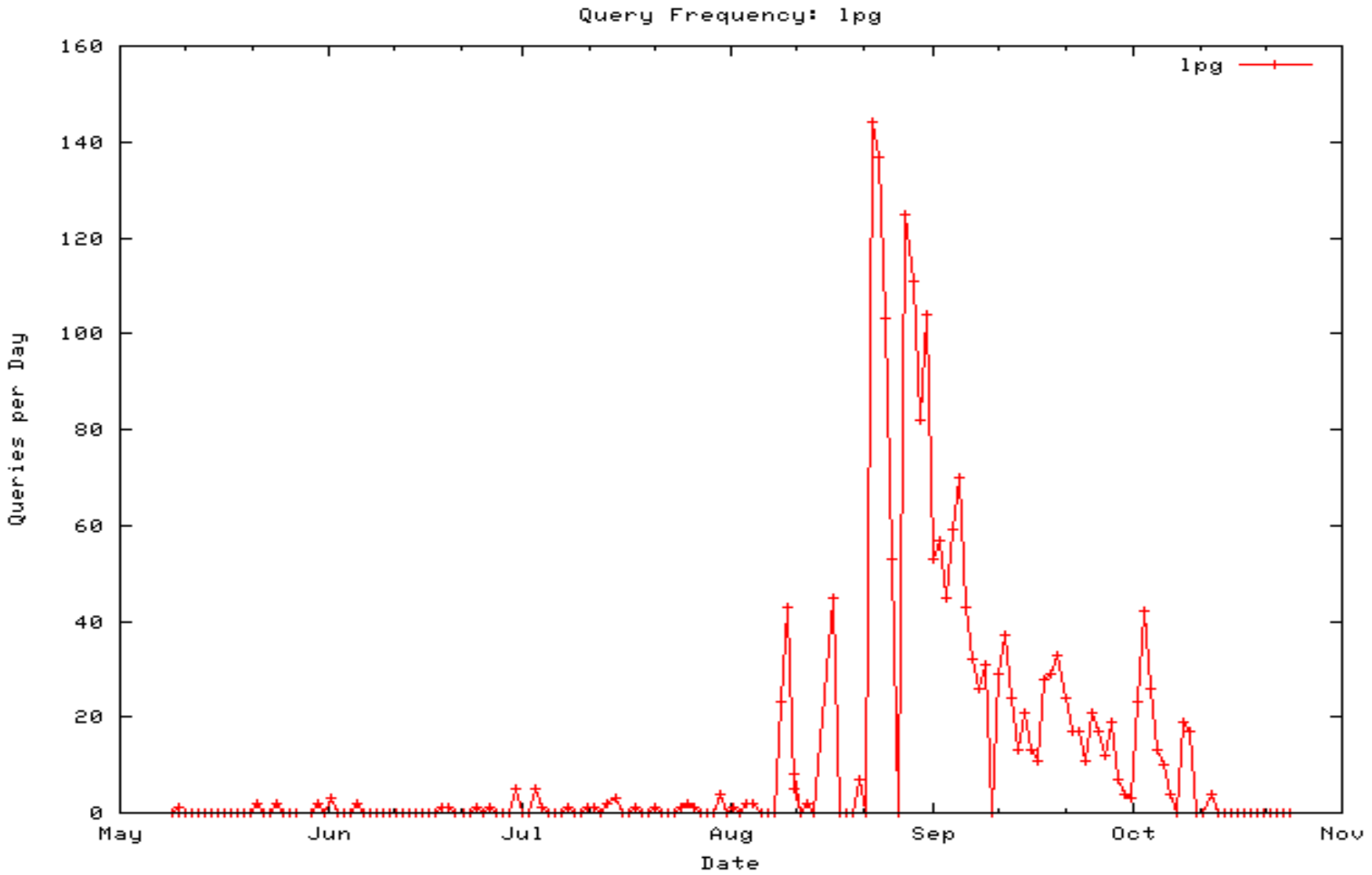
- Solid State... (48)
- Organometallic... (45)
- Cluster... (32)
- Crystal... (30)
- Quantum... (21)
- Physical... (11)
- Environmental... (8)
- Atmospheric... (7)
- Chelate... (6)
- Secondary... (6)

more types...

Chemistry By Topic

- ...Code (6)
- ...and Biotechnology (4)

Query Spike Alerting



- Thanks to:
  - Everyone whose work I have relied on
  - My son Jack for his “data exploding” montage
  - Mike Swanson for the Ned Kelly line
- Apologies:
  - For the errors and omissions which inevitably occur in a cursory historical romance like this.
  - To the friends whose great contributions I couldn't fit into this idiosyncratic tale

“Search is life”

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