Welcome to the class of

Web Information Retrieval !

Tee Time Topic

Augmented Reality and Google Glass

By Ali Abbasi

Challenges in Web Search Engines

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Challenges in Web Search Engines

- IJCAI'03 invite talk
  - Monika R. Henzinger, Google Inc. et al.
- SIGIR'05 keynote speech
  - Amit Singhal, Google Inc
- AIRS'08 keynote speech
  - Kenneth Church, Microsoft.
- WSDM'09 Keynote speech
  - Jeff Dean, Google.
- Surveys and discussions with SE companies
  - Google, Bing, Baidu, Sogou, etc.

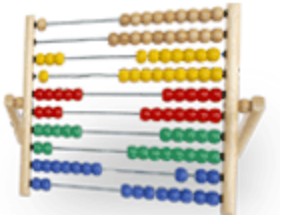
(partial of content and several images refer to above talks / papers)

Challenges in Web Search Engine

- **Scale, quality, quality evaluation**
- Spam
- Web conventions
- Multi sources fusion
- Evaluation
- UI

Challenges (1.1) – Scale

- 2006, 400,000,000 queries
- July 2008, 7.5 Billion queries*
- Nov. 2004, docs：8,000,000,000
- July 25, 2008，1 trillion docs

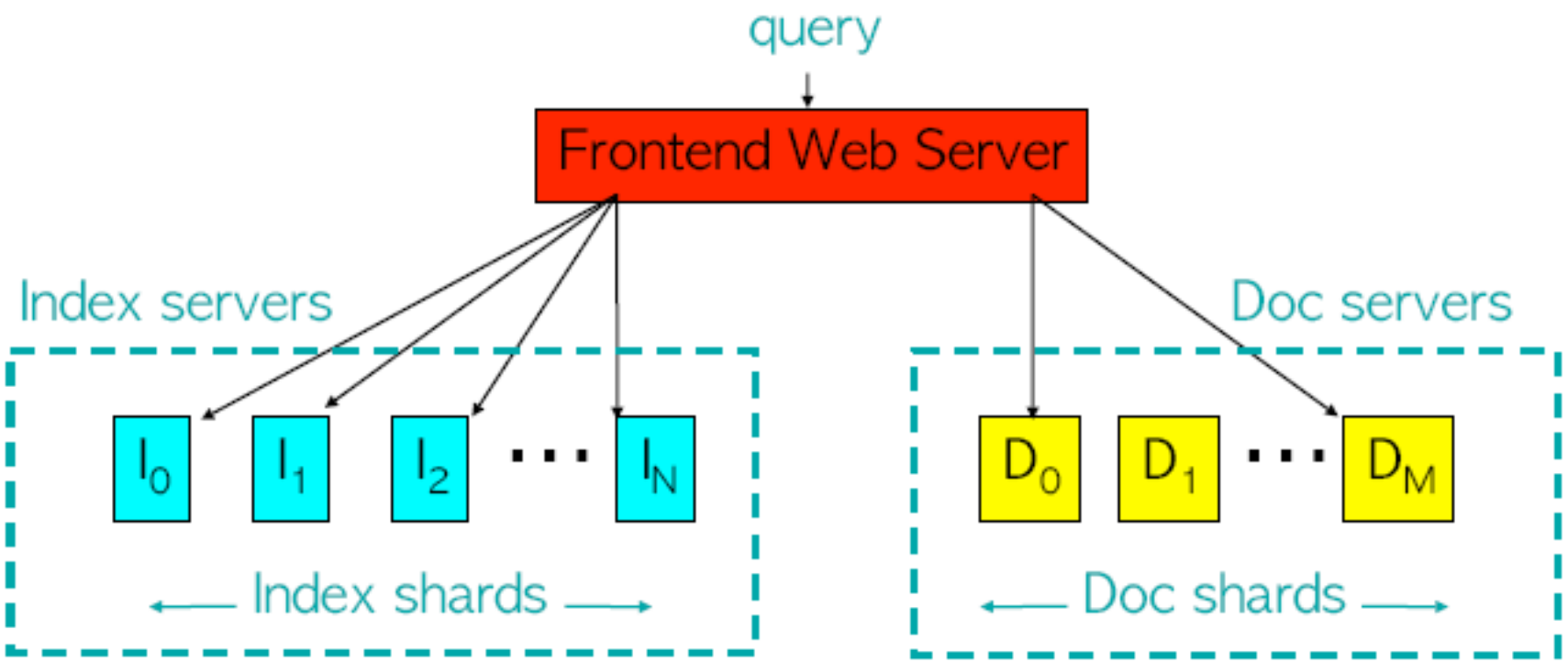


* Searchengine watch
http://searchenginewatch.com/3630718

Challenges (1.1) – Scale

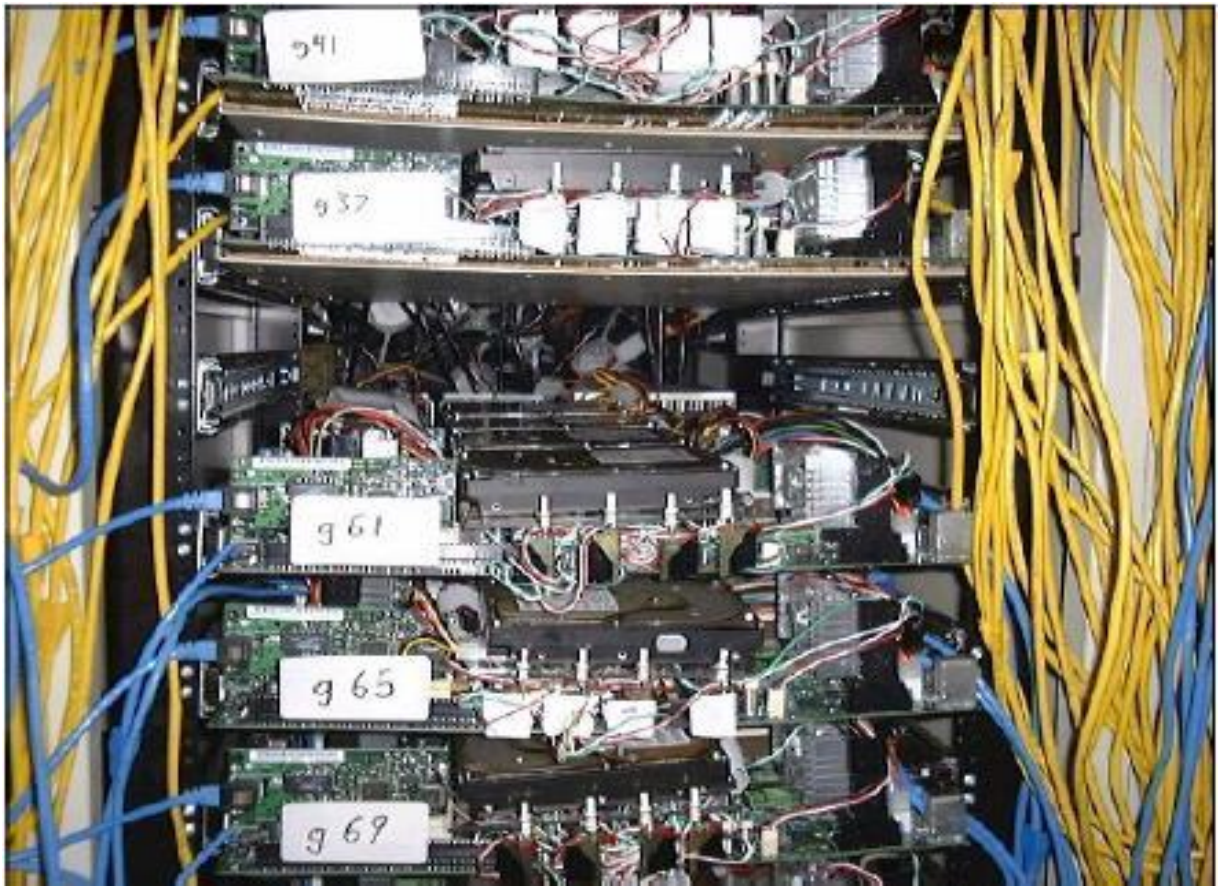
- Peak of google.stanford.edu ~ 1997

Research Project, circa 1997

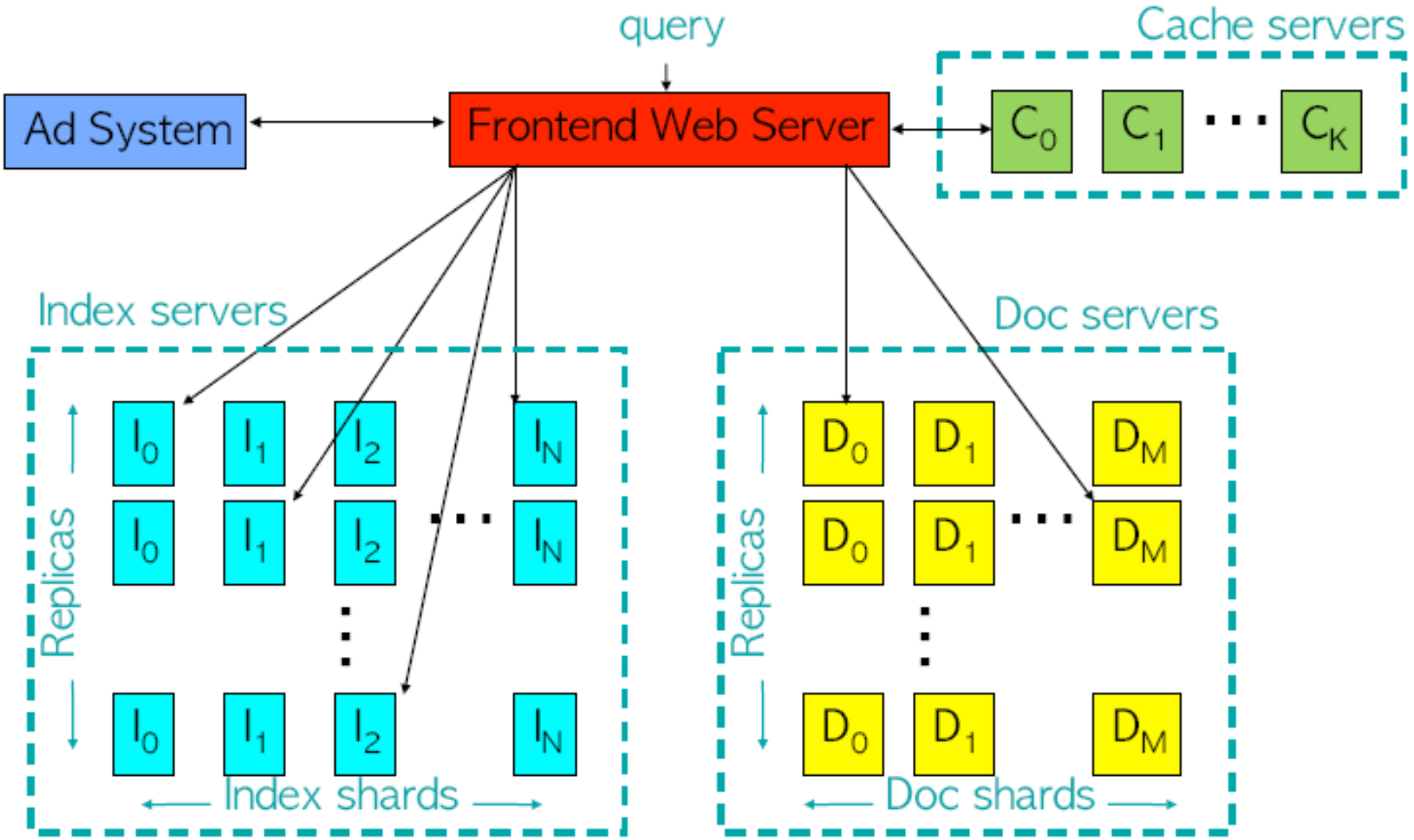


Challenges (1.1) – Scale

- "Corkboards" Google servers 1999



Serving System, circa 1999



Challenges (1.1) – Scale

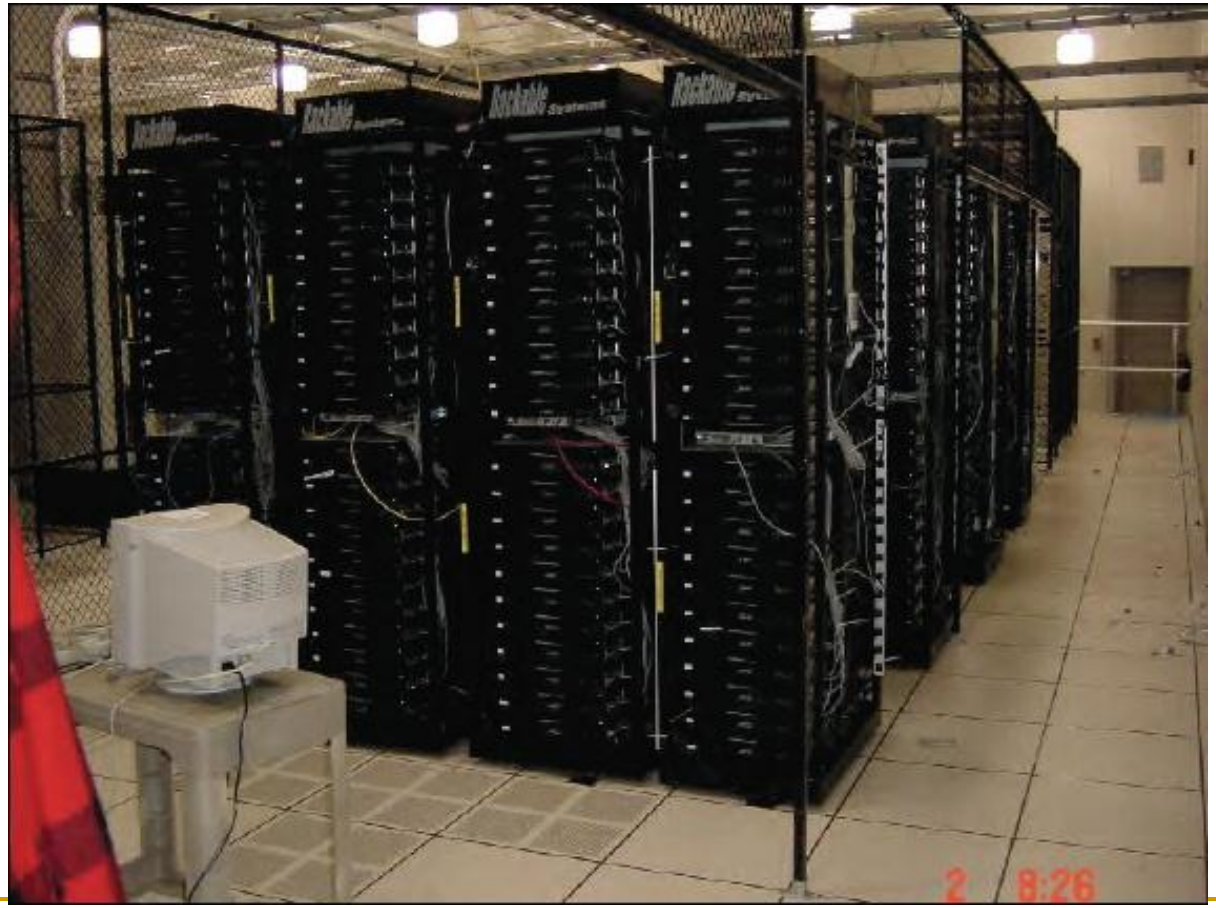
- Google Datacenter 2000

Challenges (1.1) – Scale

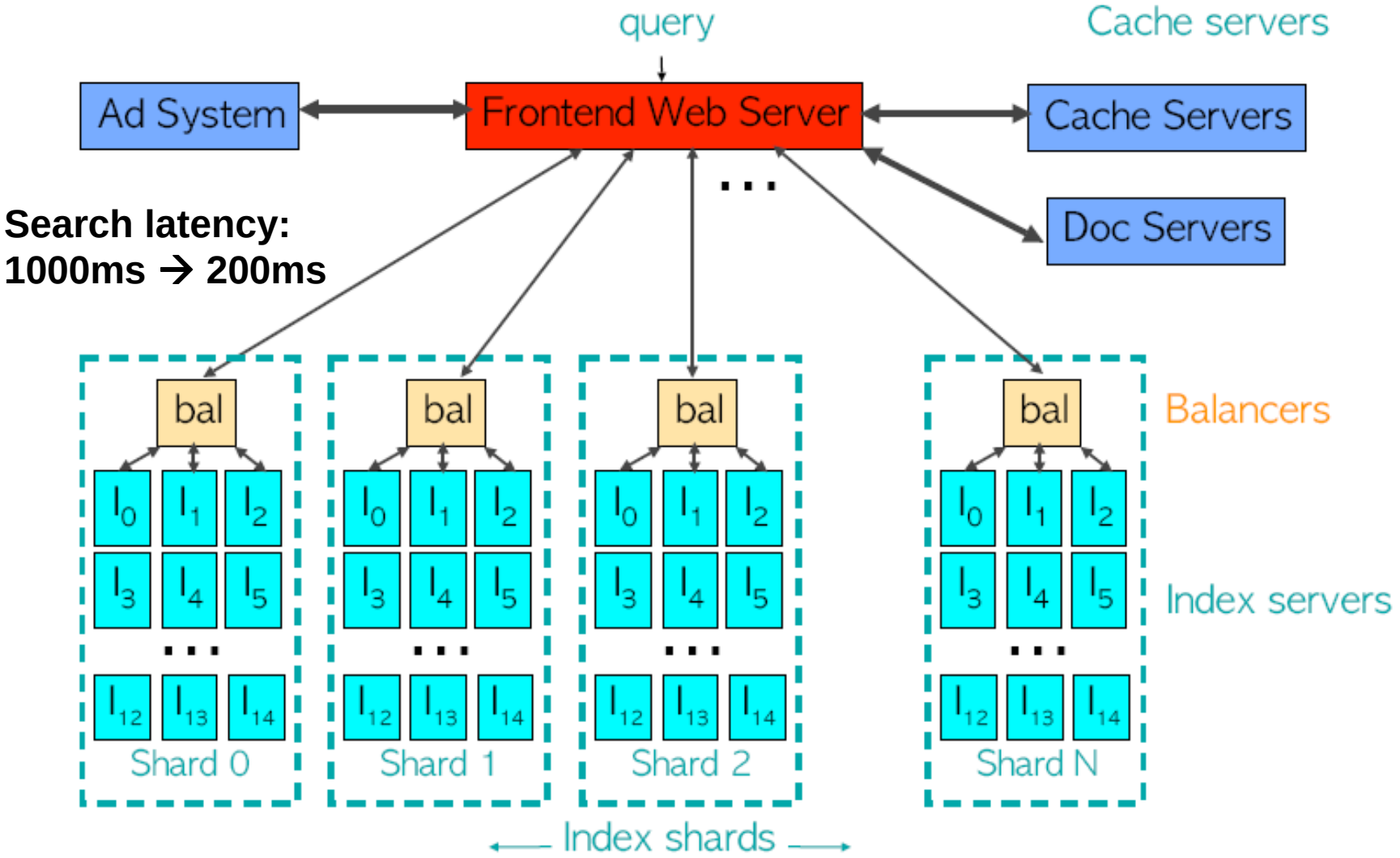
- Google new datacenter 2001

Challenges (1.1) – Scale

- Google new datacenter 2001 (3 days later)



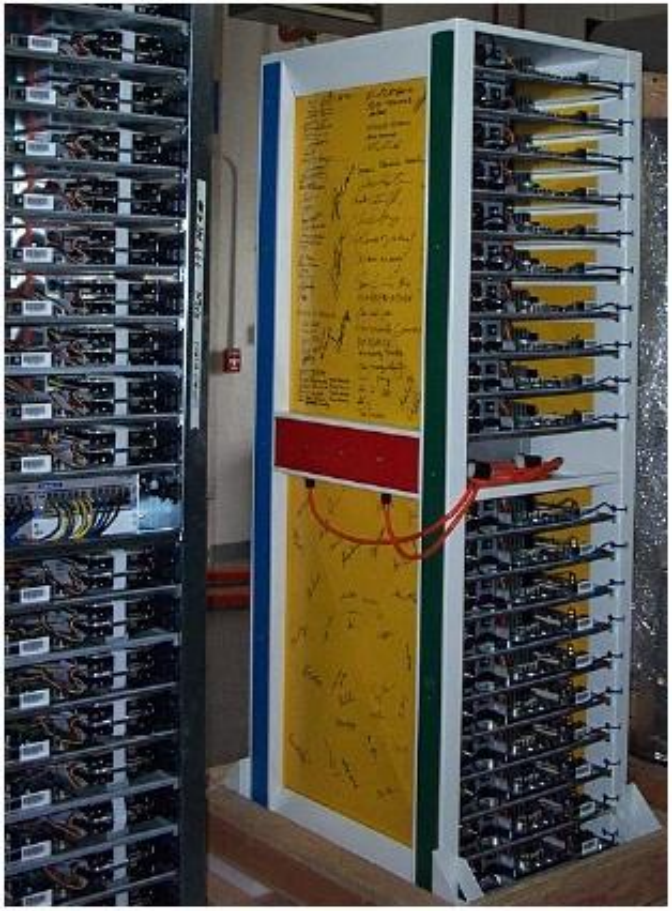
Early 2001, in-memory index



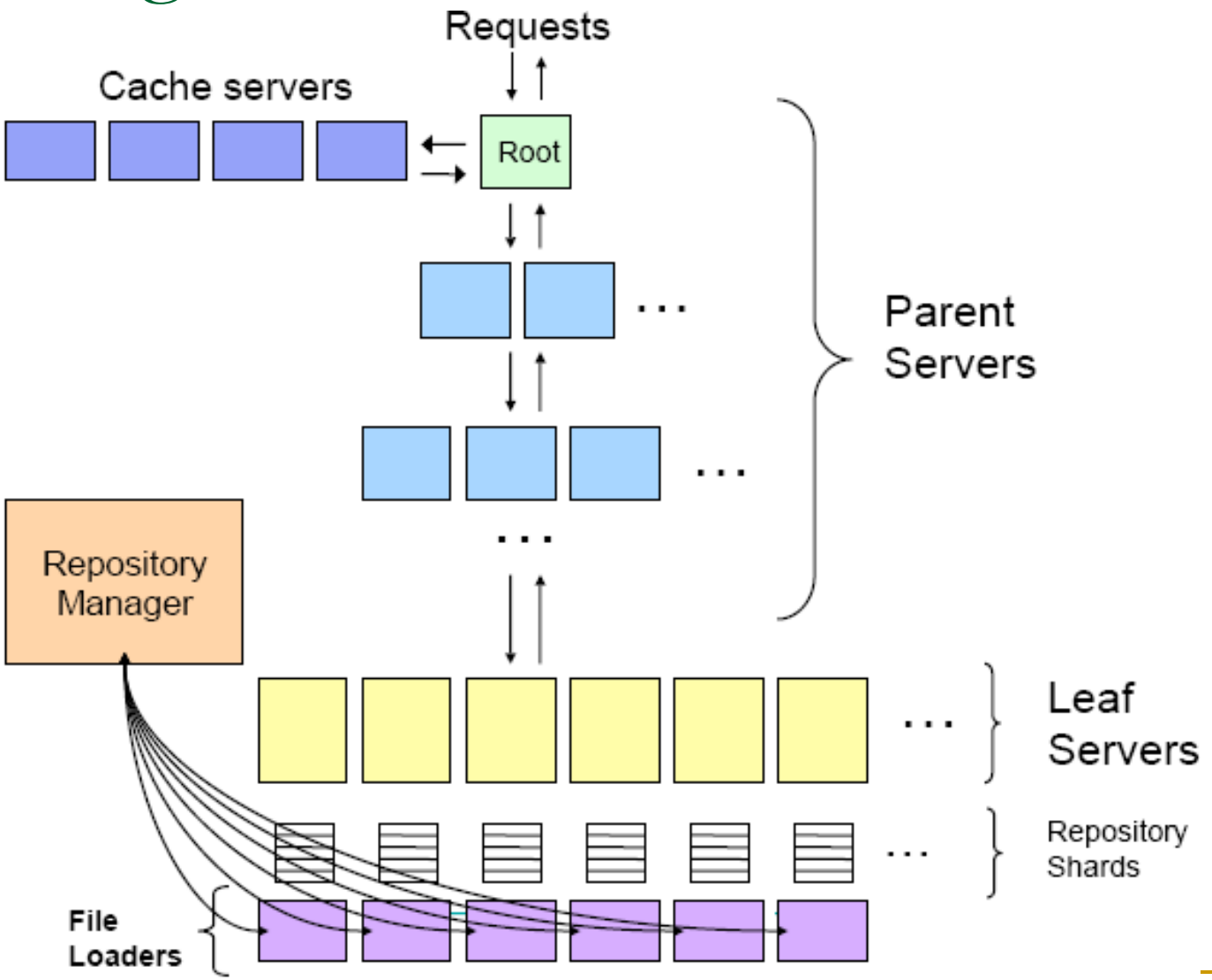
Holding the complete search index in memory: resulting in **the use of 1000 machines** to handle a single query **compared to just 12 previously**

Challenges (1.1) – Scale

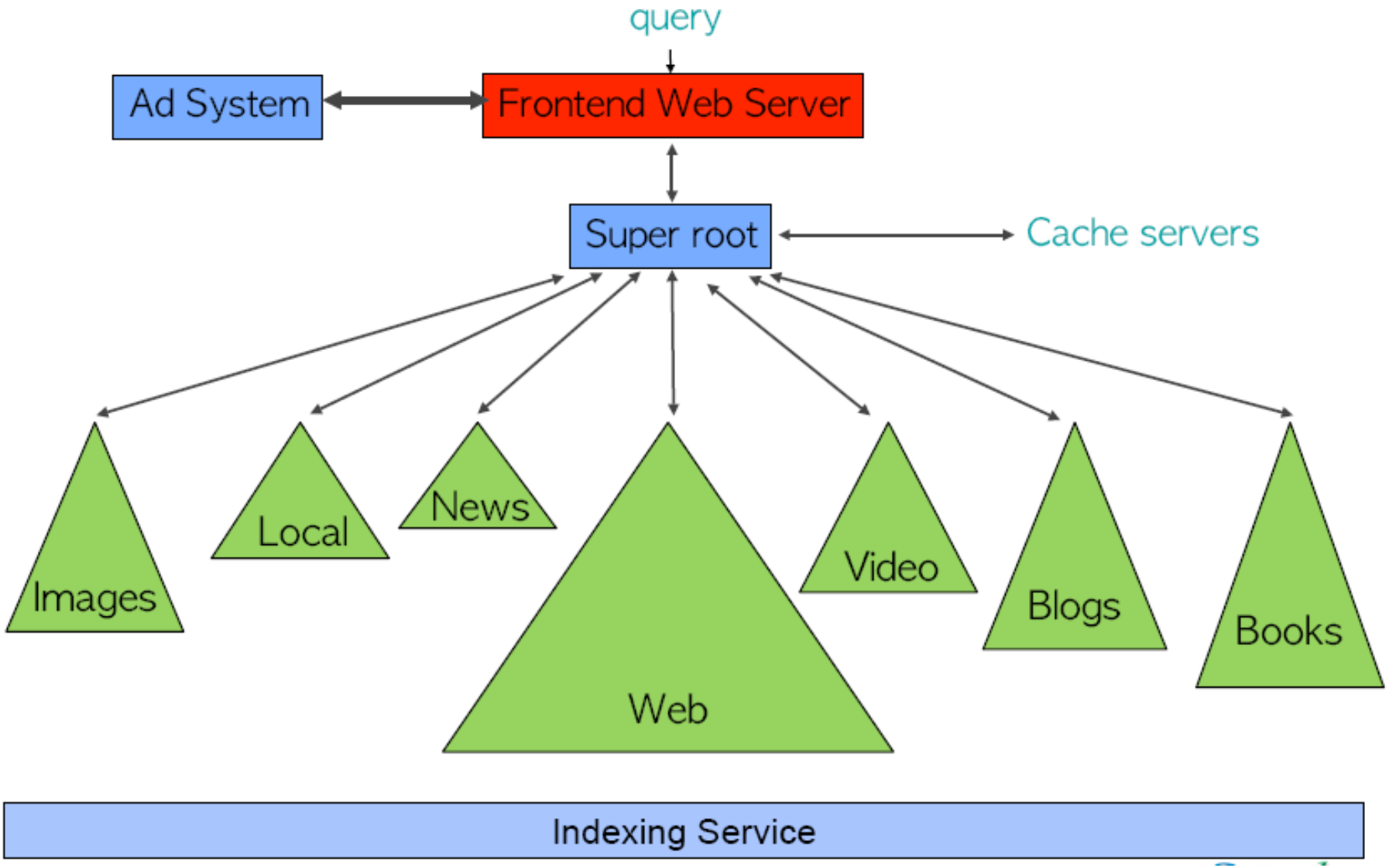
- Current large scale computing



Server design 2004



2007 universal search



Late 2009: new **'Caffeine'** engine

Google Caffeine

- 11, Aug, 2009 “Google unveils new "Caffeine" search engine.”
  - Just after the partnership between Yahoo！ and Bing
  - To make the search process much faster, more intuitive and overall produce results with greater accuracy for the user.
  - The new architecture is said to include size, indexing, speed, accuracy, crawling and ranking changes.
- Some conclusions:
  - Returns results at over double the speed to the current Google.
  - Places more reliance on keyword strings rather than exact phrases.
  - Gives greater weight to authority domains and social media, e.g. blogs
  - Gives increased weight on domain names
  - Have more accurate real time results in an effort to match Facebook and Twitter’s real time search engines.

Challenges (1.1) – Scale

Beyond system architecture:

- IR methods need significant rethinking
  - idf
    - How meaningful is idf in a heterogeneous collection of this size?
    - All words have very high idf
  - Stemming
    - Often used as a recall tool
    - Do you really need recall when you have 1 trillion docs?
  - Query expansion
    - Is it at all needed? Does it work? What about query drift?
    - How fast can you do it? What is the effect of slowdown on user?

Challenges (1.2) – Scale, and quality

Search Engine	Reported index Size	Page Depth
Google	8.1 billion (Dec. 2004)	101K
MSN	5.0 billion	150K
Yahoo!	19.2 billion (Aug. 2005)	500K
Ask Jeeves	2.5 billion	101K+
All the Web	**152 billion**	605K
All the Surface Web	**10 billion**	8K

Battle for the index

From Danny Sullivan, SearchEngineWatch web site

2002.12

"Absolute numbers are no longer useful" -- by Google, Sep 27, 2005

- How big is the Web? – 5 billion is enough

  -- by Kenneth Church (Microsoft Research), Jan, 2008

Challenges (1.2) – quality

- Misleads its human readers as well
  - Wrong info
    - e.g. 1st president of USA is Thomas Jefferson,
  - Misleading medical information
  - Once correct, but out of date
    - e.g. election result, #hurt in one accident
- Perhaps a good start point
  - Link analysis
    - PageRank, HITS, BrowseRank, …

Challenges (1.2) – quality

- An interesting point —

  Evaluating the quality of *anchor text*
  - High quality pages → low quality anchor text?
  - Judge the quality of anchor text independently?
  - Anchor text: editorial or purely descriptive?
  - To identify multiple themes in documents?
- A promising area of research —

  established quality judgments

  (link + text + user behavior) based analysis

Challenges (1.2) – quality evaluation

- Users are reluctant to give direct feedback
- Using log data
  - Still incomplete
  - **User's click** = **the page is useful**

- Collect the click-through data
  - Under some **weak assumptions**
    - Click-through of ranking A > Click-through of ranking B

      If and only if A shows more relevant info than B
- **A necessary and important rising research field**
  - **User behavior reliability analysis**

Current progress: Finding high quality pages using query-independent features

Data set	English (.gov)	Chinese (.com)
# pages	1,247,753	37,205,218
Total size	18.1G	558.0 G
#Queries / #target pages	100 /2631	650 / 48930
Found high-quality pages	52.00%	4.96%
Target pages recall (training set)	95.53%	92.73%
Target pages recall (test set)	93.57%	92.37%

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To be continued …