Data Discovery on the Information Highway

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Introduction

- Information overload on the Web
- Many possible search engines
- Need intelligent help to
  - select best information sources
  - customize results
  - browse the Web
  - handle non-textual information

ProFusion: Searching the Web

- Many search engines
  - different spiders
  - different retrieval algorithms
  - different results
- Which to use?
  - differs depending on query
  - generally want information from more than one

Distributed Agent Approach

- ProFusion is an Agent-based meta-search engine which communicates with multiple, distributed search engines
  - http://www.designlab.ukans.edu/profusion
- Routes user queries to most appropriate search engines
- Communicates in parallel
- Fuses results returned

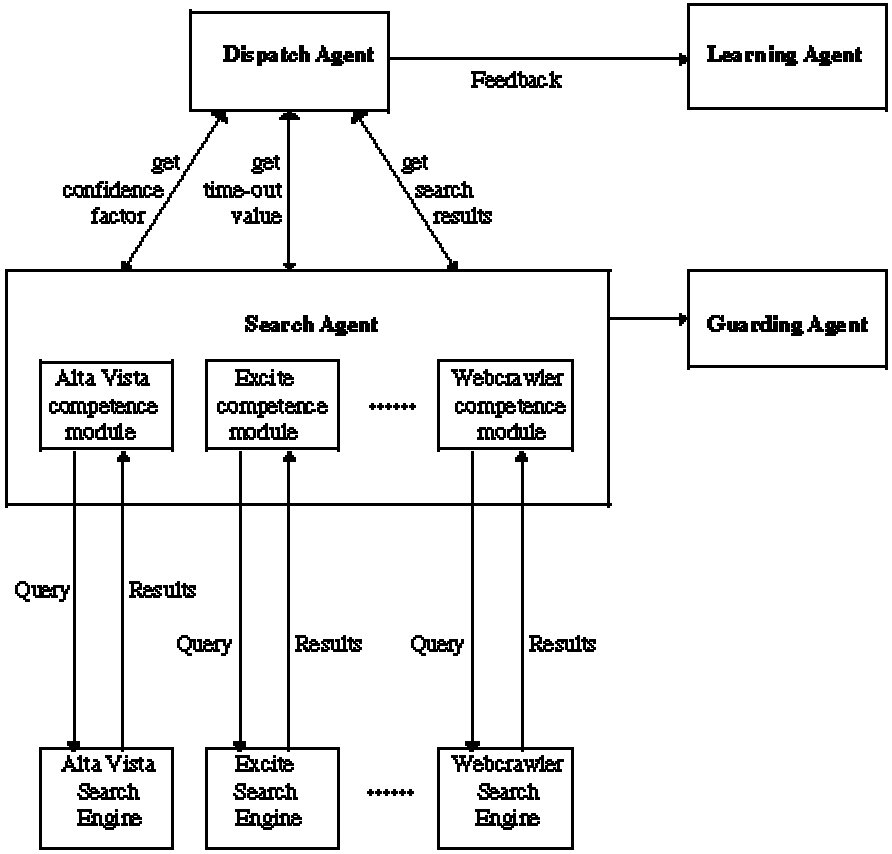
Architecture

- Knowledge Sources
  - no private index
  - meta-knowledge about strengths of search engines with respect to a collection of categories
  - lexicon which associates word with the same collection of categories

Architecture (cont.)

- Agents
  - one Broker Agent which controls search
    - routes query to most appropriate search agents
    - fuses information returned
  - one Faciliator Agent per search engine which communicates with it
  - one User Information Filtering Agent which identifies new information for registered users

Figure 1. Agent Intercommunication and Control Flow Diagram



Dispatch Agent: Query Routing

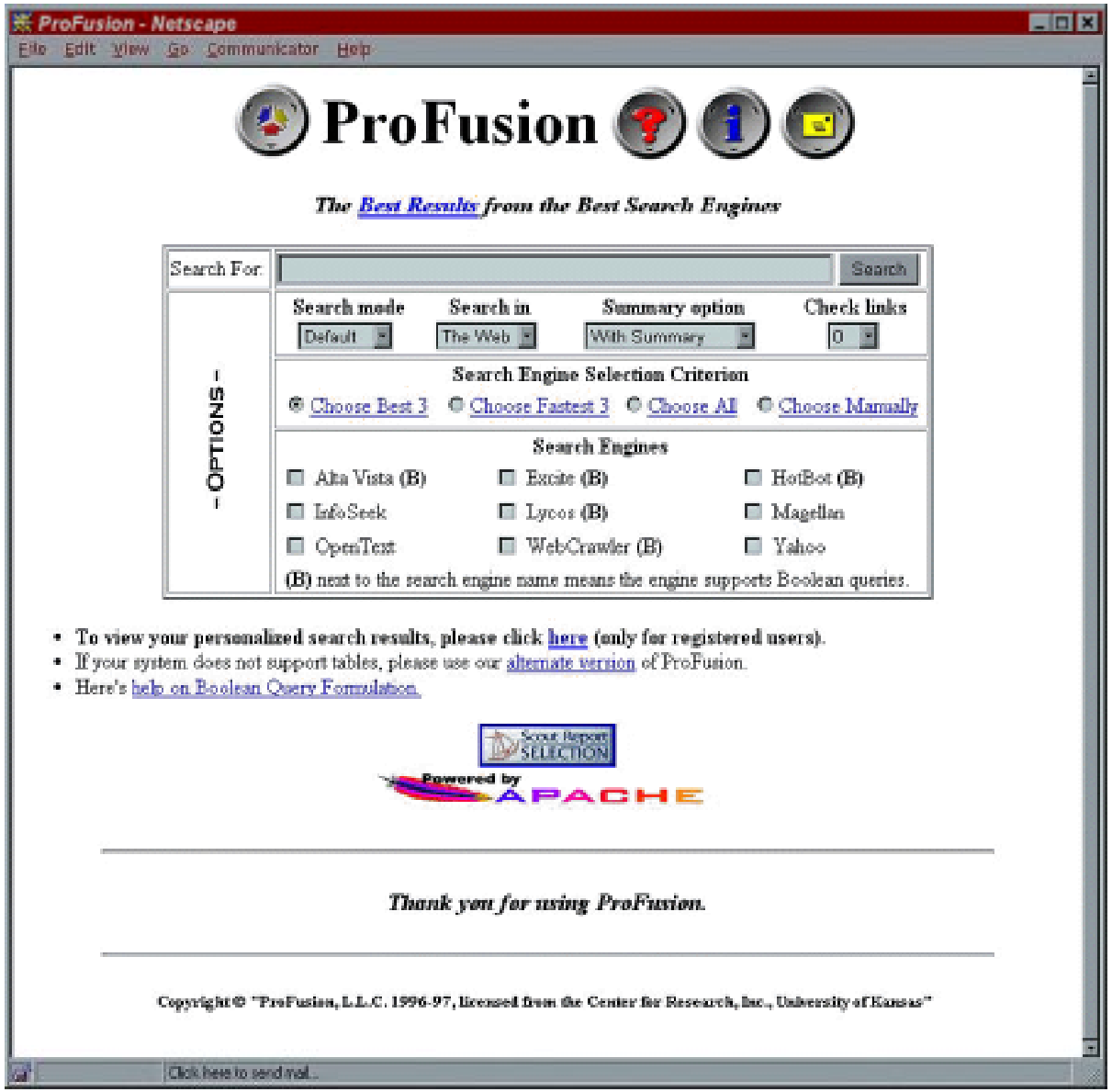
- for each word in query
  - use lexicon to map from word -> categories
  - use meta-knowledge to map from categories -> top three search engines
- if no query word are in dictionary, use default best three

Dispatch Agent: Fusing Results

- rank order results
  - normalize scores for all retrieved urls
    - search engines report match values differently
  - multiply score by confidence factor for each search engine
    - average value of performance over 13 categories
  - rank order based on result
- remove duplicates and broken links

Search Agent

- encapsulate knowlege for each underlying search engine in a “competence module”
- map from standard query representation to specific syntax for each search engine
- connect to, and receive results from, search engines
- parse result page and extract contents into standard format (URL, weight, title, summary...)
- normalize weights



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ProFusion Results - Netscape

File Edit View Go Communicator Help

Results from your search: "Pentium memory prices"

AltaVista contributed 10 items.
Excite contributed 10 items.
HotBot contributed 9 items.
Retrieved 27 unique item(s).

To automatically receive updates on this subject, click GO

Ranking Title

1.0000 Prices: Pentium 133Mhz
URL: http://www.coiinc.com/prices/p5-133.html

Summary: CII Sterling Pentium 133Mhz. Mini-Tower or Desktop Case. Intel Motherboard w/512K Pipeline CACHE. Intel Pentium 133Mhz CPU. (Upgradeable to a P5-200 Intel.

0.9500 Denny's Prices : Pentium Systems
URL: http://www.nightowl.net/~dfry/prices1.html

Summary: Denny's Prices : Pentium Systems. To place an order call at Phone (314-285-4434) or send me Email at : Denny Fry. These Pages are designed and mantained...

Learning Agent: Adaptation

- adapt to network load
  - monitor and set individual time-out values
- adapt to broken search engines
  - identify down search engines
  - prevent them from being selected
  - invoke guarding agent to periodically check status

Adaptation (cont.)

- adapt to changing search engine protocol
  - generic pattern matching grammar for parsing search engine results
- adapt to changing search engine performance
  - automatically calibrate quality of search engine results in each category
  - adjust confidence factors based observations of user behavior (which item in ranked list they select first)

User Agents: Personalized Search

- Users may register personal queries with ProFusion to be automatically re-run on a periodic basis
- Query results are presented in three categories
  - new
  - relevant
  - possibly relevant

ProFusion: Current Thrusts

- index own collection to support searching personal collection
- characterize personal collection with respect to personal taxonomy
  - basis of browsing contents of personal collection
- incorporate user's feedback to filter out and prioritize new results

Extension: Distributed Search

- currently, spiders collect all information centrally
  - lots of traffic, disk space, overloaded sites
  - “supermarket” approach
- dispatch queries to “best” sites
  - “specialty store” approach
- challenges
  - identify the best sites for each query

Distributed Search: Site Agents

- index own site to support local searches
- characterize site with respect to global taxonomy
  - meta-knowledge for routing queries to this site
  - basis of browsing contents of a specific site

Distributed Search: Brokers

- collect meta-information from Site Agents
- route queries to most appropriate sites for distributed processing
- browse Web via meta-knowledge (taxonomy of sites/pages automatically collated from collected meta-information)

Discovering Video Information

- VISION: Video Indexing for SearchIng Over Networks
  - create a database of video clips indexed by their associated closed captions
  - locate related information via Web searching to augment video clips
- Goals: entirely automatic, real time

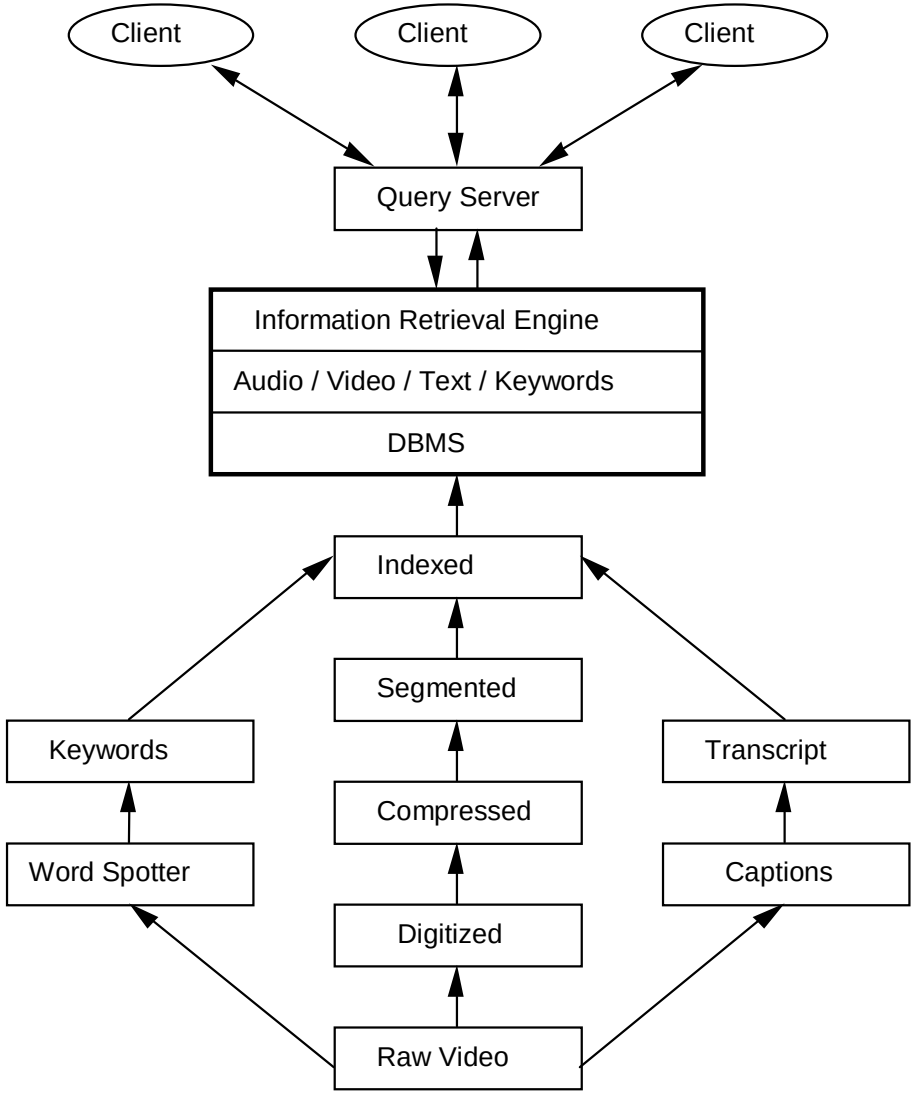

Figure 1. The architecture of the VISION Digital Video Library

Summary

- many sources of information
- need a consistent interface to locate information regardless of
  - where it is
  - what format it is in
- one source is not enough
  - locate and fuse information from multiple sources