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If Search is the Answer, What's the Question?[1]

Well, 2006 has just started & it's been 18 months since the Google IPO. This past year & a half could truly be called the "year of search". What has happened to take search from the realm of mathematicians & core software developers to the hot, maybe the hottest, technology of the last several, & perhaps the next several years? Good question – answering it would require describing not only the evolution of search technology, but also a host of associated areas such as classification, ontological modeling, natural language processing, explanation & case-based reasoning, semantic web & RDF-based operations etc., etc. There are many such descriptions (see, for instance: http://www.searchenginewatch.com/), & I'm not going to give one here except to say that search cannot be discussed today without touching on these & many other fields, all of which were seen as separate as little as 10 years ago. Search effectively encompasses all of these areas because of **how people expect to use it**, & that's the real reason why search is so important, because of how peoples' work process will evolve. This is the question that search is the answer to – "what is the structuring technology for how people will work in the near- future?"

Google went public on August 19th, 2004 with an opening stock price of $85US. As this is written, its stock price is $421.31 with a market cap of $132.7B & an operating margin of 34%. It has traded as high as $446, & just as a comparison, General Motors has a market cap of $11.3B & Boeing has one of $56.7B, which is % & 42.7% of Google's market cap respectively. Of course GM has an enterprise value (value of financial vehicles, capital goods, property etc.) of $273.8B (& Boeing of $63.5B), but that is a different story… Google & its primary challengers at this time, Yahoo & MSN (Microsoft) are competing in two important areas: search technology is at the core of each companies offering, but business model, & in particular the realization of advertising revenue, is just as important to these companies' success. Business models, however, are not the primary focus of this analysis.

[1] With respect to Danny Bobrow for his 1985 paper If Prolog is the Answer, What's the Question? IEEE Trans. Softw. Eng. 11(11). – perhaps the most insightful paper on the logic of AI languages ever published (with the possible exception of Doug Lenat's paper on why AM worked…)

What do we mean when we say search technology? The list could include general web-based search, desktop & intra-enterprise search, highly specialized search for specific industry or research segments, geospatial search, local search, retail & shopping search – I could go on. A case could be made that each of these is a separate, specialized search type that must be addressed with different algorithms & end-user interfaces. This makes for clean & distinct technology & business models. Unfortunately, it is not the case. In order to be able to understand the search landscape enough to determine what is important about it, & how it will develop over the next 3-6 years, we need to examine & begin to understand how people are going to work over this period of time.

The last five years have been pivotal in the development of technologies for the organization & use of information & knowledge. These developments include:

- Middle & client-tier component models (JxEE/EJB, .NET) & their associated interfaces, programming models & application servers
- Service based architectures & their associated application models (initially web services)
- Various distributed information management models (federation, local & web caching, web & network-based storage models, P2P…)
- Data, information, application & (perhaps soon) process integration models & methodologies
- Higher-level extension & integration of information models (ontology-based modeling, semantic web, RDF, etc)

These technologies have, for the most part[2], enabled people's work process to evolve in productive ways. I believe we are about in the middle of a ten year (😎) cycle of the development of work process described as follows.

The first thing we need, though, is a definition of work process: it is what people (& organizations) do everyday to further the business – it includes various forms of collaboration, connectivity, communication, formal & informal tasks, production of deliverables, etc. – essentially, their work. It may include business process, that is part of the formal task structure may include structured tasks related to specific business goals & its associated business (programming) logic; & it also may include many liaison & communication based tasks as well as interaction with a broad variety of application systems & information & knowledge sources.

The first two years of this cycle were focused on content driven work process; that is work process that was mainly aimed at content production, management & usage. This was a continuation of the primarily individual production of work products although some collaboration was necessary for editing & development larger-scale work products. Search in this phase was used for general research & was aimed at the web, enterprise & individual desktops. This phase ended in 2004.

[2] An examination of how these technologies have impeded the evolution of work process would be an interesting topic for a future Strategist paper.

The next four years of work process evolution are focused on collaboration & process innovation. This phase is driven by content, enhanced information management & development & execution of complex business process. Search transitions in this phase from a way to facilitate business process by location of content to a way to structure work process. It is aimed not only at general web, enterprise & desktop content, but increasingly at specialized information location & identification & use of patterns in information & process. We are halfway through this phase which will last until 2008.

Work process in the final four year phase is knowledge & model based, that is the work that people do is structured around fine & coarse-grained business models & knowledge-based processes that make such models operational. These processes are a mixture of individual & group efforts that need to be managed & coordinated across geographic & temporal boundaries in ways that were not possible previously. Search in this phase becomes not only a way to structure work process, but a way to facilitate problem solving. Figure 1 shows a visual representation of this work process evolution.

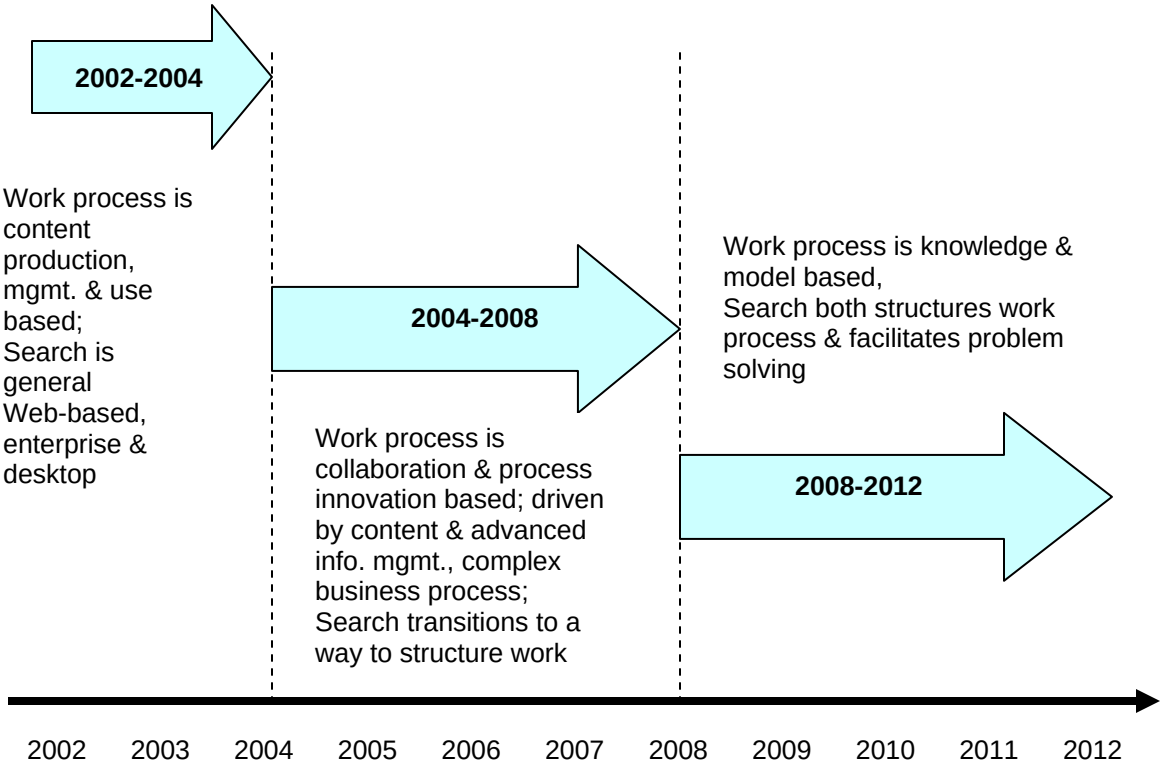

Figure 1. 10-Year Work Process Evolution

The way people work is changing, this is obvious – what's not so obvious is what these changes are & how they affect the tools that people use to facilitate & accomplish their work. Search is a prime mover in the transition from work that is centered on content production & analysis to work that is centered on process & model innovation. During

this transition, search will have to evolve itself from the ubiquitous web & enterprise engines of today that still mainly operate on key word & page rank algorithms to much more deeply focused tools. These tools will be able to refine their operation by using coarse & fine grained models, not just of business, but of more general knowledge categories. They will initially be able to structure work process because of their interactions with such models & eventually, in the 2010-2012 timeframe, facilitate work organization & problem solving as well as location of general or specialized knowledge in the context of a person's work (or personal) process. This will require the integration with search of such areas as classification, ontology-based & advanced metadata (currently RDF & geospatial but also evolving quickly) modeling, rule-based reasoning & non-deductive reasoning of various forms – this is just the beginning, but we are already seeing some of these advances in products such as Mooter, Clusty or Grokker or in the integration of rule-based reasoning with business process management &/or ontology-based modeling (Protégé, Swoop). We are also seeing the development of some of the kinds of models that will be necessary, c.f. SUMO/MILO(http://www.ontologyportal.org/). This work is just at its beginning.

OK – as the great Yogi Berra said, "Prediction is hard, especially when it's about the future". Several things appear to be (IMHO) obvious though:

- People's work process is rapidly evolving to include not just formal business process, but also knowledge & model based processes
- Search can be a central function in this evolution as it also evolves to become a tool to facilitate the context-based organization of work (& personal) process & eventually a tool that provides coarse & fine-grained problem solving capability
- This evolution will take the next 3-6 years, but the beginnings of it are visible now in the form of such technologies as: the integration of classification with search, the integration of business process management with rule-based reasoning, large & small scale ontological modeling, etc.

Search, therefore, does appear to be an answer - & the question is "how will people work in the near-future?"

As always, the opinions, predications & errors expressed here my own (DJH). Comments are welcome (david@hartzband.com) &…

remember – entropy requires no maintenence