Systems design issues for social media

Bill Howell, versions sent out: Previously part of "Semantics beyond search" paper of which the 1st was 19May11, split off 29Aug2011, current 30Aug2011, 30Dec2011 end of writing

Summary

In discussing social media with IT/MIS professionals, it has been my experience that they tend to look at the new capabilities as yet another relational database system to fit into the Business Plan and standard systems analysis tools that they have become accustomed to. To me, these approaches are well suited (or well-practiced, which isn't the same thing) to "stagnant, established" technologies that are extremely well understood, and which are highly predictable. But they are poorly suited to breakthrough technologies with very different conceptual and theoretical capabilities and impacts, and which by definition are immature and rapidly changing.

With respect to building social media capabilities into government IT systems, given their very immature state at present, rather than focus on specific ideas it is more important to consider **3 themes**:
1. Identify & cull a wide diversity of concepts that are being proposed or implemented around the world; and given this understanding…
2. Plan and develop IT systems to allow for the easy integration of new toolsets, processes and systems, many of which will be completely unknown and unpredictable at the time of integrating current capabilities (such as Facebook, Twitter, etc) into government systems. In this light, it is more important to design our IT systems to be open to accommodate new unexpected capabilities, rather than to provide a shopping list of semantic or social graph capabilities to select from.
3. Allow for "multiple conflicting developments" – demonstrations to try out many ideas and see what works in the "social media marketplace".   It for to easy to over-emphasize analysis and planning when both are of limited effectiveness.

This can be considered as the main recommendation from this report.

It is my assumption that the most important social media capabilities will be neither predictable nor well understood in their initial stages. Within that context, the current document is a limited, random look at several potential tie-ins between semantic technology concepts and work-environment applications. A second document will deal with social graphs and social sets ("…   the heart of Facebook   …"). **In both cases the intent is to push the three themes above.** A third document is planned for criteria and constraints of IT systems to achieve openness, flexibility, reliability, and robustness.

Any value of this paper will arise if it succeeds in driving thinking by others, if that in turn affects proto-types and demonstrations of new social media concepts, and the approaches to how that can be driven.

This draft paper is only "half-complete", as the area of "social graphs and sets" has not yet been addressed. I also require assistance, both from "classical MIS/IT systems" types, and those from completely outside that perspective, to criticize and augment the material in this draft. The latter group might include some relational database types if, for example, the use was entirely unconventional, as was the development approach and design.

Endsection

Status as of 30Aug2011:

- Part II.4 "Implications for social media and other platforms" - is the next target for work. This may help to explain and bring out related issues from readers.
- Part III and the Appendices – have NOT been adapted from the "Semantics beyond search" paper, which in itself is still incomplete and in point form in the corresponding Parts/ Appendices. Most sections won't be flushed out before the paper deadline.
- NO work on systems-related issues of "Social media: potential new capabilities arising from social graphs and sets" has been done yet, and that will have to await completion of a third paper of that name.
- NO assistance yet, both from "classical MIS/IT systems" types and those from completely outside that perspective, to criticize and augment the material in this draft. I am weak on many of the themes and areas.

endpage

Table of Contents

CAUTION: Please note that this document is largely drawn from home projects and posting of Bill Howell, mixed in with learning from discussions with friends, within the SPINE project, and at related workshops. It is adapted here to the context of social media as per the SPINE project at NRCan. There is therefore a strong personal bias and background perspective to this document, which limit its generality.

DOUBLE CAUTION: Systems and compiler design is NOT my field, nor have I made a special effort to read into it extensively. My own exposure has come through the papers and discussions of others, primarily via computational intelligence conferences, journal papers, and emails.

Part I - Semantics, Social Media, and Workplace Applications

Introduction

In discussing social media with IT/MIS professionals, it has been my experience that they tend to look at the new capabilities as yet another relational database system to fit into the Business Plan and standard systems analysis tools that they have become accustomed to. To me, these approaches are well suited (or well-practiced, which isn't the same thing) to "dead, established" technologies that are extremely well understood, and which are highly predictable. But they are poorly suited to breakthrough technologies with very different conceptual and theoretical capabilities and impacts, and which by definition are immature and rapidly changing.

It's not even clear that conventional IT/systems approaches are even relevant to the current stages of social media, if I define that to be experimentation and prototyping, as compared to early implementation for more established capabilities (such as exemplified by gcpedia for wikis, gcconnects for social media, and gcforums for blogs). In other words, conventional IT/systems approaches will limit current social media implementations to the already-established Twitter & Facebook capabilities of "chatter and information" (group email?) on the scale of seconds to a week. While that is certainly useful (especially for dynamic project teams etc), it falls far short of the mid-to-long-term potential of social media as introduced in a limited way in the paper "Semantics beyond search: Part I - Semantic applications to the workplace – random thoughts". The paper "Social graphs and social sets" will address even more powerful and far-reaching capabilities to be expected of social media, which are a much worse match for conventional systems.

Perhaps a very rough analogy is the "life cycle" concept for the rollover of manufacturing industries, in that the may pass through stages as follows (wherein corporate leadership tends to have the backgrounds indicated):

1. Science - There are few or no companies at this stage, and the technology doesn't work yet and/or is not competitive.
2. Engineering – New technology (products, processes, plants) works and provides benefits such that early starters may "milk" high-value applications even if the costs are still high. That helps drive rapid technology development and industry growth.
3. Operations -   Many competitors have jumped into the market, and competitive advantages (such as better fits to client needs) may be important as dominant players shake out.
4. Marketing - The market is healthy but mature, and competition is strong and has similar offerings. Differentiation, service, and niche client needs are important to success.
5. Financial - The industry/market is declining, with intense pressure on competitors, who are now especially vulnerable to financial pressures and weaknesses. Mergers and takeovers are important, perhaps as special products/ services in larger conglomerates.
6. Legal - The industry is dying due to substitutes of a lack of need for its product / service, or severe social pressures for change create legal challenges that require a legal

Don't take that analogy too seriously, but perhaps it helps to point out the difference in addressing "new social media cpabilities" (stage 1 or 2, not yet implemented) from standard systems (MIS/IT/relational database) – which is stage 4 and 5.

As mentioned in the companion papers ("Semantics beyond search", and "Social graphs and sets") it is my assumption that the most important social media capabilities will be neither predictable nor well understood in their initial stages. This isn't such a brave statement given that our use of current technologies is hamstrung by not fully recognizing important long-standing capabilities and constraints. For example, end-user definable access control and text search capabilities are still poorly appreciated by IT specialists and end users in spite of several decades of examples, and several decades of "crippled applications". Think of how often "collaboration" is limited to a barrage of emails back and forth to members of a community or project, then think of how messy it is to track and check that information when you don't have the time to file, summarize and arrange it.

Concept development is best described as a evolutionary process in an open competitive market, with most of the key breakthrough ideas coming from non-institutional sources (eg some [hacker, student, academic] on a computer at [home, school/ university, company]). Within that context, the current document is a limited, random look at several potential tie-ins between semantic technology concepts and work-environment applications (see the section "Semantic applications to the workplace – random thoughts"). A thorough literature review has NOT been done, and most of the thinking is based on my own hobby interests at home, combined with news items that have arisen within the "SPINE" project at work.

With respect to building social media capabilities into government IT systems, given their very immature state at present, rather than focus on specific ideas it is more important to consider **3 themes**:

1. Identify & cull a wide diversity of concepts that are being proposed or implemented around the world; and given this understanding…
2. Plan and develop IT systems to allow for the easy integration of new toolsets, processes and systems, many of which will be completely unknown and unpredictable at the time of integrating current capabilities (such as Facebook, Twitter, etc) into government systems.   In this light, it is more important to design our IT systems to be open to accommodate new unexpected capabilities, rather than to provide a shopping list of semantic or social graph capabilities to select from.
3. Allow for "multiple conflicting developments" – demonstrations to try out many ideas and see what works.   It for to easy to over-emphasize analysis and planning when both are of limited effectiveness.

Leading into mid-to-long-term plans and expectations

As stated in the separate paper "SPINE – Semantics beyond search", some of the "semantic applications" will likely be in use within a year or two in their simpler forms, others may require 5 to 15 years before they become commercially available, and a few applications may take a much longer time to mature.   Others still may exist only in a hybrid man-machine form for a very long time. ***But even if a tool is not immediately available, it is still important to be aware of the potentially arising capabilities and the requirements of their***

***underlying systems*,** which may help orient current development and implementation projects, especially with respect to:

1. **Openness & transparency** - keeping new systems open to new capabilities that will emerge. I can't say enough about this, that any real developments will be by local, autonomous groups who can "reach into" existing systems, and build ion this with new tools. Forcing everything through central, highly-constrained development groups may be good for brining in complete IT systems, but probably not for chasing local priorities, and later selecting the best results in different areas as a basis for thinking about larger organizational needs and available systems.

2. **Planned obsolescence** - We normally want big, expensive systems to last, but being realistic about it, that only occurs with technical, application, and market maturity. There needs to be - for immature, developing capabilities - an expectation that toolsets and systems will NOT have a long life, and that organizational resources will be needed to handle throw-out and new-in roll-over of systems. DFAIT seems to have done this with their IBM Connections system, being careful to "zero-base" the next step.

3. **Expensive action** - We often underestimate maintenance costs for "static" information systems, but evolution and experimentation is much more expensive, and will lead to many "dead-ends", with concomitant costs to rescue the data. Furthermore, benefits can be qualitatively unknown and unpredictable, let alone being close to unquantifiable. This situation does NOT match "standard operational" mindsets and processes.

4. **Stand back and watch** - Given the risks and costs, many organizations will decide to stand back and wait, purchasing last-generation technology that has established and proven itself, or implementing newer capabilities when there is at least a greater comfort that these new capabilities will at least pay off in the short term for priority organizational needs. However, even a passive approach does NOT mean inattention – as changes to data, functions, processes and systems might be easy to implement with time such that later purchase of a new social media system has an "organically grown, compatible" environment of information and systems to feed off. *[25Aug2011 Howell – examples would help here – perhaps refer to items later in document]*

5. **Local autonomy** - ALL of the issues here are strongly affected by the perspectives of "local groups" within an organization. The "overall perspective" of an organization is at best a poor compromise, as we are used to seeing with classical information systems. With new technology and concepts, the relative benefits, costs, and adaptability might vary enormously across different parts of an organization.

   Development of working prototype systems in local environments has HUGE advantages as compared to conceptualizing, designing, and implementing complete systems over the whole organizations. Localized "experiments" appears to me to fit better with evolutionary theory, and with organizational risks and benefits. Note that various groups working independently on their own approaches also puts pressure on the "Openness" and other considerations in this sub-section, helping to drive themes in this subsection in a practical sense.

Note that for "Local groups", many of the challenges in this sub-section tend to evaporate. The selection of a commercial package, or internal development, is a relatively quick decision that easily accommodates the strengths and weaknesses of the individuals in the group. Timeliness cannot be address by a large central initiative, but is a real strength of the local environment and local decision-making.

6. **Growth versus steady-state** - As illustrated by the now-current "Shared IT services" across the federal government of Canada, there are tremendous economies with the standardization and centralization of systems, so there is always a strong pressure to do this where possible.

7. **Theory and planning versus Evolution in a competitive environment** - As a starting example, while the "Shared IT services" is often presented as innovative and improved management ideas, it is actually a rather robotic, predictable, and delayed outcome of massively faster and cheaper networking (versus local servers & storage). Management theory is often simply an automatic consequence of technology changes (capabilities and costs in IT are but one example). The process is usually more one of inertia and blindness than inventiveness, and we are ALL guilty. Inertia is at least safer – blindly jumping in can really create havoc, as can even well-planned changes!

While the call above is to anticipate that major changes will occur, and to plan flexibility and adaptability into current systems in consequence, the other side of the message is that it may not be worth doing TOO MUCH preparation and adaptation, as the chances are high that anticipatory actions will be unsuited to changes that actually occur over time. Simple approaches may help somewhat (see section "II.3 Simple, starting principles"), and the process of thinking about changes may make it easier for small parts of the organization to pick up opportunities at the right time for them, even if the rest of the organization will only follow much later.

Multiple Conflicting Hypothesis for Social Media development

In the same manner that there are a vast array of toolsets available for social media, there are also many ways in which to approach its development. Here, then are a variety of simple "frameworks" for looking at the development of social media systems that may help to stimulate discussions and planning.

Two-generations-behind, low cost approaches - that avoid developments and stick with available systems:
1. Use Government Of Canada (GOC) systems that are already available –
2. Purchase commercial systems, following objectives, user needs assessments, and tests.
3. Use open source software
4. Implement crude capabilities via existing toolsets (eg hyperlink documents, spreadsheets, use macros etc0

Limited developments and toolsets

Full-scale deployment of "advanced capabilities" with "room to grow"
1. Hard to plan growth with proprietary systems – the assumption here is that you've picked the right supplier
2. Contribute dedicated teams of one or two people to open source systems to ensure that critical capabilities and features are developed and maintained.

endsection

Part II - Rapidly evolving Social Media applications: Influence on System architectures, processes and capabilities

This part of the document is "naïve", in the sense that I am not a [data, functions, process, applications, systems] designer with experience in classical areas, much less with Social Media, and less again with the semantic and, more importantly, with social sets, social graphs, and their dynamics.   As such, the reader should consider that the material in this part will be naïve, and it is only to "provoke" thinking on these issues.

II.1 Introduction

To repeat part of the Summary and the Introduction of this document:

> With respect to building social media capabilities into government IT systems, given their very immature state at present, rather than focus on specific ideas it is more important to consider **3 themes**:
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>
> This can be considered as the main recommendation from this report.

The theme of this Part II may be addressed more thoroughly in a separate paper at a later date, but it is important to provide at least some explanation in this paper. After all, as stated above, a main objective of this paper is to broader the understanding of semantics and roles it may play in new systems, and to keep these potential capabilities in mind so that system architectures will be designed with flexibility to better accommodate new applications and processes, many of which are simply unpredictable.

I fully understand that much of what I am suggesting will entirely fly in the face of the "right way to do it" as learned from decades of development of IT, MIS, Enterprise etc systems. I would like to point out that "classical" projects use 100% defined and known technologies, and worry principally about upgrades to capabilities and the development of business models etc. That is a COMPLETELY different situation from that addressed in this paper. If you are thinking in "classical" terms, you will miss the entire thrust of this paper. That will also be the case if I've explained things poorly (this is a high risk bordering on certainty for some points!).

II.2 Random, selected examples for implementation issues

The examples of this sub-section serve as illustrations of the basic theme of this paper, that anticipation (or lack thereof) of future capabilities can have an impact on the facility of adapting a system to new capabilities in a rapidly changing environment. Alternatively, one might decide NOT to provide flexibility for anticipated changes, and instead work on specifications and the initial framework of a completely new generation system with a planned implementation date, partially dependent on client and competitor pressures.

SharePoint within MMS
SharePoint's implementation within MMS was focused on collaboration within the sector ONLY, and I do not have any idea of what the "take-up" and impact has been. For persons such as me, there is very little value beyond the capabilities we already have to systems that are restricted to the sector, and which provide almost no end-user control over access even within the sector.

Web 2.0 in the federal government of Canada (gcPedia, gcConnections, gcForums)

DFAIT – IBM Connections and NGOs

OpenText – G20 System

Google Plus - **Facebook's desperate reaction**
On 24Aug2011, and article in the National Post highlighted Facebook's announcement to implement new user controls over the accessibility of individuals and groups to content that has been posted. This is a sudden, strategic reaction to the flood of users away from Facebook to Google Plus, launched only ?date - in the Spring of 2011?.   In other words, Facebook was just as blind as legacy IT administrators to the importance of end-user usage of features that have been part of operating systems for over 40 years!   Facebook could easily lose their lead simply because they failed to understand "ancient, classical technology"!   It's wonderful how only competition can force thinking, given that the "experts know better" attitude prevents critical changes from happening.

What will be very interesting is the MANNER, speed and quality of solutions that Facebook comes up with, as retro-fitting those capabilities could be problematic, inefficient and disruptive given that their systems were not designed for that from the start. However, given that a serious revamp at the very foundation of Facebook will be required, it is a perfect time to implement

other fundamental improvements that they may have been thinking f for some time, and that will lead to capabilities that leap-frog past Google.

For the users who want to re-organise their legacy material, implementing access controls over mountains of past material will also be a great challenge. But I suspect that most will leave the old "public" material as is, and implement access controls on newer material, groups, themes etc.

II.3 Simple, starting principles

Although obvious, it's important to re-iterate key basics for systems:
- security & privacy -
- stability & robustness –
- survivability

Less is More – Small, compact, powerful, flexible – like the C programming language & Turbo Pascal

Native data formats, and importing from disused software

Direct access to data in native format throughout the architecture and across applications, but subject to security

Scotch tape and bubble gum instead of a user interface?

Working on work - develop capabilities with real initiatives, projects, and processes

Working with Islands of Technophiles

End-user access control, with inheritance, policies and automated flagging of exceptions or anomalies

II.4 Technology drive is still alive

This paper was partially inspired by the observed, multi-decadal lag between technical capabilities and individual's perceptions with respect to the application of "semantics" to collaborative systems and more recently to social media in particular.   This "generational perceptual and implementation lag" is a long-standing general theme of interest to me, having first noticed it in the areas of [economic and social] [theory and policy], and seemingly present in most if not all areas of expertise.   Another drive was a repeated observation of the "relational database only" mindset of friends and colleagues from those environments, both in government and industry.

Essentially all social media users and IT providers will float along with their already-established thinking and practices, providing incremental advances and improvements. For the purposes of discussion, let's call them the "surfers". However, extremely rare individuals will be pouncing on technical capabilities in an imaginative way, building the new breakthrough concepts, capabilities and applications of tomorrow.   Let's call them the "breakers" – as their innovations tend to destroy current thinking and systems. Obviously, "surfers" and "breakers" makes for a ridiculously over-simplified dichotomy, and in general the 2 main reasons for employing dichotomies to complex systems are Pedagogy and Propaganda.

While "breakers" may focus on identifying client needs then selecting the best set of technologies to provide those needs, my interpretation of computing history is that a pure science/technology drive alone is sometimes enough, and my guess is that this may even be the main form of "immediate revolution" occurring with new science & technology, especially where the "breakers" are already well established in an area and can quickly recognize the potential breakthroughs of new ideas for their clients. "Surfers" will tend to lag market adoption of the new ideas, picking it up when clear trends develop with client adoption. To them, Part II is really "under the hood", and does not require their focus or incite their interest.

Technology-versus-needs drive

It is commonly stated that the critical focus of the social media is on people, groups and collaboration, and NOT on technologies. To me, this is somewhat nonsensical. First, marketing ANYTHING is best accomplished by carefully matching client needs in a deep way, and providing great value for the money. Second, people 5,000 years ago were no dummies – they did the same. The differences now are the technology enablers and the dramatic reductions in cost. The social media and related revolutions (Facebook, Twitter, Blogs, YouTube, and soon-to-be replacements and alternates) are ingenious blends (accidental or not) of technical-economic opportunity and old or new client wants/ needs.

Machine-human hybrids and New humans

Rather than getting hung up on the "Technology-versus-needs drive" debate, perhaps a better way to express the key focus is the "hybridization" of human-machine capabilities in an intuitive, effective blend that is obvious to users. That doesn't mean that users don't adapt and learn – quite the contrary, as we can see from the adaptation of the revolutions that occur. I guess I really shouldn't address these issues in a document within the government. It's far more potential trouble than its worth.

Why don't we get it?

Other than using web browsers and simple uses of text in databases, these types of tools are NOT often used in the office place. In fact, text searches bring out the HUGE question of psychology and sociology as to:

- **WHY** it is only within the last three years that fully-indexed text retrieval is "thinkable" within our work-place (i.e. across all documents, emails, spreadsheets, databases, Powerpoints etc etc etc that we can individually or as groups "see" across the Wide Area Network (WAN) of workplace servers), and even then only to a limited number of people in a shallow context
- **WHEN** individuals have been using web search engines for a decade or more! And
- **WHEN** very effective, low cost software has LONG been available for doing that (albeit perhaps not always scalable for huge numbers of people – but I used Isys text retrieval since 1991 with great success at 400 $ purchase or something like that!)
- This example illustrates a HUGE cognitive threshold, when one wouldn't think that should exist!!

II.5 *Implications for social media and other platforms*

1. Keep the architecture and data "open and accessible" albeit "protected, and security-competent" at all levels to maximize the ability of others to build on or morph the systems. This implies at least access to well-commented source code and native-format data, and a minimum level of description of system-level architecture, data/ message/ process structures and brief outline-documentation of the characteristics of each component in the system (a paragraph or two on each, better if available). (Asking for too much documentation can kill it for everyone?).

Technology-versus-needs drive

Machine-human hybrids and New humans

I guess I really shouldn't address these issues in a document within the government. It's far more potential trouble than its worth. Even Gary Marcus' "Kludge" emphasizes the latter in spades, without ever mentioning the obvious!! (very smart guy)

endsection

Part III - Systems and Social Media: from the perspective of individual Technologies, and Toolsets

III.1 Background

This Part tracks the same technologies and toolsets as listed in Part III and the Appendices of the paper "Semantics beyond search".   Only selected items, or groups of items, will be commented on at this early stage.

III.2 Semantic-based office tools, processes and relationships

Classical pre-semantic tools

- Text search – through simple ASCII files
- Relational databases – extremely limited capabilities (from user perspective with user data)
- Spreadsheets – really the only
- Spell check
- Grammar-checkers - Grammar checkers are important, in that they illustrate an evolution of thinking away from Noam Chomsky's "rule based" grammar towards more a simpler, more general and powerful "pattern matching" pragmatic approach. That's not to say that a naturally-evolved system can't reflect underlying rules, nor is it to say that logic is an adequate framework for any such system.

Recent innovations with semantic tools

Google
Data-mining tools (?IBM-Cognos ?)
Semantic search engines

Other than using web browsers, these types of tools are NOT often used in the office place. In fact, it is a HUGE question of psychology and sociology as to:
- **WHY** it is only within the last three years that fully-indexed text retrieval is "thinkable" within our work-place (i.e. across all documents, emails, spreadsheets, databases, Powerpoints etc etc etc that we can individually or as groups "see" across the Wide Area Network (WAN) of workplace servers), and even then only to a limited number of people in a very shallow context
- **WHEN** individuals have been using web search engines for a decade or more! And

- **WHEN** very effective, low cost software has LONG been available for doing that (albeit perhaps not always scalable for huge numbers of people – but I used Isys text retrieval since 1991 with great success at 400 $ purchase or something like that!)
- This example illustrates a HUGE cognitive threshold, when one wouldn't think that should exist!!

Missing pieces of the puzzle

Saliency & priority
Rare event detection/ tracking (Osama bin Laden)
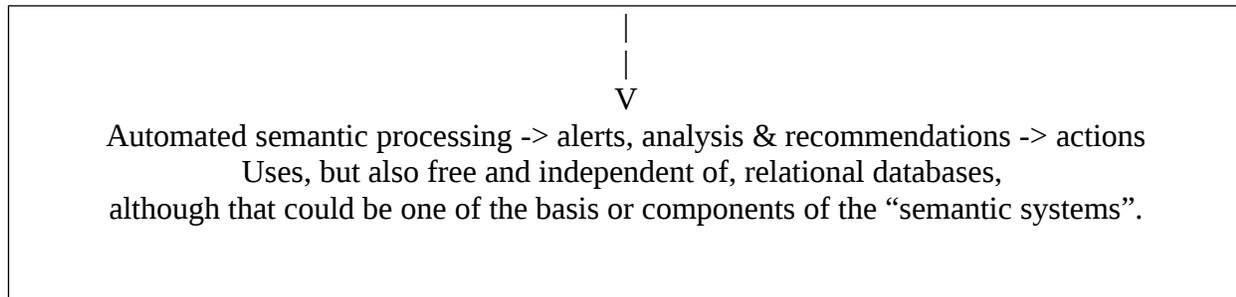Life – cheating theory and game theory
Machine consciousness (is it really that far away, at least in the simple initial forms of very limited capability, or is it already here in that simple form)

Semantic processing - An easy metaphor and example

While the appendices delve into a few more esoteric (less relevant) examples, perhaps a simple vision can be built through abductive reasoning. (*Here I use "simile, analogy, metaphor" as a working definition of "abductive" logic as a concept that belongs together with inductive and deductive logic. At least one "official" definition presents quite a different concept, and that is VERY different from the Wikipedia definition at http://en.wikipedia.org/wiki/Abductive_reasoning, so be warned.*)

Think of a semantic processor as an extension of the historical evolution of:

- Text processors - Word processors - Voice processors with general vocabulary voice recognition (I had a Sony device several years ago)	- Flat file database - Relational database - Spreadsheet	•	- Email - Calendars - Blogs - Meetups - Wikis - Social graphs & sets
External information – references media etc	Employee knowledge, expertise, education	•	•
Relational database implementations of Business Models Search engines – on the web, pathetic lack of progress on WANs & organizational systems News alerts – mass media or business information flow			

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                              V
   Automated semantic processing -> alerts, analysis & recommendations -> actions
              Uses, but also free and independent of, relational databases,
       although that could be one of the basis or components of the "semantic systems".
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Enterprise-level financial accounting, inventory, personnel, sales systems, management reporting and many, many other systems based mainly on relational database technology incorporate "business models and toolsets" to do a huge amount, variety and complexity of processing of all types of information. These systems automatically summarize, process, and abstract information to produce results of the type desired.

Relational dbs – more than spreadsheets – often a mistake! Locality of information, individual capability of building tools that will never arise from the formal frameworks.

In the same manner, by going one more step we should expect "Semantic processing" to also incorporate native format text, spreadsheet, database, email, social media, presentations and video, and high-level reports or updates, and to automatically process very general, very high volume data, information, and knowledge into pertinent, salient, abstracted information and recommendations, plus taking actions and augmenting a "knowledge basis automatically!

Perhaps the best examples are in the areas of security, espionage, and (IBM-Cognos maybe?) industrial intelligence?   But these are likely to be "invisible" to us.

endsection

Appendix A - Fashions & trends in systems design

The following listing is a sampling of my own exposure to semantic concepts over the years – it is certainly not an exhaustive list. Not that I remember it all anyways…

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