



INTELLIGENCE AUGMENTATION: *Information Architecture for a Digital Economy*

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Enterprises are innovating for the digital economy and data has become the fulcrum of innovation. In the digital world, the ecosystem is generating data every second - businesses, governments, citizens, machines and networks. The data has to be collected, understood and analyzed to create innovative products and services. Data centric innovations can deliver a wide range of business benefits - customer satisfaction, productivity, cost control, dynamic and personalized products and services and discovery of business insights.



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When such a fundamental shift is happening with data, there seems to be a contrast in the way information solutions are built within the enterprise and on the internet which is the nervous system of the digital economy. The consumer search engines have thin line interfaces waiting for users to seek information. It's possible to find information about anything one wants by simply typing into a one line interface. They use smart devices to browse, download applications, enjoy social networks, listen to music and use many more services at great speeds.

Life is simpler and easier with the digital world today. On the Internet, large volumes of data are democratized, with many sources like websites giving search engines access to information, and assistance to understand, organize, and identify.

On the enterprise intranet, the scenario is different. Information is in silos with diverse technologies, formats and structures across lines of business and access is not democratized. They need orchestration of data from diverse sources, both within and outside the enterprise as this provides innumerable opportunities for business innovation.

Knowledge workers are spending more than 20 percent of their productive time trying to find the right information. Knowledge workers need to give meaning to data and understand it unambiguously. Unlike the consumer world where the search engines provide a few thousand results when a user enters a keyword, knowledge workers need precise information pertinent to their roles.

The technologies of internet search engines and enterprise knowledge systems are creating breakthrough applications and thus driving innovations for dynamic search within the enterprise. Can we create a thin line interface akin to the internet world for enterprise users to get them the right information at the right time without having to use several applications?

Enterprise Information Management: The Four Principles of Success

The needs of an enterprise for the digital economy is to provide the right information on demand to people playing varied roles in an enterprise and answer questions with speed and agility. The technologies and architectures would need to break the data silos, understand the context of the business domain and the business processes that generate the data and deliver this through thin line interfaces like the internet search engines.

One can map this need to four key principles: discovery, find-ability, understanding, and dialogues. The intersection of these would give the enterprise areas to innovate for the digital economy. Let's look at these 4 principles in detail and see how they aid to creating a scalable and an intuitive information management system.

Discovery

Within an enterprise, silos of data assets could be in the following forms:

- Structured data from transactional databases and data warehouses
- Unstructured data from within the enterprise held in documents and email, and
- Data drawn from outside the enterprise through web content and social media.

Data virtualization technologies, such as Apache TEIID create a single fabric for diverse data sources, offering applications and users access to organizational data, while providing for data security. In this virtual environment, data repositories and warehouses can be added dynamically and information accessed on demand from multiple data sources, enabling information discovery.

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Find-ability

Find-ability covers the extent to which an information management system supports data navigation and retrieval, while enabling intelligence augmentation through knowledge models associated with the data.

Enterprises will need to leverage intelligence augmentation methodologies to view information in terms of data ontology. This involves deploying a formal method of describing entities and relationships in a domain along with their properties. Augmented intelligence will mirror complex internal relationships and captures the aggregated knowledge within a domain. These descriptions of data, in a domain-specific context, offer a better chance for finding relevant information.

Intelligence augmentation can be further used to create visualizations enabling rapid decision making. Big data analytics has moved from categorizing data to visualizing data. Here, data does not just look appealing, but has a context and is displayed in terms of its connection to other information. It functions as an information blueprint that enables more strategic decision making. Let's take the case of Proctor & Gamble that has institutionalized visual data as a significant management tool. Today, "Decision Cockpits" on their desktops represent key business information visually for all 50,000 P&G employees, while meeting spaces have embedded visual analytics from P&G's Information and Decision Solutions group that reflect P&G's market position across the globe and enable decision making.

Understanding

Understanding is about the contextual meaning, reasoning and making inferences to provide unambiguous results. Semantic technology offers a meaning-centered approach. In response to a question, it searches for topics, concepts, and associations that span a vast number of sources. It provides for auto-recognition of topics, with information extraction based on the ontology of a subject across structured and unstructured data from multiple sources.

Semantic search improves accuracy and relevance by considering the intent behind a query and the contextual significance of the words in the search. The technology provides users with a reply after it considers a search query in terms of its context, location, intent, word variation, synonyms, and foreign language interpretation. In this way, it narrows down the number of replies for a single query.

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On the Internet, this methodology has been utilized to create semantic search portals, such as Google's Knowledge Graph and Facebook's graph search. But now this capability can be leveraged within the boundaries of an organization as well, with tools, such as Thomson Reuters's Eikon 3.0. This market analysis and trading software offers users the latest updates from the financial markets at one place, with a semantic search facility that allows users to rapidly focus on relevant information.

Moreover, the single line interface offers users simple and rapid responses to complex queries, thereby facilitating market analysis in a user-friendly environment, similar to the Google experience.

Dialogues

Most users have questions that need precise answers. The need perhaps is for an answer engine rather than a search engine. Here, Natural Language Processing (NLP) can improve the quality of an information system's

response by offering a more complete understanding of the user's question. While much of the research around NLP has been associated with artificial intelligence, this also has tremendous implications for the capability to manage and search organizational information. An NLP system can even understand parts of speech and recognize words like 'what,' 'when,' and 'where' to determine the type of question that has been asked. It could even pick up words like 'for,' 'in,' or 'between' to connect various parts of a search phrase into something meaningful. The integrated capabilities of semantic search and NLP enable users to have a dialogue with information systems and get exact answers for their questions.

With the introduction of a question answering system, a user's confidence may grow and employees previously daunted by a task that required multiple steps, may now feel emboldened to ask any question.



Conclusion

Consider a digital enterprise of the future which needs the ability to create products and services dynamically for market differentiation, derive competitive intelligence, and respond to market needs with agility. Further, it will have to:

- a. Combine and harmonize information from many disparate information sources, such as journal articles, press releases, social media updates, subscription databases, internal products and services databases, internal business databases (licensing and sourcing) spreadsheets, emails, and other ad-hoc sources of information.
- b. Tie together information from internal databases with up-to-the-minute information from public sources to offer a single, cohesive view of specific companies, new products, and services launched.
- c. Extract information relevant to the business, analyze this in the context of the relevant domain, and derive insights about aggregate competitive intelligence. It will have to provide business users with data about competitive products, create business differentiation, and

disseminate information on a continuous basis.

The enterprise knowledge systems designed around the four key principles of discovery, find-ability, understanding and dialogue will be driven by tools for data virtualization, semantic search, ontologies, and natural language processing. These systems will provide an abstraction layer, above existing data management technologies, enabling enterprises to bridge the gap that separates data, content, and processes. This offers a more intelligent, relevant, and responsive interaction than the deployment of standalone information technologies in isolation.

This new-age digital information architecture will fundamentally disrupt how enterprises deal with information, democratizing data, augmenting intelligence and providing understanding and insights. As the system introduces business professionals to a world of exact answers, we will witness an increased exploration of ideas. With one click and thin line interface they can make their way through all the noise to gain deep insights from data. They can throw away time-consuming applications, reports manuals and search functionalities, and use the tools that empower them to make the right business decisions. ■

