Web 3.0: Its Promise and Implications for Consumers and Business

Introduction: The Next Stage in the Rapid Evolution of the Web
The information revolution created by the Internet quickly transformed communications into a vital part of business and everyday life. Yet, as pervasive as the Internet now is, it is still evolving and is poised to enter a new stage of development that will make it more intelligent, aware, and accessible. The next stage of the web creates the potential for individuals and organizations to use information in ways that facilitate the exchange of content between all types of devices and networks. Companies should begin anticipating this new era now and prepare their organizations to excel in this emerging environment.

The Foundation Laid by Web 1.0 and 2.0
The foundation for today's information services explosion was laid with Web 1.0, the read-only web. The initial system created a constantly growing library of information published on static websites, that users could access directly via browsers or discover via search engines. Web 2.0, often called the read-write web or the "social web," made the Internet easy for consumers to understand and use and allowed them to participate in creating and publishing content. Users could share their ideas with others via blogs, wikis, and social networking sites, add links to information published by other communities and applications, and interact with content published by others.

Web 2.0 harnesses the public's collective intelligence to give additional value to published information. Google's PageRank algorithm, for example, considers the number of user-created links to a particular web page, among other factors, to determine the importance of that page when ranking search results. Recommendation engines such as Digg.com and last.fm, which encourage people to share and discuss web content or music, use their participants' opinions to establish the value and popularity of content that is published on the web.

Web 2.0 has become an integral part of life and business. Companies, government agencies, and other organizations have leveraged the technology's publishing and participatory attributes to create new applications and business models for both internal and outward-facing needs. However, the information contained on the web today has little structure, which limits its potential use. Web 2.0 is also constrained by the extraordinary volume of information available, the escalating rate at which content is published, and the inability of the existing system to integrate data that originates from different sources or in different formats.

Web 3.0: Unlocking Information to Provide a Better User Experience
Web 3.0 is the designation generally associated with the evolution to an "intelligent web." It's anticipated that the intelligent web will address the lack of structure and organization in Web 2.0 by linking information from disparate sources and systems to make the web even easier to use, more efficient, and more valuable to its users. Web 3.0 is also referred to as the "semantic web" because it will use semantics—the study of meanings behind words and information—to interpret searchable content and thus deliver more appropriate and relevant content to end-users.

Web 3.0 will introduce new techniques for organizing content and new tools that will make it possible for software and applications to collect, interpret, and use data in ways that can add meaning and structure to information where it didn't exist before. The web will become smarter, in other words. In concept, Web 3.0 will be able to unleash services that can cut through high volumes of information from disparate digital sources—from web content to e-mail or files residing on a PC—to deliver

more relevant search results. It will offer tools to better manage flows of information, and deliver a faster and richer user experience. Machine- and intelligent software-based agents will drive the intelligent web, as well. These agents will be able to carry out search and web transactions on behalf of customers according to each user's specified preferences to push today's concept of M2M (machine to machine) communications toward M4H (machines for humans).

The result of these many advancements will be a whole new level of customization and automation that goes far beyond what customers are accustomed to today.

Defining Web 3.0

Web 3.0 is intended to evolve out of upgrades and extensions to existing web functionalities, not through the reengineering or replacement of content and systems. While it is still very early in the evolution to Web 3.0, some implementations that are available today illustrate its potential use. TipTop Search, for example, which uses semantic technologies to search Twitter messages, categorizes results based on users' emotions and experiences about the topic of interest. Microsoft's Bing search engine employs semantic technologies to suggest related blogs, tweets, and additional, related queries that a user might want to consider as they look for information on a particular topic.[2]

The term Web 3.0 is best used to explain the next era of web computing and the new information age it will introduce, rather than a set of specific technologies or technical attributes. Generally, the concept of Web 3.0 emphasizes three main features:

- The capability of obtaining contextual information from a web search
- The ability to obtain information drawn from a variety of previously incompatible or walled applications or sources
- The engagement of all types of devices and machines in the data creation, data use, and communication process that informs our daily lives, our work, and our businesses

Context Is its Differentiator

One of the fundamental features of Web 3.0 will be its capability to use unstructured information on the web more intelligently by formulating meaning from the context in which the information is published. Specific information resources on the web will be organized, correlated, and linked to other resources of common interest by the use of natural language processing and semantic technologies that can index data, and then find it, interpret it, and establish relationships between disparate data elements in anticipation of a user's search needs.

A user, for example, will be able to process text-based information in ways that are similar to the methods employed today to process structured or numeric data from spreadsheets and databases. A search engine will be able to understand queries presented as full questions and serve up accurate and relevant results, even if the results do not necessarily contain the specific search terms used. Technologies will also be able to better filter data to improve search-result quality and relevance to deliver the content that best serves the user's intentions. Intelligent filters will be used during a customer's web search, for example, to exclude results that represent a particular brand, product, topic, or information the user is not interested in. By focusing on content quality rather than quantity, such filters will also help address the problem of information overload, which can often overwhelm or unnecessarily distract users during a search.[3]

Some of the semantic technologies that will be used to make Web 3.0 possible include the Resource Description Framework (RDF), which describes information so that it can be read and understood by computer applications. RDF is used to link data from different websites or databases, as advocated by Sir Tim Berners-Lee's notion of "linked data," which extends the use of URLs beyond web pages to bring web connectivity to all types of devices and information sources. Another semantic technology is the Web Ontology Language (OWL), which could also play a key role. OWL will enable an application to process or interpret information contained in documents rather than simply presenting the information or documents to the user.

These technologies, among others, can be used to assert relationships between data obtained from individual or multiple applications or sources and merge information from previously unrelated sources.[4] The approaches also enable a Web 3.0 search engine's capability to deliver relevant results based on the context of complete phrases or questions rather than keywords.[5]

Openness Between Data Sources

The capability to cross-reference, interconnect, process, and remix data, applications, and information from the many diverse sources on the web introduces a new level of openness in the information technology sector. Interoperability between information or application silos makes it possible to combine data from individual resources in new ways and to create research results that have more value than their original source materials might have had individually. The larger body of information

> "All in all, Web 3.0 technologies will create smarter, more-efficient web programs that could drastically reduce the time it takes to compile and post information to the Internet and the time it takes users to search for it once it's there. The key for Web 3.0 is efficiency."[1]

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available to a search query allows users to ask questions across disciplines and makes it possible to use and share information in more productive ways.

The opportunities to integrate and mingle data introduced by these new capabilities will also make it possible for companies and organizations that deliver public and private cloud-based services to team up to deliver new products. Thus, openness between data sources has breakthrough potential to open up relationships between businesses and foster product and service collaborations between companies that previously may have not have had the means or reasons to work together.

The Hyperconnected Age

Interactivity with the web will reach new levels as a result of hyperconnectivity between people, computers, and connected devices made possible by pervasive broadband services and the emerging "Internet of things." Already, people are increasingly acting on information made available by a wide variety of connected devices that are becoming pervasive in society, from notebook computers to tablets, from smart phones to wirelessly embedded consumer electronics devices such as cameras. Soon the body of connected devices will include a wide range of sensor-equipped and networked products, from energy-using appliances in the home, such as refrigerators, to routine office equipment, such as web-enabled printers. The increasing activity on the web will continue to grow by orders of magnitude, which in turn will help build the information it contains and its collective intelligence.[7] The higher level of engagement with the web will be stimulated, as well, by the increasing conveniences of automated services offered over these devices by the intelligent web.

The Roles of Cloud Services, Social Media, and IPv6 in the Web 3.0

Differentiated by its context awareness, openness, and hyperconnectivity, Web 3.0 will also build on three fundamental technology-based services that play important roles in IT and communications today. One is the rapidly increasing adoption of cloud-based services and data storage, which will facilitate information access and analysis processes used to provide context-aware, intelligent information services and solutions. Another is the growing popularity and importance of social media and user-generated content, which will continue to build new bodies of data and add perspective or value to others. A third is the migration to IPv6, the next-generation protocol for the Internet, which provides the addressing scheme and common IP-based platform that will facilitate connectivity of devices and components to build the "Internet of things." IPv6, combined with semantic technology, linked data, and the openness of previously incompatible data and applications, will help facilitate the convergence of data, applications, systems, and communications to build the Web 3.0.

Content creation and distribution through video technologies for example, already mainstream services on the Web today, promise to take on even more importance as cloud computing, social networking and IPv6 technologies introduce enriched software and services for customers in the Web 3.0 era. These technologies will make video even easier to use and apply for security, entertainment and communications services. As these will technologies make it possible to access services, generate data and store it, Web 3.0 services will help organize and link the information to optimize its use.

Benefits for Consumers

One of the main benefits of the Web 3.0 for consumers is that their interactions with their devices and applications will be personalized. Companies will be able to take advantage of the many intriguing features and capabilities Web 3.0 brings to build better services and relationships with their customers.

In the near future, services made possible by the intelligent web will begin creating new and creative interactions between customers, their devices, and their applications. The impact will be felt in the social networking sphere, where applications will have a better ability to make use of customer-generated content and opinions; in the mobile web, which will become the predominant means of accessing content and services; and even in the entertainment sector, where televisions and gaming devices will add intelligent services such as the ability to recommend media to customers based on past usage and preferences or interactive features that allow customers to create their own content.

The ability to organize information contextually based on natural language processing and semantic technologies, combined with user-defined criteria, will make searches far more powerful than is possible with today's algorithms. Data output will be more personalized and common tasks and activities will be more intuitive and easier.

Behavior- and location-aware applications will be enhanced by the enriched context made available to the application and by automated interactions with and between more types of devices. Governed

Semantic technology "provides an increasing opportunity for application development professionals to better exploit information, integrate systems, and deliver applications that give the business new and more powerful ways to use information."[6]

by an individual's preferences, intelligent agents will be able to act on behalf of the user. Early illustrations of these capabilities created with current technology include smartphone applications that consider a user's location and personal interests to recommend restaurants or social venues. Additional examples include services that make it possible for a smartphone to communicate with a user's PC in the workplace to log their arrival at work and authenticate their access to the network, or smart-grid applications that alert a customer if an energy appliance is malfunctioning.

As the "Internet of things" builds and expands and a consortia of service providers form to exploit the cross-platform interactions between data and services that the Web 3.0 facilitates, these types of personalized, automated applications will become more prevalent and powerful.

Benefits for Business Users

As new devices and software enabled by Web 3.0 tools and techniques become an integral part of the business process, individual companies will find new opportunities to increase efficiencies, build intelligence into their business processes and strategies, and better target their customers' and employees' needs.

For example, the barriers that previously separated business applications and communications networks will start eroding to make business processes more fluid for users as they move in and out of virtual and physical work environments. Workflows will become simplified by the automation of common workday tasks and activities. Business decisions will be grounded on more and better data generated by intelligent systems and connected devices functioning both inside and outside the corporate network. The increased access to customer data and ability to reuse it in different arms of the enterprise will lead to the development of new solutions that can improve customer relationships and sales.

In particular, Web 3.0 can be viewed as a business intelligence (BI) engine. It is well known that corporate BI initiatives are hampered because conventional IT systems can't integrate information from private or disparate data sources to derive a holistic view of the organization. While most corporations have a small number of highly focused BI requirements, individuals within a company might have multiple needs to perform analytics, data mining, and reporting to support corporate decision making. The ability to access previously unavailable information—and funnel it into an automated process or mashed-up application—will add value to company information and empower employees to better serve the company. Companies will also find numerous, new opportunities to tailor solutions to their customers based on the business intelligence that Web 3.0 tools and technologies provide.

Trust and Privacy: New Concerns and Solutions

The increased levels of access to information, new abilities to integrate and share formerly incompatible data sources, and the pervasive use of connected devices and applications that will take advantage of this information in the Web 3.0 era introduce fresh trust and privacy concerns for consumers and business. In particular, the creation of new applications that combine public and private data for Web 3.0 services can introduce security issues that are more complex and challenging than previously experienced.[8] The use of intelligent agents to act on behalf of an enterprise or individual is also expected to present new risks.

Trust and privacy concerns have already become evident in the consumer and media backlash against social networking sites. Hypothetical examples are also illustrative. For instance, the smart grid, which will eventually connect every house and even household appliances to the utility grid, generates continuous information about consumers' personal behaviors, not only their energy consumption but also data on the make and model of household appliances, which can be support warranty programs or notification of product upgrades. Potential misuse of data made possible by these and other initiatives in the Web 3.0 era, such as intrusive product marketing programs, could open up entirely new areas of privacy concerns.[9]

On the other hand, the information resources and services that will become available in the Web 3.0 era may lead to an increasing number of more effective privacy and identity management solutions. Already, large organizations are banding together to create more open systems and standards to fight cybercrime and malicious behavior with more unified and automated methods.

Identity management solutions will become much more powerful, granular, and automated to make authentication and interaction with multiple systems simple for everyone. Software-based information agents that use reputation systems and various forms of automation will be able to watch out for the best interests of their customers to help prevent unknowing use of a malicious site or accidentally jeopardizing a public persona.

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Because Web 3.0 will have trust and privacy implications for individual users as well as organizations, policy makers and business leaders need to consider how they can best educate users on potential security vulnerabilities and practical solutions. Community leaders may want to provide online security training in schools and public settings in a manner that is analogous to civics classes or first-aid training. Businesses will need to establish policies to protect their corporate assets and business-critical information as well as their corporate reputations.

Opportunities Offered by Better Information Access

Despite these areas of concern, Web 3.0 will usher in a new era for business and more opportunities in which the Internet plays an increasingly important role. It will introduce a novel information age for business as semantic technologies add meaning to linked data and create greater openness among data sources. The new information age will be fed by hyperconnected users and the "Internet of things," which will make the web and services that operate on it more intelligent. The increasing contributions of information from cloud-based resources and social networks will help facilitate it. Another enabler will be IPv6, which will make it possible to maintain constant communications with devices and machines.

Because it will be able to open up access to information and combine information from disparate sources and organizations, Web 3.0 will lead to the formation of new consortia and partnerships to drive new opportunities of interest to businesses, industries, and consumers. Many internal and external business processes will become more open and transparent. Machine-to-machine information exchanges will become more meaningful and interoperable with corporate information systems. The pace of innovation will speed up significantly, and new opportunities for disruption will emerge. Competition will increase as companies pursue innovative services with Web 3.0 capabilities and as cloud-based services and long-tail applications make it possible for small or previously unrepresented groups to compete with larger firms on more equal footing.

Conclusion: Practical Advice for Business Leaders

The evolution to Web 3.0 will yield enriched capabilities for individuals to use and create content and it will provide enterprises with substantial and numerous opportunities to grow their businesses and improve efficiencies. Organizations need to prepare for it by modernizing their infrastructure and systems lest more agile rivals outmaneuver them. Web 3.0 will challenge many of the organizational structures and processes used in today's businesses. The following suggestions should help companies begin preparing now to get ahead on the technology curve and position their businesses for this new, competitive arena.

Look for Opportunities

Take inventory of the systems in your enterprise that will most likely evolve from proprietary platforms to more open access and standards-based applications; these are probably systems that you are considering moving to the cloud today. During your inventory process, identify usage scenarios that could elevate levels of agility, competitiveness, and business performance if the systems were more integrated, automated, and aware.

During your evaluation, look in particular for areas in your business where lack of information is a problem, or where your current methods for using vital information are limited. According to Forrester Research, "By focusing on business pains arising from a lack of information, application development professionals can identify areas where semantic technology might help."[11]

Scrutinize the Workflow Process

Think through your current business models and decide how you could reengineer workflows to create new efficiencies or develop new revenue streams if pervasive connectivity and automated intelligence could be built into your everyday business functions. Examine the sources and nature of your business data, because the structure of this data and managing its flow will become increasingly critical elements of business operations. Identify key business decision points and consider how they would work if automated intelligence could be applied to the decision-making process.

Begin Adapting Enterprise Data

Companies can take numerous, tangible steps now to prepare their enterprise data for the Web 3.0 environment. Here are some suggestions:
- Initiate a master data management project to establish consistency across all data sets in the enterprise.
- Incorporate semantic technologies into enterprise search.
- Lead cross-functional efforts to develop taxonomies and ontologies of enterprise information.

"Treat information as a corporate asset—because it is one."[6]

- In procurement activities, give priority to solutions and applications based on languages that will be used in Web 3.0.
- Redeploy enterprise IT resources to focus on internal data management and taxonomical efforts with off-the-shelf software rather than developing in-house approaches.
- Deploy Enterprise 2.0 platforms that will move enterprise data from individuals' desktops into a repository for later application of semantic technologies.

Conduct Pilot Projects

Begin experimenting. Give your developers opportunities to work on special projects to see if a semantic technology is feasible and suitable for your company. If an idea proves feasible, expand it into a pilot project. Your developers will gain skills and experience and your organization will gather qualitative and quantitative insights into the possibilities the technologies might bring to your business.

Focus on the Customer

Because Web 3.0 services will find their earliest uses among consumer-facing applications, now is the time to understand how customers might want to pull and use data from your organization in a Web 3.0 environment. Consider how your customers' access to readily-available and automated intelligence will affect your industry and how your business can adapt to seismic disruptions to core business models.

Examine the customer experience you provide for your customers today. Keep in mind that Web 3.0 will be driven by data containing user identity, profile, and preference information, including location and behavior patterns. Consider how your company could change the customer experience if existing technology barriers were removed and the company could gain access to previously unavailable customer data to develop insight into their past, current, and future behaviors.

Last but not least, revisit your privacy policies that pertain to customer data. While organizations are of course anticipating and preparing for the introduction of new privacy and security safeguards that come with the increased intelligence of Web 3.0, customers will need reassurance that the new services they use will protect and respect their personal information. Give your data usage policies customer-relations priority and make the policies clear and understandable.

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