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TECHNOLOGICAL AND SOCIAL DRIVERS OF WEB 2.0

Abstract: The author identifies technological and social drivers and determinants of the second incarnation of the World Wide Web, i.e., Web 2.0. Born in 2004, this new phenomenon has been constantly gaining importance, to the extent of a perceived change of paradigm in the use of cyberspace. Six basic market drivers point to the new role of the user, whilst eight core patterns of Web 2.0 deal with both technological and social aspects of this new phenomenon. All those trends, patterns and forces are intertwined, creating an endless potential for both business and private applications of modern cyberspace. And recently the development has gone well beyond Web 2.0 – Semantic Web (Web 3.0) and Web Operating Systems (Web 4.0) epitomize the nearest future of the Web.

Keywords: cyberspace, Web 2.0, social aspects, technological aspects.

1. Introduction

The sharp and unexpected end of the dot-com era in 2001 appeared to be a turning point in the Internet revolution. After the collapse of the stock markets, and especially Internet stocks, many thought this was the end of Web-based enterprises. However, those dot-coms which survived presented similar qualities. First of all, these companies comprehended the concept of a global Net as a platform, instead of trying to adapt obsolete business models to the new digital reality.

Within the next three years a set of completely new phenomena was shaped, and it brought about a significant qualitative jump in the development of cyberspace. In 2004, D. Dougherty, the vice-president of the O'Reilly Media and one of the pioneers of the Net, during a brain storm, proposed a new name for the next generation of the World Wide Web – Web 2.0 (version 2, release 0). Dougherty noticed that, contrary to popular belief, Web not only did not collapse, it did become richer and stronger after the dot-com burst. A totally new paradigm of thinking, full user participation, openness, and network effect, i.e., databases which become wiser and applications which become more intelligent the more people use them, viral marketing, driven

by the stories and experiences of cybernauts, etc. All those things, and a few others, began to create a truly global computer platform.

The next year brought a confirmation of this new reality. In 2005, the number of uploaders exceeded the number of downloaders on the Internet [Kelly 2005]. As a result, the prestigious *Time* magazine announced that the Person of the Year 2006 is… YOU, meaning by "you" the global collectivity of the Internet users [*Time* 2006].

This article identifies the basic technological and social drivers of the new phenomenon of Web 2.0. It discusses the market determinants, the basic patterns, and most important qualities of the second incarnation of the WWW. It also exemplifies the basic differences between the concepts of Web 1.0 and Web 2.0. It also goes well beyond the Web 2.0 philosophy, pointing to the Semantic Web and Web Operating Systems as the 3rd and 4th incarnations of the Web.

2. Market determinants of Web 2.0

Despite the passing of the next few years, it is still very hard to embrace all the elements that compose Web 2.0. According to A. Shuen [2009, p. Xiv], a leading author in this domain, even recent M.B.A.s have a hard time pulling together all the necessary pieces of the Web 2.0 business model. T. O'Reilly [2005] himself writes that Web 2.0 has no specific boundaries, it is rather a set of principles and practices which interconnect the infinite collection of Internet sites. J. Musser [2007] defines the second generation of WWW as a set of economic, social and technological trends which together constitute a base for the next stage of Internet development.

These trends have different names and forms, implement different technologies, but they have one thing in common. It is a keyword, an adjective, which is used in the vast majority of phrases referring to Web 2.0 – "social". It seems that with the birth of Web 2.0 everything suddenly turned "social": *social computing*, *social software*, *social search*, *social networks and social networking*, *collaborative tagging*, *collaborative filtering*, *emergent collaboration*, *socialization of the Web*, *socialization of the user-generated content*. Or finally, *harnessing collective intelligence*, a leading catchphrase of the whole Web 2.0 concept.

The decisive role of the user is seen in the basic market drivers of this new phenomenon. According to literature (e.g. [Musser 2007; Horrigan 2010/2006], there are six such drivers:

1) The consumer base got global.
2) The Internet users are always on.
3) The users are connected from everywhere.
4) The users are not only connected, they are engaged.
5) The production costs decreased dramatically.
6) There are new revenue opportunities.

1) As of September 30, 2009, 1,733,993,741 people worldwide have Internet access. It means an increase of 380% during a decade. The most dynamic increase was noticed in the Middle East (1648%) and Africa (1392%), in Europe a "mediocre" 300% [Internet World… 2009]. One of the crucial demographic determinants is "the digital natives" – those under 30. For them cyberspace is a completely natural phenomenon. In the US, 88% of this group are online and 51% contributes to the content online [Horrigan 2010/2006, p. 10]. The most significant impact of this is that network effects are increasing in importance due to sufficient critical mass.

2) Broadband usage reached 50% already in 2004 [Anderson 2004]. Broadband connection translates to the simple fact that the users are practically "always-on." The Internet becomes part of the essential fabric of daily lives, for example, 53% spend more time online after getting broadband. Moreover, 73% of all users who post content online are those with high-speed connections [Horrigan 2010/2006, p. 10].

3) By the end of 2009 the number of mobile phone users reached 4.6 billion globally [*Mobile phone* 2010]. It is more than double of the number of Internet users. Of those 4.6 billion, 28% has Internet access from their mobile devices [Ipsos Research... 2009].

4) As of today, more than 50% of US adults have contributed their content online [Horrigan 2010/2006, p. 10]. These are different formats – photos, video, audio, various texts and comments in Wikis, discussion groups and blogs, product reviews, etc. According to data from 2006, one of the most popular social sites, MySpace.com, signed up 280,000 new accounts a day, and the video sharing site YouTube served 100 million videos a day [Reiss 2006]. Since that time those numbers, already unbelievable, must have risen exponentially. As a result, the Web has changed from a one-way "write" medium to the two-way "read-write" platform.

5) According to some sources, in the first six years of the new millennium IT infrastructure costs were down by more than 70% [*Electronic Computer*… 2006]. This process was accelerated by cheaper hardware, free software infrastructure based on open source, access to global labour markets, and search engine marketing, which enabled access to niche markets in cyberspace.

6) All these phenomena create quite new revenue opportunities. For example, in the years 2002-2006, online advertising in the US was up by 280% [Internet Advertising Bureau 2006, p. 5].

3. Generic patterns of Web 2.0

Much more important and useful is the identification of eight core patterns of the next generation of the World Wide Web (see e.g. [Musser 2007; O'Reilly 2005; Shuen 2009]).

Harnessing Collective Intelligence, through the creation of the architecture of participation which capitalizes on the network effect and specific algorithms that

produce software which is getting better the more people use it. Competitive advantage in Internet applications depends on the amount of data which users themselves provide. The involvement of the users can be done both explicitly and implicitly, as a by-product of their activities. And so, network effects occur when a product or service becomes more valuable as the number of people using it increases.

Data is the next "Intel Inside". "Intel Inside" was a marketing buzzword of Intel. The new adaptation of this catchphrase is based on the usage of unique, hard-to-recreate data sources. Data has become as important as function, and examples include Google's search database, Amazon.com's product catalogue, eBay's auction data or YouTube video library. This data-driven approach obviously relies on open standards. Among the basic benefits are: maximization of data as a strategic asset, new data-centric business models, greater consumer loyalty, data reuse philosophy, value at multiple data layers.

Innovation in Assembly. Remixing data and services requires a new approach to computers, but creates new opportunities and markets. This approach is based on the conviction that a platform beats an application nearly every time. The Web itself is becoming a platform, replacing desktop operating systems. What is more, individual websites are becoming platforms and platform components as well. It marks the shift from proprietary to open standards, and from static to dynamic websites. This trend enables the provision of scalable growth models, builds trust and communities, creates new revenue models which can be directly tied to platforms. Last but not least, it opens a huge potential for remixability. Content and information are becoming available in the smallest units, which allows for mash-up. The smaller and more granular the unit, the more ways to use it and remix it as an individual song composed of a dozen songs, news article, photo or product report. Even a new generation of websites emerged, sites which need almost no site of their own. Using platform components provided by others (e.g., Amazon's data storage) and logic which occurs within the browser context (e.g., Ajax) these sites can exist and operate without the traditional server-side infrastructure (e.g., Amazon S3 Ajax Wiki). Another component of this trend is known as SaaS – Software as a Service, available online and not sold as a packaged product.

Rich User Experiences combine the best of traditional desktop and modern online software. The static websites are being replaced by rich Internet apps that combine many of the best elements of the desktop and online experiences. This engages users to the extent not known before. Besides, it creates competitive advantage, rises user satisfaction rate, improves performance, lowers web site abandonment, and significantly reduces IT costs. Best practical cases include collaborative editing, e.g., Wikis and Writley.

Software Above the Level of a Single Device. The idea of a global platform requires a new brand of software, the one that spans Internet-connected devices and goes well beyond single desktop applications. It helps build and exchange online experiences and brings closer the idea of ubiquitous computing. The users have access to their applications everywhere and new markets are being opened overnight.

Perpetual Beta. Old models of software development assumed a completed process and a packaged product. SaaS (Software as a Service) models favour online, continuously updated software applications, which are no longer artifacts but ongoing services. This marks the end of the era of monolithic releases and of the software adoption cycles. Instead, new features are added on a regular basis as a part of the user experience. The users are also real-time testers. Software becomes a service that is always on and improving. The basic benefits of this approach include much faster time to market, significantly reduced risk, closer relationship with customers, real-time data enabling better decisions, and, last but not least, increased responsiveness.

Leveraging the Long Tail. The economic model of the Long Tail demonstrates the shift from a world of limited choices and mass market to a world of nearly limitless choices and niche markets. Small sites make up the bulk of the Internet's content and so narrow niches make up the bulk of the possible online applications. Some markets were too small to profitably capture, but the reach of the WWW makes them easy to monetize. What is more, narrow niches constitute the majority of the Internet's possible applications and audience.

Lightweight Models and Cost-Effective Scalability. Scalability in this approach is connected with business models and technology. In a nutshell, much more can be done much better and for much less. This includes commoditization and reuse, but also network effects and "good, old" Business Process Reengineering, as far as processes are concerned. One of the trademarks of this is syndication, as an important "by-product" of granulation and mash-up.

Needless to say, all these generic patterns of Web 2.0, listed above, are interconnected and intertwined. For example, patterns related to *Lightweight Models* are *Perpetual Beta* and *Innovation in Assembly*. *Harnessing Collective Intelligence* is a typical social issue, with strong and obvious relations to *Rich User Experiences* and *Architecture of Participation*. At the same time, however, these social aspects would be impossible to apply without the technological ideas of *Data as the Next Intel Inside* or *Innovation in Assembly*.

4. Convergence of business and technology

As can be seen from the analysis above, the full advantages from the core patterns of this new phenomenon arise from their simultaneous occurrence. It is easy to notice the coexistence of three categories of new models, i.e., business, social, and technological. Innovative business models are exemplified by the Long Tail, viral marketing, search engine marketing, dynamic Web services, Wikis, etc. New social models in cyberspace include network effects (or rather, their full utilization), harnessing collective intelligence, virtual communities and emergence of patterns of collective behaviour, folksonomies, tagging, blogging, etc. And among new technology models are the ideas of Web as a platform, software as a service, mash--up, syndication, etc.

Within this interdisciplinary ecosystem several other sub-patterns can be identified. Global and massive connections enable network effects, which move the users from the "one-to-many" communication models into a truly virtual "many-to-many" connections and relations. In this new reality the "edges" of cyberspace became even more important than its core. This, in turn, enables the full application of the Long Tail approach.

Decentralization disintegrates the communication structures of the past. Bottom-up approach wins over the top-down model, meaning that individual users, acting without centralized control, initiate the vast majority of all information processes on the Internet. At the same time, "push" strategies lose to modern "pull" models which are necessary for effective adoption on the individual level.

"User focused" is one of the leading catchphrases of Web 2.0, and the user is in the centre of the second generation of WWW, indeed. This opens unlimited potential for participation, conversation, collaboration, and real impact on everything which happens in cyberspace.

Openness, another leading idea, begins with the Internet's open technology standards, creating open ecosystems of loosely coupled applications created over open data, open APIs (Application Programming Interfaces), and highly granulated and reusable components, ready for mash-up. This open approach penetrates into the social fabric of the Web, meaning greater transparency, trust, shared intellectual property, etc.

Table 1. Differences between Web 1.0 and Web 2.0 (exemplification)

Web 1.0	Web 2.0
Read	Read-write
Propriety sites	Blogging
Domain name speculation	Search engine optimization
Individualization	Collective intelligence
Publication	Participation
Content management systems	Wikis
Taxonomies	Folksonomies
Control and coordination	Syndication
Software packages	Software as a service
Long software life-cycle	Perpetual beta
Site as a platform	Web as a platform
Static services	Dynamics services
Homogeneity of transmission	Content remix (mash-up)
Integration	Granulation
Britannica online	Wikipedia

Lightweight in Web 2.0 means downsizing and simplification. It also means the application of software is designed by small, often virtual, teams, with the help of simple data formats and agile methods, business focusing on constant lowering the costs, marketing using simple costumer-to-customer viral approaches.

Emergence allows for a natural creation of structures, processes and behaviour over time, instead of predefined application structures and models.

Table 1 presents the exemplification of the basic differences between Web 1.0 and Web 2.0.

5. Beyond Web 2.0: Semantic Web and WebOS

In the fall of 2006 a new term to describe the dynamic advances of the Web was introduced by J. Markoff [2010/2006] – Web 3.0. While there is still no confirmed definition and different experts have given different meanings, it is sometimes referred to as Semantic Web. Generally, it is supposed to describe the conversion of the Web into a global database. As a result of this process, structured data records will be published in the Web in remotely queryable and reusable formats, e.g., XML, RDF, and microformats. This phenomenon, known as the Data Web, is supposed to be the first step to a full Semantic Web, enabling a new quality of data integration and application interoperability. The bottom line is, the data will become openly accessible and linkable as Web pages. Next, both structured and unstructured content will become available in semantic formats, using RDF or OWL.

Besides transforming the Web into a database, this new trend has close connections with artificial intelligence. It remains to be seen whether Web 3.0 develops into a global intelligent system or whether intelligence will reveal emergent properties, surfacing in an "organic" and natural way, as people use the available applications more and more.

Next, reasoning software is expected to develop over time, and it will be based on description logic and intelligent agents. Set of rules will be used expressing logical relationships between concepts and data.

Also, Web 3.0 is expected to evolve into a series of 3D spaces, emulating the concept of Second Life. Three-dimensional shared spaces will open up new ways of connecting and collaborating.

An expanded definition of Web 3.0 has been introduced by Nova Spivak, and it encompasses and harmonizes different technology developments. It includes: ubiquitous connectivity, network computing, open technologies, open identity, the intelligent web, distributed databases and intelligent applications [*Web 3.0…* 2010].

And there is also the fourth generation of the Web "in the making", i.e., Web Operating Systems (WebOS) which are supposed to reach maturity in the 2020s. It is a part of a new emerging field of metacomputing, focused on the methodological, technological and practical aspects of the development of large computer networks, including internet, intranet, etc. [Clauß 2010]. Metacomputing is understood as

all computing-oriented activity, involving computing knowledge common for the research, development and application in this domain. Practically, WebOS describe network services for Internet scale distributed computing.

6. Conclusions

It is easy to notice that all materials concerning the new reality of Web 2.0 hover around business strategies and practical applications, especially in the area of software. It suffices to mention the subtitles of the leading thematic books referenced in this article: *Principles and Best Practices*, *Design Patterns and Business Models for the Next Generation of Software*, *A Strategy Guide*. There is not many, if there are at all, theoretical studies or more sophisticated methodological analyses. As a result, the domain of Web 2.0, and it seems that the domain of the Internet and WWW in general, is still at the pre-scientific stage of development. This area is still considered more a purely practical and business field than a coherent and complete theory.

This is, unfortunately, quite a common phenomenon. According to K. Perechuda [2008, p. 7]: "Creators of modern management concepts and methods […] as a rule concentrate on operationalizational effectiveness, not caring about solid theoretical and methodological grounds." Cyberspace defines then a wide spectrum of potential research. What is more, Web 2.0 seems especially adequate for all topics covering information processing because of the concentration on the user and the evident reference to social aspects. And so, as the Internet, constituting the technological backbone of cyberspace, is analyzed mainly from the perspective of data (their formatting, flow, storing, managing, etc.), the World Wide Web, and especially its second incarnation, should be approached from the perspective of semiotics, interpretation, context, and knowledge.

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TECHNOLOGICZNE I SPOŁECZNE CZYNNIKI ROZWOJU WEB 2.0

Streszczenie: W artykule zidentyfikowano technologiczne i społeczne determinanty rozwoju drugiej generacji World Wide Web, tj. Web 2.0. Po pojawieniu się w 2004 r., ta interesująca koncepcja do tego stopnia zyskiwała znaczenie, że dziś mówi się o nowym paradygmacie wykorzystania cyberprzestrzeni. Sześć zasadniczych czynników rynkowych Web 2.0 wskazuje na centralną rolę użytkownika, a osiem dominujących wzorców dotyczy kwestii zarówno technologicznych, jak i społecznych. Wszystkie te czynniki, wzorce i trendy są wzajemnie powiązane, stwarzając niezmierzony potencjał efektywnego wykorzystania cyberprzestrzeni. Ostatnie rozwiązania w obszarze kolejnych generacji WWW, tj. Sieć Semantyczna (Web 3.0) oraz Webowe Systemy Operacyjne (Web 4.0) wskazują na dalszy kierunek rozwoju Globalnej Sieci.