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# The Metamorphosis of World Wide Web: An Overview of Web 1.0, 2.0, Semantic Web 3.0 and their Application in Library and Information Services Delivery

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**Abstract**

*In the past few decades, Internet has grown leaps and bounds changing in terms of outlook, content, flexibility and capability. The gradual evolution of the World Wide Web (W3) attests to its unprecedented penetration into human day-to-day activities through its larger than life affordabilities. This paper, therefore, presents an overview of the evolutionary stages of Web 1.0, 2.0 and Semantic Web 3.0, highlights some of their differences with emphasis on various scholars' perceptions and concepts. Also, the challenges and implications of the new Web 3.0 to libraries and what librarians should do to keep pace with this trend of technological evolution formed part of the discussions of this paper. The paper concluded that the librarians should increase their technological knowledge-base, become proactive and think ahead of these streams of technologies and how they can be adapted professionally for the good use of their clients.*

**Keywords:** World Wide Web, Web 1.0, Web 2.0, Web 3.0, Semantic Web, Social Web, Library 2.0, Library 3.0

## Introduction

The impact of Internet on the changing faces of information and knowledge sharing through the application of World Wide Web right from version 1.0 to 2.0 and now 3.0 has been rather phenomena in the information world and professional fields as well as disciplines spanning through the science – social, natural and health to education, transportation, industries, economies, governments and virtually all facets of human life. It is no gainsaying that Internet and its Web are now being looked up to as a great weapon that can be employed to solve many myriads of problems facing humanity especially as regards the gap in education, culture, knowledge, health and technology created by distance barrier around the globe.

In the present knowledge economy, any economy that is dominated by consumers of technology without the knowledge of technology is doomed. This is partly Nigeria's problem; the ever enthusiastic masses enjoy new technology without the knowledge of such technology. The new model of any brand of automobile will get to Nigeria within a month but where is our own technological know-how? Where is the knowledge to maintain the automobile? Barring the crime, it is amusing to see many with phobia for Automatic Teller Machine (ATM). However, librarians are trained custodians of knowledge and should not be plagued with lack of any form of knowledge be it social, political or technological. The more knowledge we gain, the better positioned we are to help our numerous clients and information users who look up to us for information services. We should bear in mind that our users' satisfaction is our professional fulfilment.

## Evolution of Web 1.0, 2.0, & 3.0 in Libraries

**Web 1.0 in Libraries.** Web 1.0 was designed by Tim Berners-Lee as a platform of information that is read only. It consists of static and non-interactive web pages that at most allow for an interchange of documents. In 1996 there were 45 million global users. The focus of Web 1.0 was on companies and owning content. Web 1.0 was used for Geocities, Hotmail, home pages, Netscape, Britannica Online, content management systems, HTML documents, page views, portals, directories, Yahoo!, dmoz, taxonomy, web forms, and advertising (Rusak, 2009).

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**Web 2.0 in Libraries.** Web 2.0 lacks an explicit definition. However, Crawford (2008) viewed it in general terms as a platform for participation, a focus on communities, sharing content or user-generated content, and an interchange of data. The focus of Web 2.0 was on web applications. The success of Web 2.0 depended largely on word of mouth recommendations for viewing sites. Over 1 billion people were using Web 2.0 in 2006. In the era of Web 2.0, the consumer and content publisher differentiation is becoming less defined.

According to Crawford (2008), Library 2.0 encompasses a range of new and not-so-new software methodologies that can and will be useful for many libraries in providing new services and making existing services available in new and interesting ways. According to Stuart (2007), libraries should embrace the revolution (or evolution). Library Thing embodies Web 2.0 features such as containing data; linking to multiple areas such as books, reviews, users, and catalogs; has services for individual recommendations; supports tagging and traditional subject headings; and supports the needs of the community. Examples of Web 2.0 use include Flickr, YouTube, Digg, read-write Web, blogs, Wikipedia, RSS (Really Simple Syndication), social tagging "folksonomy", Cascading Style Sheets (CSS), Synchronized Multimedia Integration Language (SMIL), Scalable Vector Graphics (SVG), Extensible Markup Language (XML), and Google.

Web 2.0 is associated with web applications that facilitate participatory information sharing, interoperability, user-cantered design and collaboration on the World Wide Web. A Web 2.0 site allows users to interact and collaborate with each other in a social media dialogue as creators of user-generated content in a virtual community, in contrast to websites where users (consumers) are limited to the passive viewing of content that was created for them. Examples of Web 2.0 include social networking sites, blogs, wikis, video sharing sites, hosted services, web applications, mashups and folksonomies.

The term "Web 2.0" was coined in January 1999 by Darcy who predicted that the Web we know now is only an embryo of the Web to come. According to Kingsley (2003) and Eric (2003), the term Web 2.0 did not resurface until 2002. These authors focus on

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the concepts currently associated with the term where, as Scott Dietzen puts it, the Web becomes a universal, standards-based integration platform. Web 2.0 enables users to connect, communicate and collaborate with each other, forming online communities and socializing. It also encourages participation through open applications and services (Kumar, 2009). The Web 2.0 offers all users the same freedom to contribute. While this opens the possibility for rational debate and collaboration, it also opens the possibility for spamming and trolling by less rational users. Best (2006) noted that this requires what is sometimes called radical trust by the management of the website. According to him, the characteristics of Web 2.0 are: rich user experience, user participation, dynamic content, metadata, web standards and scalability. Further characteristics, as opined by Larry and Sharon (2009) such as openness, freedom and collective intelligence by way of user participation, can also be viewed as essential attributes of Web 2.0.

Web 2.0 can be described in three parts. Rich Internet Application (RIA) defines the experience brought from desktop to browser whether it is from a graphical point of view or usability point of view. Some buzzwords related to RIA are Ajax and Flash. Web-Oriented Architecture (WOA) is a key piece in Web 2.0, which defines how Web 2.0 applications expose their functionality so that other applications can leverage and integrate the functionality providing a set of much richer applications (Examples are: Feeds, RSS, Web Services, Mash-ups) and Social Web defines how Web 2.0 tends to interact much more with the end user and make the end-user an integral part.

**Web 2.0 as the Social Web**

A third important part of Web 2.0 is the social Web, which is a fundamental shift in the way people communicate. The social web consists of a number of online tools and platforms where people share their perspectives, opinions, thoughts and experiences. Web 2.0 applications tend to interact much more with the end user. As such, the end user is not only a user of the application but also a participant by podcasting, blogging, tagging, contributing to RSS, social bookmarking and social networking.

The popularity of the term Web 2.0, along with the

increasing use of blogs, wikis, and social networking technologies, has led many in academia and business to coin a flurry of 2.0s, including Library 2.0, Social Work 2.0, Enterprise 2.0, PR 2.0, Classroom 2.0, Publishing 2.0, Medicine 2.0, Telco 2.0, Travel 2.0, Government 2.0, and even Porn 2.0. Many of these 2.0s refer to Web 2.0 technologies as the source of the new version in their respective disciplines and areas. For example, Miller (2010) argues that Blogs, wikis and RSS are often held up as exemplary manifestations of Web 2.0. Miller believes that Library 2.0 means harnessing this type of participation so that libraries can benefit from increasingly rich collaborative cataloguing efforts, such as including contributions from partner libraries as well as adding rich enhancements, such as book jackets or movie files, to records from publishers and others. Miller (2010) links Web 2.0 technologies and the culture of participation that they engender to the field of library science, supporting his claim that there is now a "Library 2.0". Many of the other proponents of new 2.0s mentioned here use similar methods, implying that the meaning of web 2.0 is role dependent (Web2.sys-con.com.)

**Web 3.0**

Definitions of Web 3.0 vary greatly. Amit (2010) believes its most important features are the Semantic Web and personalization. Focusing on the computer elements, Wolfram (2010) has argued that Web 3.0 is where "the computer is generating new information", rather than humans. Keen (2007) considers the Semantic Web an "unrealisable abstraction" and sees Web 3.0 as the return of experts and authorities to the Web. For example, he points to Bertelsmann's deal with the German Wikipedia to produce an edited print version of that encyclopaedia. He further optimized that Web 3.0 will emerge from new and innovative Web 2.0 services with a profitable business model.

Smart (2010) defines Web 3.0 as the first-generation Metaverse (convergence of the virtual and physical world), a web development layer that includes TV-quality open video, 3D simulations, augmented reality, human-constructed semantic standards, and pervasive broadband, wireless, and sensors. According to some Internet experts Web 3.0 will allow the user to sit back and let the Internet do all of the work for them. Rather than

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having search engines gear towards the keywords, the search engines will gear towards the user. Keywords will be searched based on culture, region, and jargon.

**Web 3.0 in Libraries**

Some possible future uses of Web 3.0 include 3D web, the semantic web, and the real world web. Increases in computer processing power and higher bandwidth will allow 3D web to become a reality. 3D web will allow users to interact with one another in real time and explore information and virtual objects in new ways. Virtual worlds, such as 3D web, can be incorporated and used for information services and libraries. In order for 3D web to become popular with the general public, it is essential that it be browser friendly. According to Stuart (2010), the Alliance Virtual Library has had a presence on Second Life since 2006. The virtual library is staffed by volunteers and houses a variety of collections. RezLibris is an online magazine dedicated to Second Life librarians. He regretted that the Second Life wave did not take hold and gain popularity with the general population because it requires software to be downloaded and higher computational requirements than the 'traditional web', involving a more complex set of computer skills to allow successful browsing and creation of content for the general public.

Web 3.0 is often referred to as the semantic web. The semantic web is a web of information that is meaningful to computers. The term is gaining popularity in vocabularies, however, it is often used incorrectly. Quick Response (QR) codes can be incorporated into library catalogs. QR codes in library catalogs allow the patron to save the author, title, and shelf number of a book of interest on their smart phone. QR codes can also be incorporated into the library floor plan, and allow for an MP3 audio tour of an area of interest within the library. Libraries can also use real world sensors to allow the patron to keep informed on how busy the library is, and what conference, meeting rooms, computer terminals, etc. are available in real world time. In order for Web 3.0 to be successful in libraries, librarians and information professionals need to leave the notion of individual data repositories behind and start thinking of interacting with data on the web as a large information resource.

**Semantic Web 3.0**

The **Semantic Web** is the roadmap of a "man-made woven web of data" that facilitates machines to understand the semantics, or meaning, of information on the World Wide Web (W3C, 2008). The concept of Semantic Web applies to methods beyond linear presentation of information (Web 1.0) and multi-linear presentation of information (Web 2.0) to make use of *hyper-structures* leading to entities of hypertext. The term was coined by Tim Berners-Lee, the inventor of the World Wide Web and director of the World Wide Web Consortium ("W3C"), which oversees the development of the proposed Semantic Web standards. He defines the Semantic Web as a web of data that can be processed directly and indirectly by machines.

Shannon (2006) noted that Tim Berners-Lee has described the semantic web as a component of 'Web 3.0'. Semantic Web is sometimes used as a synonym for Web 3.0, though each term's definition may vary depending on whom you ask. Many believe that Web 3.0 is the "next big thing" but there only lies speculation as to just what that might be. It will be an improvement in the respect that it will still contain Web 2.0 properties while continuing to add to its ever expanding lexicon and library of applications. There are some who claim that Web 3.0 will be more application based and centre its efforts towards more graphically capable environments, "non-browser applications and non-computer based devices, geographic or location-based information retrieval" and even more applicable use and growth of Artificial Intelligence (W3C, 2007). For example, Wolfram (2010) has argued that Web 3.0 is where "the computer is generating new information", rather than humans. Alam (2010) also opined that Web 3.0 will primarily focus on dramatically improving the functionality and usability of search engines. Berners-Lee (2006) however promised that access to a semantic Web integrated across a huge space of data, will afford us access to an unbelievable data resource.

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The table below by Amit (2007) neatly sums up the main differences between Web 1.0, Web 2.0 and Web 3.0.

| Web 1.0 | Web 2.0 | Web 3.0 |
|---|---|---|
| The mostly read only web | The wildly read-write web | The portable personal web |
| 45 million global users (1996) | 1 billion+ users (2006) | Focused on the individual |
| Focused on companies | Focused on communities | Lifestream |
| Home pages | Blogs | Consolidating dynamic content |
| Owning content | Sharing content | The semantic web |
| Britannica online | Wikipedia | Widgets, drag & drop mashups |
| HTML, portals | XML, RSS | User behaviour (me-onomy) |
| Web forms | Web applications | iGoogle, NetVibes |
| Directories (taxonomy) | Tagging (folksonomy) | User management |
| Netscape | Google | Advertainment |
| Pages views | Cost per click | |
| Advertising | Word of mouth | |

**Purpose and preparedness of Semantic Web 3.0**

The main purpose of the **Semantic Web** is driving the evolution of the current Web by enabling users to find, share, and combine information more easily. Humans are capable of using the Web to carry out tasks such as finding the synonyms in another language, reserving a library book, and searching for the lowest price for a DVD. However, machines cannot accomplish all of these tasks without human direction, because web pages are designed to be read by people, not machines. The semantic web is a vision of information that can be readily interpreted by machines, so that machines can perform more of the tedious work involved in finding, combining, and acting upon information on the web.

Berners-Lee (1999, p153) originally expressed the vision of the Semantic Web as follows:

> *I have a dream for the Web [in which computers] become capable of analyzing all the data on the Web – the content, links, and transactions between people and computers. A 'Semantic Web', which should make this possible, has yet to emerge, but when it does, the day-to-day mechanisms of trade, bureaucracy and our daily lives will be handled by machines talking to machines. The 'intelligent agents' people have touted for ages will finally materialize.*

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For example, a patient might present a set of symptoms which correspond to a number of different distinct diagnoses each with a different probability. Probabilistic reasoning techniques' are generally employed to address uncertainty.

**Inconsistency**: These are logical contradictions which will inevitably arise during the development of large ontologies, and when ontologies from separate sources are combined. Deductive reasoning fails catastrophically when faced with inconsistency, because "anything follows from a contradiction". Defeasible reasoning and paraconsistent reasoning are two techniques which can be employed to deal with inconsistency.

**Deceit**: This is when the producer of the information is intentionally misleading the consumer of the information. Cryptography techniques are currently utilized to alleviate this threat.

This list of challenges is illustrative rather than exhaustive, and it focuses on the challenges to the "unifying logic" and "proof" layers of the Semantic Web.

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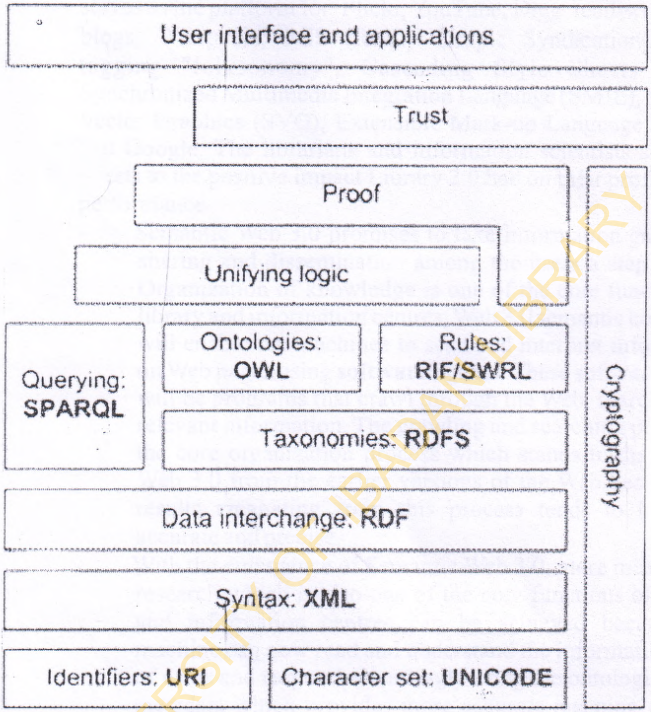
**Components of Semantic Web**




**The Semantic Web Stack**

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**Implications of Semantic Web 3.0 for Library and Information Centres**

The current possibilities of information gathering, sharing and dissemination among many users of Library 2.0 was a by-product of Web 2.0 which makes possible the consumption as well as contribution to the pool of information on the W3. Library 2.0 contains data that links to multiple areas such as books, reviews, users, and catalogs. It provides services for individual recommendations; supports tagging and traditional subject

headings; and supports the needs of the community. Web 2.0 serves as the platform for Flickr, YouTube, Digg, read-write Web, blogs, Wikipedia, RSS (Really Simple Syndication), social tagging "folksonomy", Cascading Style Sheets (CSS), Synchronized Multimedia Integration Language (SMIL), Scalable Vector Graphics (SVG), Extensible Mark-up Language (XML), and Google. The librarians and information scientists severally attests to the positive impact Library 2.0 had on their professional performance.

Semantic Web 3.0 promises to take information gathering, sharing and dissemination among the users a step further. Organization of knowledge is one of the core functions of library and information centres, Web 3.0 semantic compliant will enable the machines to scan and interpret information on Web pages using **software agents**. These software agents will be programs that crawl through the Web, searching for relevant information. The crawling and searching process is the core organization process which stands to distinguish Web 3.0 from the earlier versions of the Web because the results emanating from this process tends to be more accurate and precise.

With the emergence of Semantic Web 3.0, more meaningful research which is also one of the core functions of library and information centres can be achieved because the machine can now read and understand the information need of users and respond accordingly using the ontologies from metadata which provides more accurate meaning of data, hence more accurate results of findings. Information personalization and intelligent search are also greatly encouraged through semantic Web 3.0.

The Web of junks has been a great source of concern to many library and information professionals, the emergence of Semantic Web 3.0 may gradually bring an end to the web of junks where more irrelevant information is sometimes captured in the process of information searching.

With the effective usage of ontologies from metadata, more accurate results can now be found in the process of information seeking among Library 3.0 patrons.

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## Conclusion

It is obvious that the rate at which technology is advancing has left some wandering in the ocean of uncertainties – not sure whether they are actually coping with the trend or not as more and more possibilities become the feature of Internet and W3 technology. Librarians and information professionals in the developed nations have proven their mettle in the face of this technology proliferation and remain very relevant in the scheme of things. What happens to librarians in the developing nations? We need to increase our technological knowledge-base, become proactive and think ahead of these streams of technologies and how they can be adapted professionally for the good use of our clients. The semantic Web 3.0 is here just as others have come, we can and we shall cope with it by using it as a platform to deliver effective and efficient services to our patrons.

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