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The Development of the Web and Its Impact on Libraries and Scholarly Communications

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THE DEVELOPMENT OF THE WEB

AND ITS

IMPACT ON LIBRARIES

AND

SCHOLARLY COMMUNICATIONS

Michael B. Binder, Dean Emeritus

Western Kentucky University Libraries

August 31, 2012

Introduction

In 2011 when I was given the opportunity of taking a research leave to explore a topic of my choice, I immediately thought of the changes in which we find information today both in our work and home lives. This was a natural reaction for me because ever since I had initiated my studies of librarianship and information science, I had been most interested in technology and its impact on libraries. This started with Professor Susan Artandi at Rutgers when I first learned of systems analysis and library automation and reached greater fruition under Professor Leon Montgomery's instruction on programming languages—learning PIL (Pitt Interpretitive Language) and FORTRAN—and their use in automating library procedures. It continued and gained greater steam as I pursued my career in administering first college and then research libraries.

In my administrative career I always tried to either be a pioneer in services enhanced by technology or be close to the curve. This was true when I initiated online database searching in the early days of DIALOG and also became an early adopter of OCLC integrated online services. At Western Kentucky University where I spent the majority of my

library leadership experience, it was a priority that we serve as early adopters of technology that showed the potential of enhancing our services in some considerable way. I was fortunate to have a strong and willing faculty and staff corps to lead. As a result, we launched several firsts, including the first web site in Kentucky and also the first digital institutional repository (TopSCHOLAR). Nationally we also distinguished ourselves as we developed one of the first homegrown information portals, and, as mobile technology took fruit, one of the first library mobile sites. With the availability of iPhone apps, we released one of the first university library apps and also an iPad version of our library newsletter. And when social networking gained prominence, we were early Facebook adopters and Twitter tweeters.

Hence I lived and breathed the development of technology and social media throughout my administrative career. During my research leave and for awhile afterward, I looked at the background behind these significant contemporary developments in an effort to better understand them both for myself, and for you, the reader.

I hope you will benefit from reading this report as much as I did in researching and writing it. Changes in the topics continue to occur regularly and in this hyper-connected instantaneous world in which we live, are reported on almost every minute. I kid you not. Just follow the twitter commentaries of leading technological and social media gurus and you will understand what I mean, if your initial reaction is, really? To maintain the currency of my understanding of developments in the fields encompassed by the report, I will be posting entries in my soon-to-be launched blog, "Library and Tech Trends Watcher." I hope you will take a look.

The Development of the Web

Web 1.0

As Phil Simon states in *The Age of the Platform*, "we can only understand this new age—and how we arrived here—by first taking a look at where we have been" (Simon, 2011, 1). Looking back on the early years of the web, we now call its formative period, Web 1.0, and see it percolating from 1993 to early 2005.

In fact, the web as we know it first began a long evolution in 1969, when the USA's Defense Advanced Research Projects Agency (DARPA) with university and private industry partners assembled four "networked" mainframe computers into what became known as ARPANET. For more than two decades, the early beginnings of the Internet consisted mainly of text-only bulletin boards, newsgroups and early e-mail. So from approximately 1969 to 1989, the new form of computer connectivity remained the province of academia and the federal government. Change began to occur with CompuServe and AmericaOnline introducing commercial Internet services. However, these online pioneers all functioned with mainframe-based computer services.

Also during this time period, beginning in 1993, Mosaic (the early version of today's Netscape browser) was released by the National

Center for Supercomputing Applications (NCSA). In effect, it was the very first web browser and the bequeather of what we now call the Internet. Throughout the 1990s, the development of the Internet proceeded apace. First used for the development of basic web pages (extremely unsophisticated when measured against today's high-tech flash and design-oriented pages), rudimentary e-mail systems and simple instant-messaging programs, we were all really impressed with the marvelous technology and the changes in our lifestyles it portended. In fact, by the late 1990s, online shopping through the web sites of Amazon and America Online had begun in full earnest. As Simon notes, this keen interest in the emerging technology was reflected in extraordinary valuations and stock prices of high-tech companies across a wide range of sectors. Even the mass media took notice as Netscape co-founder Marc Andreesen found himself on the cover of *Time* magazine in 1996.

Just a few years prior, I had described early experimentation in online shopping, stock services, weather reporting, etc. through a different technology—one called videotext and teletext technology—that had its heyday in the 1980s, just prior to the development of the Internet and its web-based services (Binder, 1985). Amazingly, all of this was coming true as the Internet bubble continued to expand. It burst as all bubbles eventually do, bringing the financial collapse of numerous Internet-enabled startups. However, while many companies went by the wayside, the technology on which they were based—the Internet—not only remained but continued to grow in strength, reliability and speed. While it was becoming more common to see people conduct their banking and shopping online—as documented by the Pew Internet and American Life Project (2005)—in essence, the first applications made of the Internet were largely focused on surfing the web. Enter what became called Web 2.0: where we find ourselves today.

Web 2.0

Web 2.0, well, what is it really? As I indicated above, it incorporates the basic technology of Web 1.0 while moving way beyond it in many different ways. The actual birth of the term and the first explanation of the concept it embeds is credited to Tim O'Reilly, the publisher of O'Reilly Media. In September 2005, he posted the following entry on his publishing company's web site (as quoted by McAfee, 2009):

> The concept of "Web 2.0" began with a conference brain-storming session between O'Reilly and MediaLive International. Dale Dougherty, web pioneer and O'Reilly VP, noted that far from having "crashed," the web was more important than ever, with exciting new applications and sites popping up with surprising regularity. What's more, the companies that had survived the collapse seemed to have some things in common. Could it be that the dot-com collapse marked some kind of turning point for the web, such that a call to action such as "Web 2.0" might make sense? We agreed that it did… (loc. 431-434)

O'Reilly and his cohorts proceeded to study in great detail what Dougherty had dubbed Web 2.0. Their research centered on the by then developed community-built encyclopedia, *Wikipedia*, in addition to social networking (Facebook and MySpace), bookmarking (Delicious), video-sharing (YouTube), classified ads (Craigslist) and blogging sites (Blogger and Typepad) as well as a web search engine (Google).

Web 2.0 functions like no technology before its debut. Very simply put, it places power in the hands of the individual and the network they're using with web content dispersed in formats conducive to individual use. The online experience hence improved considerably, and continues to get better as programmers gain ever greater expertise in exploiting the capabilities of the software. Moreover, integration and the elimination of barriers formerly between computer desktops and mobile devices increases the application possibilities far beyond what the creators of the web first envisioned. (Funk, 2009, xi-xii)

Any organization, profit or non-profit, can benefit from adopting Web 2.0 approaches irrespective of its size and/or budgetary resources. While more complex web applications can be developed given the necessary finances, armed only with a book, web-based tutorial or continuing education workshop, people of all types and backgrounds can, and have been learning and adopting web-based approaches.

In actuality, to fully understand Web 2.0 involves a lot of answers to fundamentally complex questions. Most important for applications of business—called Enterprise 2.0 (McAfee, 2009)—there are the questions of basically how to make money for the business, or how to "monetize" the web-based application. Hence business model analysis and corporate strategy as well as entrepreneurship is involved and studied in depth. From the technical side, there is a lot that goes into the design, information architecture and programming sides of Web 2.0. It's much like a car. While it's nice to know how the mechanical side functions, we don't need to know to be able to drive it. Ditto for Web 2.0 in terms of the capability to use it. However, for those interested in the inner workings of programming languages internal to web functioning and how they interact with RSS feeds and web-designed services such as e-commerce and online banking, a range of learning

opportunities are available from books to videos. In fact, a series of YouTube videos can be watched to gain the technical perspective of Web 2.0.

Tim O'Reilly provides further definition. At one of the Web 2.0 conferences his publishing company sponsored, he summarized Web 2.0 thusly (as quoted by Schuen, 2008):

> Web 2.0 is the business revolution in the computer industry caused by the move to the internet as a platform, and an attempt to understand the rules for success on that new platform. Chief among these rules is this: Build applications that harness network effects to get better the more people use them. (loc. 195)

Also unique to Web 2.0 was the concept that businesses could make more money by giving things away than by charging for them. This idea is also referred to as freemium. It's been the task of Web 2.0 companies to figure out how to profit, monetize, capitalize and leverage its new business models while starting from different premises than traditional ones.

Yet another concept inherent to Web 2.0 is the groundswell, described by Li and Bernoff (2009) as:

> A social trend in which people use technologies to get the things they need from each other, rather than from traditional institutions like corporations. (loc. 139)

The concept is based on a report from Forrester Research in 2006 called "Social Computing" that described a new trend in the online world: one where people were using the new web-based tools to connect with each other in different ways depending on the function of the site itself. Obviously this happens with those who use Facebook, YouTube,

Delicious, and even Wikipedia. Also, through a buyers' site like eBay, people can buy from other people rather than a store, even an online one. Linux is a larger illustration inasmuch that it involves numerous programmers across the globe cooperating to build and maintain an operating system used by the masses rather than relying on a corporate entity like Microsoft. Fandango is one of many movie sites wherein people decide what movie to attend based on other folks' views rather than the mainstream media reviews.

So what all is going on here? There are varying explanations. I've examined a few and will describe their different take on the same phenomenon in the remainder of this section.

Li and Bernoff (2009) describe the phenomenon as the confluence of three forces: people, technology and economics. In their eyes this collision has led to a new era, one we discussed earlier that they call the "groundswell," and a process that continues to evolve, and rapidly. Let's look at each of those forces. First, people have always had a natural reaction to be averse to institutional and corporate influence, with the most extreme going as far to rebel and protest. Just look at the 2011 Wall Street protest for evidence. Technology, as I've described, beginning with Web 1.0, has become increasingly ubiquitous—and with the advent of smart phone technology, the web is literally in our hands. We can not only surf, shop, bank, etc. with our new technology, we can also connect with our friends and colleagues over web sites and apps designed specifically for those purposes. The end result is masses of people connecting with each other, sending news feeds and photographs of what they think will interest their friends, throughout the day, endlessly. The economics of the groundswell relates to the online traffic. Google has so far been the most successful at monetizing its approach to the web. As described by Battelle in his book *The Search:*

How Google and Its Rivals Rewrote the Rules of Business and Transformed Our Culture: "Google made billions, one nickel at a time." (Schuen, 2009, loc. 186) This is not fiction. Advertisers pay a minimum of a nickel a click for posting paid advertising on web pages via Google's AdSense company; as the clicks number into the tens and billions of clicks, the ad revenue is shared both by the page on which the posting occurs and by Google. And the numbers are astronomical. Back in 2009, writing about it, Ken Auletta in his *Googled: The End of the World as We Know It* noted that Google's advertising revenues—at the time more than $20B a year—accounted for over 40 percent of all the online ad revenue. Just think, prior to the advent of Web 2.0, profits of this sort from the online world were dreamed about but generally unthinkable. From a site provider's perspective—such as a web site of a well-trafficked blog or that of a local business—the arrangement is pure nirvana; one doesn't have to place the ads by himself/herself. You only have to register for an account with Google AdSense, which allows Google to place the ads where it believes they'll have the most traffic—and then wait for the Google checks to flow in. Of course ad revenue is only one of multiple funding streams available to web users, but it is a significant source and is growing mightily. Hence taken together—people, technology and economics—we have the phenomenon aptly dubbed the groundswell by Schuen (2009) and the company she represents, Forrester Research.

Several observers of Web 2.0 have characterized the maturation of the web in terms of it representing the onset of a "Platform Age"—Funk (2009) devoting a chapter to the concept and Simon (2011), an entire book. As discussed earlier when addressing the fact that so much power has literally been placed in the hands of people, it was noted that folks can thereby have their own version of the web—and

instantaneously, too. Hence we're seeing simultaneous effects both cultural (the groundswell) and technological (the interactive computer programming), the end result being a smooth and increasingly touch-oriented user interface. Again, while looking underneath the hood isn't necessary to use the product, it does glean a better understanding of how Web 2.0 was not only made possible but continues to make enormous strides in its growth and development. Four attributes should be noted as particularly making Web 2.0 distinguishable: "dynamic, interactive websites; software in the cloud; high bandwidth, rich media experiences; and distribution across mobile and other devices." (Funk, 2009, 34) None of these were present when the web was in its 1.0 form. Phil Simon in his book, *The Age of the Platform: How Amazon, Apple, Facebook, and Google Have Redefined Business*, goes into considerable depth on the various corporate infrastructures that have been created, asserting that "It's all about the platform" (Simon, 2011, loc. 220) He rightly points out, for example, that due to the development of publishing electronic platforms, the book is no longer the "book" printed on paper; instead, through the miracles of digitization, it has the capability of offering much greater depth, variety and substance. I personally call the books that through their hyper-links embed access to full text as well as multi-media, "magic books"; often modern e-books are hard to distinguish from web sites. Beyond the dramatic transformation of the book through a platform-based business, as Simon notes:

> The platform is becoming one of the most important business models of the new millennium—and with good reason. Buoyed by the success of Amazon, Apple, Facebook and Google, many exciting new companies are hitching their wagons on the platform." (Simon, 2011, 24)

Similar to the big four companies, their goal is:

> become a platform *plank*, preferably a powerful one; build a useful and complementary—that is, a product, service, or community that integrates with an existing platform, or better yet, *platforms*. (Simon, 2011, 24)

Hence we've seen the continued development of new companies developing platforms for their own products and/or services (their planks). Several companies are noted by Simon as holding the promise of themselves becoming "the next victors of the Age of Platform." They are: *Foursquare*, the location-based mobile platform started in 2009, which allows its users to "check in" via the Foursquare smartphone app (or text/SMS), share their location with friends, receive points and so-called virtual badges; *Twitter*, which started in 2008 with its roots in micro-blogging, that has grown into a major communications medium—it's rare when there isn't a day on the TV news when someone is quoted for their tweets—and makes its API (automatic programming interface) available to developers, spawning off numerous Twitter-related products, such as Tweet Grid, TweetDeck, Hootsuite, Slice, etc.; *Wordpress*, the blog publishing company, which dates back to 2003 and has grown to now more than 20 million web sites powered by wordpress.com (from yours and mine to some of the most powerful sites on the web, such as those offered by the NFL and CNN); *Groupon*, the local deals company, started in 2008, that had enough confidence in its future to reject, in 2010, a $6B acquisitions offer from Google—and, similar to Twitter, makes its API available to developers, thereby enhancing its own application in the business marketplace; *Adobe Systems*, best known for its products used by millions—Adobe Reader and Adobe Flash; and *LinkedIn*, which with over 100 million users internationally has become a major platform in both the professional

communications and job-seeker platform category, and, most importantly, been able to successfully monetize its various planks. To this list, I would add one other, *Pinterest*, which according to a report aired on the ABC show, Good Morning America, on August 27, 2012, is the fastest growing web site ever. Soon after its launch as a beta version in March 2010, Pinterest began to be used by people "to plan birthdays, weddings or vacations, do craft projects, list things they would like to wear or aspired to own and provided tips on many different topics" (Taylor, 2012, 6) By May 2012, only two years from its modest launch, it had more than 110 million visitors with most of them coming from the UK and the USA. It is now recognized—after Facebook and Twitter—as the third most visited social media platform; its circled P now sits next to the large F and the small t on the most heavily used web sites. It works through pinnings of images and the creation of boards. In illustrating how it might be deployed, Taylor (2012), an early Pinterest enthusiast, says:

> If you are a foodie, for example, you can find hundreds (at least) of other foodies with which to share recipes. If you love sports or cars, the same thing applies, you will be sharing and pinning in no time. (p. 4-5)

With respect to platforms, it is believed that along with its rapid growth, Pinterest is poised to become yet another major platform for a wide range of business and organizational functions.

A last perspective on the development and manifestations of Web 2.0 is provided in the view that the development of mobile, specifically the smartphone, has been the driving force behind the recent acceleration of the Information Revolution. In the words of Michael Saylor, author of

The Mobile Wave: How Mobile Intelligence Will Change Everything (2012):

> What amplifies the transformational power ahead is the confluence of two major technological currents today: the universal access to mobile computing and the pervasive uses of social networks. Social networks radically increase the use of computing devices, and mobile computing increases the usefulness of social software. It's a virtuous cycle that magnifies the impact of both waves…Mobile technology puts real time information in your pocket, allowing everyone to magnify his or her knowledge in any setting. In the hands of business executives we see faster and smarter decision making. In the hands of consumers we see smarter buying via "hijacked retail." In the hands of third world farmers we see much more efficient markets. And real time information distributed through growing mobile social networks has proven powerful enough to drive revolutions, toppling long-standing governments in a matter of days. Information is powerful and we are living through an Information Revolution, with consequences comparable to the Agricultural and Industrial Revolutions. (loc. 63-74)

While this ends our discussion of the second configuration of the web—that, as O'Reilly first noted we should call Web 2.0—and allows us to move onto a consideration of Web 3.0, it should be remembered that in the case of Web 1.0, it took people a few years to realize it had ended and a new web era was upon us; that may be what will occur with Web 3.0. It's highly conceivable that we won't know it's "Web 3.0" until some web visionary points out its clear attributes and how it differs so notably from the characteristics and limitations we encountered with Web 2.0.

Web 3.0

Say we were to take a trip to the land of Web 3.0. What would it look like? Well, while nobody really knows, when Berners-Lee first described the concept beyond his fellow programmers to lay people, it began to be thought of as the semantic web and a web of data—in contrast to the Web 1.0 and Web 2.0 which have essentially been various degrees of linked web pages (also termed hypertext links) or universal resource locators (URLs). Berners-Lee, Hendler and Lassila described this future evolution of the web in an article in May 2001 published in *Scientific American*:

> … Most of the Web's content today is designed for humans to read, not for computer programs to manipulate meaningfully. Computers can adeptly parse Web pages for layout and routine processing—here a header, there a link to another page—but in general, computers have no way to process the semantics: this is the home page of the Hartman and Strauss Physio Clinic, this link goes to Dr. Hartman's curriculum vitae.
>
> The semantic web will bring structure to the meaningful content of Web pages, creating an environment where software agents roaming from page to page can readily carry out sophisticated tasks for users. Such an agent coming to the clinic's Web page will know not just that the page has keywords such as "treatment, medicine, physical, therapy" (as might be encoded today) but also that Dr. Hartman *works* at this *clinic* on *Mondays*, *Wednesdays* and *Fridays* and that the script takes a *date range* in *yyy-mm-dd format*

> and returns *appointment times*. And it will "know" all this without needing artificial intelligence on the scale of 2001's Hal or Star Wars's C-3PO. Instead these semantics were encoded into the Web pages when the clinic's office manager (who never took Comp Sci 101) massaged it into shape using off-the-shelf-software for writing Semantic Web pages along with resources listed on the Physical Therapy Association's site.
>
> The Semantic Web is not a separate Web but an extension of the current one, in which information is given well-defined meaning, better enabling computers and people to work in cooperation. The first steps in weaving the Semantic Web into the structure of the existing Web are already underway. In the near future, these developments will usher in significant new functionality as machines become better able to process and "understand" the data that they merely display at present. (p. 29)

So there you have it; in addition to the contrast to Web 2.0 I mentioned earlier—going beyond hyperlinks to data—Berners-Lee et al. add that the machines will have semantic capabilities to comprehend the data they display. Also, their noting that the first steps of incorporating the Semantic Web are underway refers to ongoing research under the auspices of the World Wide Web Consortium (W3C), which Berners-Lee founded in 1994 at MIT and continues to serve as its director while maintaining his position as Chair in Computer Science at the University of Southampton, England. It is important to note, as addressed in the Wikipedia entry for Tim Berners-Lee that he had made his world wide web idea and its initial development available freely. The W3C eventually determined that in a similar way, its standards should be based on royalty-free technology, so they could easily be adopted by anyone with the capability to do so.

In 2006, Berners-Lee described the semantic web as a component of Web 3.0:

> People keep asking what Web 3.0 is. I think maybe when you've got an overlay of scalable vector graphics—everything rippling and folding and looking misty—on Web 2.0 and access to a semantic Web integrated across a huge space of data, you'll have acess to an unbelievable data resource... (Wikipedia, Semantic Web entry)

Proof that the transition from Web 2.0 to Web 3.0 remains an area of research rather than practical application may be found in the following additional portion of the Wikipedia entry:

> Some of the challenges for the Semantic Web include vastness, vagueness, uncertainty, inconsistency, and deceit. Automated reasoning systems will have to deal with all of these issues in order to deliver on the promise of the Semantic Web.
>
> - Vastness: The World Wide Web contains many billions of pages. The SNOMED CT medical ontology alone contains 370,000 class names, and existing technology has not yet been able to eliminate all semantically duplicated terms. Any automated reasoning system will have to deal with truly huge inputs.
>
> - Vagueness: These are imprecise concepts like "young" or "tall". This arises from the vagueness of user queries, of concepts represented by content providers, of matching query terms to provider terms and of trying to combine different knowledge bases with overlapping but subtly different

concepts. Fuzzy logic is the most common technique for dealing with vagueness.

- Uncertainty: These are precise concepts with uncertain values. 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.

Impact on Libraries & Scholarly Communications

In this last and concluding part of this report on the development of the web, the impact on libraries and scholarly communications in general is is assessed. It is rare nowadays to find a library un-weblike nor not making use of social networking applications like Facebook and Twitter. While this section is restricted to libraries in the academic environment, much of the commentary would apply to libraries in the public and corporate sectors as well.

The primary question is, have libraries in academe responded well to the challenges of Web 2.0? I answer resoundingly yes and am reinforced in that belief by no less an authority than James Neal, now Vice President of Information Services at Columbia University who in prior positions deaned at both the University of Indiana and Johns Hopkins University. Neal and his co-author, Damon Jaggers, Associate University Librarian for Collections and Services at Columbia, assert that their review of library practices applying Web 2.0 services "indicate clearly that academic libraries are stepping up to the challenges and opportunities of Web 2.0 services." (Neal and Jaggers, 2010, 65)

Libraries have been assisted in their efforts to integrate the new web-based services by a variety of conferences, courses, publications, blogs, web sites, and wikis. For example, back in 2007, Laura Cohen edited a volume published by ACRL, entitled *Library 2.0 Initiatives in Academic Libraries*. It contains numerous examples and models for implementation ranging from individual librarian's projects to large institutional collaborations—from the belief that web-scale projects, programs and services can be developed on varied levels depending on

the availability of institutional support, staffing and of course funding. And in 2008, ARL SPEC Kit 304 was devoted to the topic, *Social Software in Libraries*, including discussion along with concrete "library" applications of not only social networking (Facebook and MySpace) but also media sharing (YouTube, iTunesU, and Flickr), social bookmarking (Connotea, LibGuides, delicious, MTagger, and LibraryThing), wikis, blogs, RSS feeds, instant messaging, virtual worlds and widgets. More recently, ALA created ALA TechSource, which in addition to publishing Library Technology Reports, Smart Libraries Newsletter, and the ALA TechSource Blog, also has created TECH SET edited by Ellysa Kroski. This multi-volume series includes several titles directly relevant to the web, covering such topics as cloud computing for libraries, mobile library applications, semantic web technologies and social searching for librarians, wikis for libraries, blogging for libraries, library videos and web casts, and others.

With especial relevance to the earlier noted prominence that anything "mobile" has developed in society at large, libraries have not been immune from such widescale development. In fact, a wiki devoted to describing best practices for library mobile applications and interfaces has been developed and is available at: http://www.libsuccess.org/index.php?title=M-Libraries. There one will find extensive information on library mobile site tools, collections, instruction, tours, augmented reality and even services that will translate your web site into a mobile friendly one. In fact, not until I browsed through the site did I learn that MIT has created "MIT Mobile Web Open Source Project." A long list of the links for library web sites "especially designed for viewing on mobile devices" is also made available. There is much more found on this wiki along with an abundance of links, including: information on SMS notification and reference services ("texting" to the general public), QR (Quick

Response) 2D Codes, Augmented Reality, library vendors offering mobile interfaces or applications, publishers providing databases for mobile devices (iOS, Android, iPhone and BlackBerry), and lastly additional resources for further study.

The mobile wiki is part of a much larger wiki, entitled "Library Success: A Best Practices Wiki" which can be accessed at http://www.libsuccess.org/index.php?title=Main_Page. In addition to the mobile component described above, there are several other categories under Technology that relate to this discussion, including: Digitization, Electronic Databases, Institutional Repositories, Improving Access (with reference to open_url, metasearch, metadata harvesting, etc.), library systems, web browser extensions, web services, widgets, free/open software, SMS or Short Messaging Service, technology in library service, technology planning, virtual worlds, and web site design (with individual categories for calendars, content management systems, Google My Maps, podcasting, web statistics packages, and web tips and tricks).

It is clear that there is no dearth of resources readily available for those libraries and librarians wishing to further their capabilities in web-related topics.

In a similar manner, there has been widespread application of the web in the sphere of scholarly communications. I noted above the links to those databases with mobile designs; those are in addition to the same databases being available in standard web designs. During the period of web expansion into society at large, both commercial publishers, professional associations and university presses were making their journals, conference proceedings and books increasingly available in digitized format including via the web. It's not within the scope of this

report to go into depth on the various scanning projects and the attendant legal issues and battles that have been fought other than to mention that they continue unabated with no clear resolution in place. Even public libraries have not been immune from the desire of commercial publishers to directly interface with end users and bypass the intermediary/library whenever possible.

What is within the purview of this report is the change in academic publishing through the development and promulgation of what has become known as the "open access" (OA) movement. In this regard, Peter Suber has been the leading visionary, architect and communicator. His book, *Open Access* (MIT Press, 2012) was recently published as part of the new series, MIT Press Essential Knowledge. Interestingly, while I obtained the book from Amazon as a Kindle publication, it will itself be OA twelve months after its publication. As the series title indicates, Suber does exactly that, covering the essential knowledge re: Open Access—its definitional aspects, the motivation behind the movement, its varieties, relevant policies, the scope, the economics and what he calls, "the casualties". Also, the future of open access is projected. What then is open access? As the first word of the term indicates, it indicates openness and is defined by Suber as a kind of access where "authors, unencumbered by a motive of financial gain, are free to provide to their readers." (loc. 126) Further, "open access (OA) literature is digital, online, free of charge, and free of most copyright and licensing restrictions." (loc. 126) According to the Wikipedia entry, "OA self-archiving was first formally proposed by Stevan Harnad in 1994 although it was already being done by computer scientists in their local FTP archives in the 1980s; also, high-energy physicists have been self-archiving centrally in the arXiv since 1991."

So we've got a good idea of its beginnings. Most remarkably, a study conducted in 2010 found that about 20 percent of the total output of peer-reviewed articles published in 2008 could be accessed via Open Access publications and/or institutional document repositories. Certainly this was a result of the tremendous growth of the World Wide Web during this period. It clearly shows how much scholarly communications—specifically disciplinary journals—have been impacted by the development of the web.

Suber describes the basic idea behind OA in simple terms:

> Make research literature available online without price barriers and without most permission barriers. Even the implementation is simple enough that the volume of peer-reviewed OA literature and the number of institutions providing it have grown at an increasing rate for more than a decade. If there are complexities, they lie in the transition from where we are now to a world in which OA is the default for new research. This is complicated because the major obstacles are not technical, legal, or economic, but cultural…
>
> In principle, any kind of digital content can be OA, since any digital content can be put online without price or permission barriers. Moreover, any kind of content can be digital: texts, data, images, audio, video, multimedia, and executable code. We can have OA music and movies, news and novels, sitcoms and software—and to different degrees we already do. But the term "open access" was coined by researchers trying to remove access barriers to research… (loc. 179)

Regarding the cultural obstacles that Suber notes as major, what he is really referring to is the generational changes that are bound to influence

future development of OA. The new generation of Gen X scholars, he says, will gradually replace those who didn't grow up with the Internet and web access. Furthermore, the expectations are totally different—the new generation expects to publish and find everything they need online; those they're replacing, somewhat not as comfortable with online publishing and overly concerned about the copyright police. It's hard to argue with his assertion that over time:

> Those who want to live in a world where all peer-reviewed literature is free online are themselves growing in numbers and will soon hold power in universities, libraries, learned societies, publishers, funding agencies, and governments. Generational change is on the side of OA. (loc. 1793)

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