"Through the looking glass: envisioning new library technologies" mobile libraries, beyond the Web site

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Libraries have consistently sought to use technology to reach out into their communities. From the early horse-drawn bookmobiles originating in Britain to the modern bicycle-powered carts in dense cities, the phrase "mobile library" has long been associated with traveling collections. But with the advent of digital collections, and most notably since Apple launched the iPhone in 2007, the phrase "mobile library" has evolved to become synonymous with mobile devices such as phones and tablet devices rather than traveling bookmobiles. By creating new resources, libraries have worked to meet emerging needs and adapt to this transformation.

This column will highlight recent and near-future innovations relating to mobile access that can facilitate new interactions between patrons and libraries. It will explore mobile hotspots that allow library patrons to "check out" the Internet to access a world of information, as well as the related technologies on the horizon that are poised to transform Internet access worldwide. Innovative libraries and vendors are catching up to the implications of "mobile" beyond the Web interface and are making their collections and technological offerings available using re-envisioned bookmobiles, servers and library circulation modules. By using new and cleverly reconfigured technology, libraries can continue to play a central role in the sharing of information in an increasingly mobile world.

Access to the Internet

For any online interface to be meaningful, no matter how well designed, the patron must first be able to access the Internet. An Internet connection underpins most efforts by libraries to provide digital literacy services and connects their users to virtual resources. While many people take access for granted, large inequities in access to communication technologies are still very real. Nearly four billion people still lack access to the Internet worldwide, and the quality and affordability of that access still varies widely (Luckerson, 2014).

Even in developed countries, some geographical regions still lack access to affordable Internet. When it is available, it is frequently not accessible to large parts of the population for reasons that coexist with class, race and education, among other factors. Historically, libraries have played an important role in helping bridge this divide by providing use of computers and Internet connections to their patrons at no charge. In recognition of this role, grants and policy initiatives around the world have targeted libraries as a community resource that can provide access to and support for the informational resources provided by the Internet (Thompson *et al.*, 2014).

Checking out the Internet

Now, as Internet access is increasingly being provided wirelessly by satellite, new mobile hotspot technology allows libraries to "check out" the Internet to their patrons. This takes Internet access outside the library walls. For instance, patrons at the Providence Community Library (RI) can now check out a mobile hotspot, powered by Mobile Beacon, just as they would check out any other piece of technology (Lynch, 2013). With this small mobile device, they can connect to high-speed satellite Internet wherever they go. Mobile Beacons create wireless Internet access in the nearby area using technology similar to tethering with smartphones. The hotspot has a single button, which makes it easy to use. That button creates a local Wi-Fi signal, and the access is controlled by a password. Patrons can then connect their personal computer, tablet or other device to the Wi-Fi signal and access the library's Web site or any other online resource they choose.

Different libraries have used this innovative technology in different ways. In Providence, RI, patrons can check out the device for a week. In areas where the focus is on providing access to users who would not otherwise have access to a reliable Internet connection, the devices often check out for either six months or a year. In almost all instances, the device is loaned only after the patron has received some form of basic training and signed an acceptable use policy.

The New York Public Library's pilot study with 100 devices revealed just how meaningful this idea could be when compared to providing access to the Internet only within the physical space of the library. Patrons using a mobile hotspot spent nearly 3 hours a day online, while the average usage of a library workstation was only 40 minutes. Additionally, much of that time was spent online during times when the library is typically closed (Lynch, 2014b). As satellite Internet and related technologies continue to expand, libraries will have the opportunity to be a shared community resource that empowers their patrons via access to the Internet.

The infrastructure that powers the Internet

Technologies such as Mobile Beacon are themselves dependent on

larger infrastructure changes and shifts in the industry. For instance, they cannot provide access to satellite Internet in areas where there is no satellite provider. In the case of Mobile Beacon, that provider is a Sprint network of satellites. Before libraries and other users can replicate this success worldwide, they will first need to confront the reality that there are many places where no infrastructure supports Internet access.

However, many large technology companies are investing in new technology designed to bring the rest of the world online. For instance Elon Musk, the chief executive officer (CEO) of SpaceX and CEO and chief product architect of Tesla Motors, has announced that he wants to launch smaller micro-satellites to provide Internet to currently underserved areas (Musil, 2014). These satellites would operate at a smaller scale than traditional satellites and presumably cost significantly less to launch and operate.

Similarly, Facebook's Connectivity Lab has been tasked with exploring options to expand access to the Internet. Rather than build better satellites, they want to expand the reach of existing satellites using infrared lasers and drones. This would enable them to launch relatively inexpensive, low-flying aircraft that could be used to expand the range of the signals created by satellites to more accurately target the needs of specific regions (Grove, 2014).

Perhaps the most surprising effort is Project Loon, funded by Google. Its goal is to use high-flying balloons, rather than drones or other aircraft, to provide Internet access to areas that would not be served otherwise. In just a couple of years Project Loon has made remarkable progress, and their balloons can now last over 100 days. The technology that powers them has also improved dramatically – the balloons now use sophisticated monitoring systems to make readjustments to control their own locations. In 2015, Google hopes to continue refining this experimentation in the Southern hemisphere, with relatively less populated areas, and by 2016, they intend to bring their first customers online in South America, Southern Africa or Oceania (Oremus, 2014).

This is one of Google's many "moonshot" projects: they are expensive, high-risk projects that Google believes will have commensurately high rewards if they are successful.

For both Facebook and Google, part of the reward is not just in direct funding by subscribers but also in expanding the market for their other, better known services.

In the near future, some combination of these efforts will help provide more robust Internet coverage around the world. Even in relatively well-populated areas near large cities, significant areas, or "dead zones", exist without reliable satellite Internet. As the infrastructure for providing Internet access continues to grow, libraries can look for opportunities to expand that access and ensure that their communities can benefit. This expansion is a prerequisite for providing access to digital literacy efforts, as well as the myriad of other resources that are delivered through the Internet.

Gigabit infrastructure in physical libraries

The technology that supports access to the Internet can have beneficial effects for physical libraries as well. In the USA, many communities are beginning to invest in fiber-optic gigabit Internet. This technology allows for significantly faster speeds than is typically offered by traditional providers. In some communities, such as Chattanooga, TN, this effort was funded as a local municipal project. Just as public libraries are a public resource, so too can the investment needed for this ultra-high-speed Internet be a shared community resource.

In Vermont, a new gigabit network was completed in December 2014, and it now connects libraries across the state. As a result, even in rural counties, these libraries are starting to consider what new services they will be able to provide in their spaces. With more powerful Internet, it is possible to transmit more data, more quickly, which enables different kinds of presentations and technology. More people can connect at once and transmit more robust kinds of interactions. The libraries can host network-wide programs or envision new public programming opportunities, partnering with high-tech companies to provide the latest training opportunities (Enis, 2015).

Access to content

Providing access to the Internet is not the only way that libraries can ensure their patrons can access everything the library has to offer. For years now, some libraries have been offering "Technology Petting Zoos," in which libraries host events designed to introduce their patrons to the most recent technology they have to offer (Buljung and Cooper, 2013). This idea has become even more important as the technology at libraries continues to expand. The digital bookmobile, sponsored by Overdrive, has recently taken this idea on the road, traveling in a large bus and making stops in the USA and Canada. Wherever they setup a temporary location, they have the tools with them to train patrons to use downloadable resources provided by libraries (Reynolds, 2014).

Using similar technology, patrons who have mobile devices but no access to the Internet can use retrofitted mobile libraries to download and access resources such as e-books and downloadable audiobooks that otherwise would be inaccessible to them. They can be loaded onto patrons' personal devices or patrons may even use mobile devices that they have checked out from the library. Libraries could even drive into communities to loan mobile hotspots, along with a tablet that would make that device meaningful. By bringing technology to communities, libraries can take the old idea of the traveling library and combine it with whatever new innovations the libraries provide.

Access to library spaces

As libraries continue to evolve, so too does the relationship between the spaces that libraries provide, and their value to the communities they serve. The concept of a mobile LAM (Library, Archive and Museum) perfectly illustrates how emerging technology can be used to create mobile spaces that build on libraries' interdisciplinary education mission. A mobile LAM is a modified large bus, with equipment

onboard that is designed to provide engagement with all the technology that libraries have to offer. This includes not only tablet devices but also smart boards and even limited print material collections (Rovatti-Leonard, 2014).

A mobile LAM also expands on what the idea of a library can be by incorporating educational materials for self-directed learning, as well as museum collections. It is easy to see how a mobile LAM could also bring a technology petting zoo, described above, to allow patrons to interact with technology too expensive to check out, on a large scale, such as three-dimensional printers or virtual reality applications.

With the right equipment, such vehicles could be custom designed to meet the needs of a particular community. One LAM could focus on teens and make stops near established hangouts, hoping to stimulate self-directed, or better yet, collaborative learning experiences. Another could focus on providing research tools to farmers, provide students engaged in online learning with experience with presentation software or give communities tools to allow patrons to learn a new language. Libraries already use technology to facilitate events of all kinds in their spaces, and many of them can be re-envisioned to take place in controlled mobile spaces.

Access to library services go mobile

Such mobile libraries are, like the traditional bookmobiles of the past, expensive to design and operate. However, the professionals who help users locate, understand and interpret information – library staff – can also use new technologies to become mobile. By doing so, they can provide core services without having to bring much more than the bare essentials with them.

This is true even within physical library spaces. Vendors such as Innovative and SirsiDynix are redesigning their Integrated Library Systems with tablet devices in mind. This redesign means that libraries are increasingly able to perform certain functions, such as circulation, with ease while on the go. Combined with the increasing set of databases and library Web sites that are formatted to run on a mobile device, information professionals can now leave the traditional desk behind and travel within the library to reach their users. This movement facilitates more flexible services and offers the opportunity to re-conceptualize the purpose and meaning of the library desk. As the popularity of mobile devices continues to grow with patrons, library staff can demonstrate how to use library resources on a device that is similar to the one with which their patron is already familiar.

Access to library services in communities

The next evolution of this technology is the "Library in a Box" concept, which has been used to great effect by Worthington Libraries in Ohio (Lynch, 2014a). Using just a laptop that connects to their integrated library system (ILS), a mobile hotspot device, a barcode scanner and a receipt printer, they have everything they need to connect their users wherever they happen to be. By combining these few pieces of existing technology, libraries can operate in any space that will have them. They are not dependent on local Internet connections or computers.

Instead, the technology frees library staff to interact with the community at events such as book clubs, garden clubs, senior centers and street fairs. Because these improved ILS can connect securely from any location via a virtual private network, library staffers can register new users while away from the library. Once registered, patrons can instantly begin to learn how to access digital resources such as e-journals, e-books and streaming music. This means that the library can almost instantly provide access to collections without having to carry physical items with them.

Access to content

In some places, even this form of traveling library is not yet possible. In such situations, rather than rely on new technologies, existing resources can be reallocated with well-designed software to bring information to the user. If one can solve the copyright issues, databases of journals and other information resources can be transported on storage drives to almost anywhere.

LibraryBox takes this idea one stop further by combining media storage with a small low-powered Web server. LibraryBox is an open-source software program that can be paired with hardware to create a small device that allows anyone with a Wi-Fi device to connect to the newly created server. Using a computer, tablet or any other similar device, the user can then access whatever information resources have been placed on the LibraryBox; for instance, journal articles or e-books, without the need for a direct connection to the Internet (Griffey, 2014).

A recent crowd-funded project called Lantern shows how this kind of technology could transform information accessibility in the future. Lantern is a solar-powered device that can transmit information to local devices through Wi-Fi signals. Because the device is solar powered, it does not even need to be located in a place with reliable electricity to function. It starts off with a robust set of information, drawn from sources such as Wikipedia and copyright-free e-books. By using satellite connections, it also is constantly updated with new files using technology called Outernet. Outernet constantly broadcasts a core set of information, including updated news and weather, to Lantern devices.

In turn, the Lantern device can be accessed by Wi-Fi, and the Wikipedia entries, news alerts and so on can then be accessed by anyone with a Wi-Fi device (Brasil, 2014). With only the weakest connection to a satellite, it can provide immediate access to some of the core content of the Internet in locations that would otherwise be cut off from the Internet entirely.

Looking forward

The technological infrastructure that supports mobile libraries will continue to develop and expand access to information around the globe. Libraries can allow this to happen without them, but they also have an opportunity to participate in providing access to their communities. In this new context, libraries can also repurpose existing or newly refined technology and exploiting to transform how libraries provide access to their patrons.

Although Apple launched the iPhone in 2007, it has taken until very recently for libraries to develop Web sites and ILS systems that truly take advantage of that change. As these systems expand, it is up to libraries to find new ways to make the content they provide accessible and meaningful to their users, wherever they are.

REFERENCES

Brasil, C.C.B. (2014), "Outernet gets data to the unconnected", *BBC News*, 14 October, available at: www.bbc.com/news/technology-29593734

Buljung, B.B. and Cooper, K.G. (2013), "iPads, Kindles and Tablets, oh my: using a technology petting zoo to teach about downloadable ebooks", *Library Hi Tech News*, Vol. 30 No. 1, pp. 5-7.

Enis, M. (2015), "Vermont libraries benefit from completion of fiberconnect project", *Library Journal*, available at: http://lj.libraryjournal.com/2015/01/industry-news/vermont-libraries-benefit-from-completion-of-fiberconnect-project/

Griffey, J. (2014), "LibraryBox: portable private digital distribution", *Make*, Vol. 37, p. 74.

Grove, J.V. (2014), "Facebook building drones and lasers with connectivity lab", *CNET*, 27 March, available at: www.cnet.com/news/facebook-building-drones-and-lasers-with-connectivity-lab/

Luckerson, V. (2014), "Internet users surge to almost 3 billion worldwide", *Time*, 25 November, available at: http://time.com/3604911/3-billion-internet-users/

Lynch, J. (2013), "Loaning out internet access at the providence community library", *TechSoup for Libraries*, 9 October, available at: www.techsoupforlibraries.org/blog/loaning-out-internet-access-at-the-providence-community-library

Lynch, J. (2014a), "Library in a box: how worthington brings library services anywhere", *TechSoup for Libraries*, available at: www.techsoupforlibraries.org/blog/library-in-a-box-how-worthington-brings-library-services-anywhere

Lynch, J. (2014b), "Mobile Beacon and the NYPL: loaning out the internet to thousands of New Yorkers", *TechSoup for Libraries*, 15 December, available at: www.techsoupforlibraries.org/blog/mobile-beacon-and-the-nypl-loaning-out-the-internet-to-thousands-of-new-yorkers

Musil, S. (2014), "Elon Musk confirms ambitions to launch internet satellites", *CNET*, 10 November, available at: www.cnet.com/news/elon-musk-confirms-ambitions-for-internet-satellites/

Oremus, W. (2014), "Not as loony as it sounds", *Slate*, 2 December, available at: www.slate.com/articles/technology/future_tense/2014/12/project_loon_how_google_s_internet_balloons_are_actually_working.html

Reynolds, T. (2014), "Bring your tablets and library cards, the digital bookmobile is coming into town", *Jacksonville.com*, 19 November, available at: http://jacksonville.com/current/mandarin-st-johns/2014-11-18/story/bring-your-tablets-and-library-cards-digital-bookmobile

Rovatti-Leonard, A. (2014), "The mobile LAM (Library, Archive & Museum): new space for engagement", *Young Adult Library Services*, Vol. 12 No. 2, pp. 16-21.

Thompson, K.M., Jaeger, P.T. and Taylor, N.G. (2014), *Digital Literacy and Digital Inclusion: Information Policy and the Public Library*, Rowman & Littlefield Publishers, Lanham, MD, available at: http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10924289

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