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Community Broadband Snapshot Report™

Libraries: Broadband Leaders of the 21st Century

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Introduction

Gig-envy is driving hundreds of cities, towns and counties across America to contemplate becoming the next Chattanooga, Tennessee, Lafayette, Louisiana or Sandy, Oregon with their blazing fast public-owned broadband network. The local library might hold the key to their success.

No, we don't mean checking out a book from the library about broadband. We mean incorporating the library institution as a key planning source, a funding partner and a customer source on a community network. Libraries and their staff probably are one of the most under-appreciated and underused resources in the community broadband movement. Some libraries are in the forefront of creative partnerships with local businesses and community centers that foster leading-edge entrepreneurialism beyond libraries' walls. Libraries reach out and touch virtually everyone in their communities across the entire economic spectrum, so it's very exciting to imagine what the library of tomorrow will look like.

Libraries often have the fastest broadband connections in the community, in some cases clocking a gigabit or more access capacity going to library buildings. San Antonio, Texas, for instance, has a gig going to each of its 27 branches, as do the libraries systems of Burlington, Vermont and Salt Lake City, Utah.

In this digital age of Google and Wikipedia, libraries are still places that huge numbers of people frequent, from kids to senior citizens, in urban areas and rural enclaves. The Philadelphia, Pennsylvania library system with its 54 facilities has over six million annual in-person visits collectively and 10 million online visits. But even across the state in sparsely-populated Cambria County, the County's 14 library branches recorded nearly 300,000 in-person visits in 2014.

"I think there's a failure of imagination in some ways in the ability to see what libraries are doing today and what they could be doing tomorrow to build on our traditional competencies," says Larra Clark, Deputy Director of the Office for Information Technology Policy at the American Library Association (ALA). "When it comes to community broadband networks that have been built, we could have improved the impact of some of these investments if we had utilized the existing network of libraries. Libraries have a sense of place, a highly qualified staff and a good technology infrastructure. Libraries can be mobilized in really powerful ways for this country."

This report helps readers understand 1) libraries' evolving community roles, 2) how broadband helps libraries carry out those roles and 3) how libraries can facilitate broadband planning and financing so they both acquire enhanced value to the community. The report's primary audiences are library professionals, the community broadband industry and civic leaders pursuing community broadband networks.

The state of the business of libraries

We spoke with libraries connected to local community broadband networks, as well as to libraries that receive broadband access through various private sector providers. We explored differences in library broadband goals and achievements, hoping to detect patterns and expecting that trends would emerge. The largest libraries we researched had recent annual circulation of materials, including digital media, of 25 million (New York City), 15.5 million (Salt Lake County, UT), 6.5 million (Contra Costa County, CA), and 3.9 million (Boston). We also spoke with libraries serving small towns and rural communities that are also working just as hard to serve their patrons.

This is not intended as a scientific survey, but rather a snapshot of how innovative libraries across the nation are serving their patrons and guests with their available broadband, and what this could mean for the future of community broadband. It quickly became clear that every library we spoke with is providing maximum access to broadband for its patrons, even if the definition of "maximum" varies by location. Almost all the libraries we interviewed also have experienced, or expect to experience, bandwidth shortages at times when demand outstrips supply - even those libraries with a gig.

We found that many libraries have the fastest broadband capacity and speed of any entities within their communities. We should note, however, that having the fastest speeds and having the speeds and capacity that library staff feel makes them adequately prepared for the future are two different things. Overall, libraries feel that they need to regularly assess and improve their capacity in order to keep up with increasing need and evolving technologies.

The libraries we interviewed use fiber, cable, or DSL to provide service, just like the average consumer. While we did not speak with any system using Wi-Fi for its primary access, almost every library provides its patrons with Wi-Fi for use on the premises, with some respondents mentioning bandwidth problems when the Wi-Fi network was extended off-premise as far as parking lots, or during hours the library wasn't open.

However, libraries in areas served by gig community networks that provide 24/7 Wi-Fi didn't raise those issues, perhaps because the bandwidth is sufficient to absorb that marginal additional use. Libraries in general appreciate that the FCC has increased funding for Wi-Fi capacity and internal connection upgrades so libraries can support streaming video and audio services, 3D printing and software development.

It is typical that libraries have two sets of infrastructure, one being the Wi-Fi system that patrons use, and the other infrastructure (typically DSL or fiber) that the staff uses as well as the desktop PC that patrons use. Not all of the libraries in cities that have public- or co-op-run networks use those community networks, often because they are under existing contracts with incumbent ISPs.

Speeds reported varied from a gig down to one system that offers 30 Mbps down/10 up, which was served by a community network. A sizeable number of systems offer the public around 70-100 Mbps (down). For the purpose of this report, we considered 25 Mbps (down) to be the minimum speed to be called "broadband." Everyone we spoke with met this threshold except the Thomas County, GA, system, which has 20 Mbps at some of its branches.

That being said, there is a distressing reality. Don Means, Director of the library advocacy group Gigabit Libraries Network (GLN), reports, "A lot of libraries have very old services such as T1s. The California State Library conducted a survey of libraries in the state and found that 27% are running T1 lines. This technology is at least 50 years old and is still very expensive!"

A lot of libraries are billed $800 - 1,000 a month for a 1.5Mb service. But they are not paying that much, maybe 10% of that: the FCC's E-rate system is paying for it. "So this is an area where there is a lot of money that's being wasted that could be used to support investments in fiber, which is I think a goal that everybody wants to shoot for at some point," says Means.

The evolving business of libraries

To better imagine the potential role of libraries in the broadband realm, community broadband teams and stakeholders have to wipe away 1990s images of these institutions. Libraries have come a long way from being simply a place where books are stored and providing Wi-Fi mostly as an amenity for low-income residents without sufficient residential broadband.

There are approximately 23,000 libraries across the U.S.A. including public libraries, those in K-12 schools and colleges as well as business or other special interest libraries. Book lending, Wi-Fi access and kids' storytelling hours have been supplemented with an array of services. Now your library card might enable you to borrow video games, robots, canoes, kayaks, Legos and Kindles.

"What libraries have always done is provide democratic shared access to information, culture, tools, educational materials, communal experiences and in recent years an increasing number of technology resources," states Dan Cohen, Executive Director of the Digital Public Library of America (DPLA). "Libraries now offer programming classes and serve as testing spaces for technologies for businesses and individuals. Take 3D printers, for example. When they were first available these devices were very expensive and the average person or small business couldn't afford them. They're still very expensive. But a number of libraries made 3D printers available to patrons." Libraries are becoming gateways to tech tinkering.

The current core mission of libraries – both their physical and digital destinations – is to be information and knowledge centers. 21st century libraries are where all types of print, audio and

video materials are collected, distributed and increasingly created. Think of broadband infrastructure as a medium through which the business of libraries is conducted, but also as an agent of change for the library business.

Library professionals report that they keep up with patrons' expectations by offering digital media in multiple forms, including e-books, online databases, and streaming media, although the latter contributes to bandwidth shortages on occasion. Many of the libraries we researched also offer makerspaces, with 3D printers, and dedicated technology labs. Those that don't currently have those amenities generally mentioned them as "wish list" items for down the road, funds permitting. Children's computer services are also more advanced, with many systems offering separate computers for minors, with browsing compliant with the Children's Internet Protection Act (CIPA), and dedicated Minecraft servers.

Many systems we interviewed have recently beefed up their computer training offerings for adults in an effort to move patrons from digital literacy to digital fluency. We heard staff from all sizes of library systems note the improvement in quantity and quality of in-person computer trainings, plus subscription-based online training services.

Job searches, workforce development, and homework help are some of the professional and educational applications available to patrons using their library's connection, as well as from home as their Internet access permits. Some libraries use online training options like Lynda.com for their own staff development needs, especially those with minimal training budgets.

Some offerings stood out, such as in Contra Costa County, where patrons can download their own software onto the library's public computers for their use (the computers are wiped clean daily). Publicly accessible video conferencing and video editing are bandwidth-heavy uses that we heard about in a couple of small libraries with gig service, and mentioned as a "wish list" item in others. Kansas City, MO and Rowan County, NC have projects digitizing their Civil War archives, and providing local history portals thanks to high-speed broadband. Kansas City also plans on an online local encyclopedia.

Perhaps most intriguingly for the future, mobile hotspot lending is getting a lot of attention lately, with New York City libraries being the most publicized example. The New York Public Library currently has about 10,000 units on loan to patrons' homes, each available for a year. The program is mainly grant-funded, so maybe not likely to be a financially sustainable long-term project. It also raises the question in some quarters of whether libraries should be in the broadband business. While this is debated in the library community, previously un-served low-income families in New York now have home broadband for a year.

Many library branches are located in relatively easy-to-access areas of cities and towns. However, not every branch within a city has the same books, audio-visual tools, learning sessions, etc. Broadband makes it possible for libraries to share resources so now a broader range of resources is available to any one patron. Libraries can become regional institutions, such as is the case in the Cape Cod region of Massachusetts. Thirty-eight libraries in the various towns are

linked together so patrons can order books or other resources online and pick them up at the nearest library.

The world of libraries in your pocket

Taking things one step further, DPLA and broadband morphs your local library into a gateway to library content nationwide. “We work with 2000 libraries and museums across the country to digitize their collections of print, audio and video content from 500 languages, and make them available to anyone globally online,” says Cohen. In addition to servicing library patrons, DPLA makes life easier for people who rarely or never make it to the library.

DPLA’s over 11.5 million items include artwork, books, audiovisual recordings, historical documents, maps and artifacts that participating cultural heritage institutions make available to the public. “Some files only take up a meg or two, but then there are items such as TV news clips from the civil rights era provided by a library in Georgia," Cohen observes. The potential for library services resulting from this digital archival technology is high.

DPLA recently turned the concept of home libraries on its ear when it was announced that more than $250 million worth of e-books are soon going to be available to kids in need via a free program called Open eBooks. A few major publishers signed on to the program to give access to thousands of popular books selected by the DPLA’s Curation Corps. The New York Public Library agreed to create a special e-reader app for this program that is part of the president’s ConnectED initiative to improve kids’ access to broadband Internet and educational materials.

Of course, the gating factor to the success of this program is availability - or unavailability - of Internet access in low-income neighborhoods as well as access to smartphones and tablets. A small army of nonprofit organizations may be necessary to help address these issues, but a major hurdle is being overcome by having Open eBooks up and running. Broadband and libraries’ philosophy of democratic access makes programs such as these possible, and we should expect to see similar projects launched in upcoming years.

The library business evolves to human creativity centers

Physical and online libraries are already centers of human interaction for entertainment, business and learning. Broadband elevates this interaction and transforms libraries into on-ramps for many people’s participation in this digital world. Libraries are sources for digital training labs, film and music studios, ideas generators, community-planning centers, shared working spaces and maker spaces. Aside from the municipal governments’ public meeting facilities, libraries are the quintessential community meeting place. Being outfitted with gigabit connections makes libraries the apex of personal development and entrepreneurial activity.

At a basic one-to-one level, broadband and technologies such as Skype and streaming video make libraries communication outposts, particularly in rural areas and small towns. This can be

particularly valuable for distant relatives keeping up with seniors, parents maintaining connections with kids away at college, independent consultants expanding their markets, and recovering hospital patients.

Not all cutting-edge library programming is broadband-based, however. The Santa Monica Public Library takes the one-to-one interaction to the peak with their Human Library where, according to the blog Roadtripper, "you can actually borrow a person who has stories to tell gathered from a unique life experience. For half an hour, you can sit down with someone like a politician or a funeral director, all of whom have incredible stories to share. Unlike a book, they're able to answer your questions and tailor the storytelling experience to you."

Santa Monica Public Library Director Maria Carpenter cautions, "We think broadband would take away from the essence of the intimate personal conversation. While you can do that via Skype, you do miss out on a certain organic spontaneity and the non-verbal cues." Like the old-school song says, "Ain't nothing like the real thing, baby" to add a deeper experience for the patron. On the other hand, though, libraries can develop an "expert's corner" in which the staff assemble experts in various fields to go one-on-one via broadband. The Human Library can target one group of patrons with its own unique value, while the expert corner targets other types of audiences.

The Topeka Public Library is putting its own spin on a service that an increasing number of libraries are pursuing - makerspaces. The Web site WhatIs.com defines a makerspace as "a community center that provides technology, manufacturing equipment and educational opportunities to the public. Makerspaces allow community members to design, prototype and manufacture items using tools that would otherwise be inaccessible or unaffordable such as 3D printers, digital fabrication machines and computer-aided design (CAD) software." Libraries' makerspaces are tapping into twin motivating factors of the spirit of invention and the desire for entrepreneurship.

The Topeka library has its own makerspace that is focused heavily on digital technology design. It also partnered with 712 Innovations, a membership organization that is a combination makerspace and shared workspace that has equipment and technologies such a laser cutter, soldering equipment and industrial strength sewing machines. Together, the library and 712 Innovations transform the library's role as information center to active facilitator of both digital and physical creations.

We have made the case that broadband generates solutions for various communities' needs, even for needs constituents may not yet know they have. As you identify them, search for individuals and organizations that will fund those solutions. For example, position your library as a broadband-driven incubator of ideas and inventions, or as centers of human creativity, and you should find a notable increase in potential funders for your entire community network infrastructure, not just the infrastructure the covers the library.

The age of digital library branches

Topeka's library also is making strides for what may be the next big expansion of these institutions, the result of rethinking the traditional model where you have a main library and a number of branches located throughout the city. Topeka has only one physical branch that serves over 179,000 people spread out over 550 square miles, which can limit access by patrons located far away from this location.

Several years ago, the library decided it would replicate online as much of their operation as it could rather than build more physical structures, and take advantage of the digital realm to create new services. Digital content is steadily increasing as a percentage of their collections budget and the library expects to spend in 2016 nearly $300,000 just for e-books and audiobooks.

The Library embarked on a mission to create virtual library space. In the same way that libraries have bookmobiles that can go everywhere to reach its patrons, Topeka is creating new points of information distribution in many places where there are patrons. There are "embedded librarians" at work at places such as 712 Innovations and area community centers. Partnership agreements with major local employers allow icons to be in embedded on companies' intranets so employees can access library information and services, plus order materials and content the library delivers to employees at work.

We should expect that some libraries will replicate the shared-desk practice popularized by firms such as Andersen Consulting in which several people would flit in at various times to the same desk, plug in their laptops, complete work assignments and be gone. Eating establishments such as McDonald's and Starbucks provide Wi-Fi to increase its food business, but are always concerned with people staying for hours and not buying food. But a regional or national chain operation such as Walgreens may see Wi-Fi-powered branch libraries and creativity centers as an amenity that draws patrons but doesn't affect its primary business.

Libraries' tech operations

Broadband is a service that libraries provide, and the end products of that service – Internet access, digital literacy, entrepreneurialism, career training, etc. – are in large part what give libraries their value to the community. Broadband is also an indispensable operations tool, and the network's capacity and assurance of reliability are what give the technology value to library administration.

You can never have too much capacity. By the way, please don't confuse speed with capacity. Your local four-lane highway can easily handle a Maserati going at 129 miles an hour (speed), but one thousand Maseratis (capacity) accessing the highway at one time will be slowed to a crawl. So even though a number of library systems' networks clock in at gigabit speed, the network capacity can enable each patron to 50 Mbps or 100 Mbps when fewer patrons are using the computers, but down to 10 or 20 percent of that in the busiest hours.

Library directors frequently long for increased capacity. “Philadelphia applied to be a gig city some years ago, though we’re not sure why it didn’t happen,” says city’s Library Director Siobhan Reardon. “When I talked to my colleagues who ran the libraries in places such as Chattanooga and Kansas City, gig networks make a world of difference. It’s fascinating how it has deeply penetrated every corner of those cities.”

In addition to increasing the visibility of library services, a number of libraries in need of more capacity are pursuing partnerships that shift the network workload to businesses and other organizations. Teaming with community centers can share or increase the bandwidth for digital inclusion and literacy programs. Projects in which library embed staff, makerspaces and e-book distribution into local business allow libraries to redirect bandwidth other needs.

Partnerships also expand the human resources of the library. During the drive for Obamacare, government supporters termed “Navigators” helped consumers and small businesses understand healthcare options, and some of the navigators worked in libraries temporarily. Clark says, “The opportunity of the library to serve as a hub opens the door to these kinds of partnerships, particularly when it comes to websites and government forms. We make these relationships to build libraries’ capacity to serve more patrons. It’s not strictly limited to training how to use technology, but almost everything we do now has a component of that addresses hardware or software.”

IT resources boost reliability

Libraries depend on IT professionals to ensure reliable networks. In larger cities, libraries are part of the municipal structure and have access to both people and technology resources of their cities’ IT departments. Santa Monica Public Library Director Carpenter states, “We have embedded three City of Santa Monica IT staff in the library who upgrade our switches, help us design our vibrant learning center interface, maintain our servers and provide planning assistance.”

Libraries of all sizes have their own IT staff, some with dozens, and some such as the Cambria County Library with only one. Technology skills are a must with today’s frontline library personnel, and subsequently this relieves a lot of the customer support responsibilities from IT.

Some libraries have the software and database as in-house applications specific to the library system and managed by library staff. Some of the more adventurous libraries’ IT staff are exploring RFID Systems to help their circulation management, though it does require the onerous task of putting barcodes and radio frequency transmitters on every book. But on the upside, checkout kiosks save patrons long wait times and enables librarians to spend more time assisting patrons.

Many libraries have already updated their job descriptions for librarians to reflect a higher level of technical skills, and several directors in our interviews noted that library/information management graduates have those skills in place already. The big libraries tend to have a large IT staff and more ability to segment responsibilities. That's not the case in the small libraries, which tend to do more learning on the fly as technology evolves.

Overall all, library staff have become technologically nimble to better serve their patrons. In one library system, the IT Help Desk staff is available to take calls from patrons needing help with their e-readers. At another, the IT staff is preparing a "petting zoo" of e-readers for librarians' training. At one library with a small staff, one of them wrote a program aggregating all the local job openings daily to provide a hyper-localized job search database for patrons. Katherine Bates, Senior Program Manager at the Urban Libraries Council reports that a sizeable number of their member libraries rival the Apple Genius Bars with the quality of service they provide patrons with iPhones and tablets.

Smaller towns and rural counties may call on outside contractors and vendors to provide their broadband services. Gayle Simundza, Executive Director of Cape Libraries Automated Materials Sharing (CLAMS) in Hyannis, MA says there are nine services similar to theirs in the state of Massachusetts. "CLAMS has servers that 28 libraries share wired access to databases and applications that manage cataloging, acquisitions and serials and enable [as of 2014] 255,000 patrons to checkout 3.5 million books, CVDs and other materials from any of the member libraries. We offer tech support and training, and another vendor manages e-book checkouts."

These types of work hand in hand with network builders to ensure libraries' maintain high levels of patron satisfaction. "We've connected these libraries across all 15 towns on rural Cape Cod with reliable, low-cost, high-speed fiber broadband via the OpenCape community broadband network. It has provided a critical foundation for library health and innovation for decades to come," said Alan Davis, President and CEO of CapeNet.

CLAMS' servers are housed in the integrated CapeNet Data Center that also supports the OpenCape community broadband network. CLAMS encourages libraries to create a LAN network through which patrons get their Wi-Fi, and one library is testing its Wi-Fi access through the OpenCape network. Already they are reporting significant improvement in their patrons' services.

<u>As library role become more complex, networks become simpler</u>

The broadband project team needs to keep abreast of technologies that are going to reduce the need for hardware components, handle network operations with much lower cost and use more efficient software as possible.

Various libraries support their network servers that link with servers in different towns or states so they can share library resources such as software, makerspaces and 3D printers. "From a technical perspective this is fairly easy to do," states Daniele Loffreda, Industry Advisor for Ciena. "If you look at a regional or national service provider, such as an AT&T or Frontier,

they've got the metro-networks connected by some long-haul, or ultra long-haul circuits. It would be similar with libraries. You can have libraries in different municipalities connected by a long haul or an ultra long haul technology." The potential for difficulty currently, however, is with compatibility (or lack thereof) of various vendors, service providers and politicians.

Down the road the possibility for hiccups with the network could grow based on whether or not 3-D printing becomes widespread and uses for it become intricately more complex. To put this into perspective consider what happens when you electronically send a full MRI scan and a single file can be as much as 30 gigabits of data.

The big question is, what goes into 3D printing? "If all the libraries are doing is providing is the capability to print out an image, and this may or may not catch on with patrons," states Loffreda. "But in any event, this process is done locally and probably won't affect the library's resources too much, particularly if the library can charge for the service. But what happens when you try to coordinate sending 3-D printer output that involve several data centers, libraries and other organization? Because that affects broadband traffic."

What happens if the small town doctor has a patient who suffers a severe arm or leg fracture? Similar to data-intensive MRIs, he or she might want to create 3-D printouts of the limb in order to create a custom brace, and this can involve a product vendor, an orthopedic specialist in another city and the local library. Is this is going to create a four or five-gigabit file or bigger? Maybe an architect needs to have 3-D printouts of several models for a house or a hotel. One can imagine biomedical research involving several local colleges, a telecommuting research analyst, national companies and 3-D printing in the mix.

If they hoping to pull of that, Loffreda says, "Any one of these applications represents a huge amount of data and all of those 0's and 1's may have to come from somewhere else. You're going to need a pretty big pipe or otherwise it's going to take three days to actually print out the files."

State of the library business in five years

Given the level of experimentation among library staff nationwide, as well as the continuous evolution of Internet technologies, it is very difficult to predict trends, advancement, and new types of patron services that will dominate libraries in five years. But the libraries we interviewed were comfortable discussing some of current new trends they see continuing.

One thing that libraries are hoping to deliver to their patrons in the next three-to-five years: more! More speed, even at libraries with a gig. More capacity, especially since there are patrons who bring in two or three personal devices and expect to connect all of them. More access to online programs, with coding training mentioned a lot. More open hours at those libraries that are still recovering from the recession. Libraries without makerspaces or dedicated training space hope to add them, although the challenge is often finding room to expand, not just funding.

This “more, more, more” mindset can be a double-edged sword, though. “We are inventing faster than we can really absorb the impact of these technologies we’re pushing out the door,” says Means. “We create the technology and the technology re-creates us as it shapes our environment and that in turn shapes our behavior if not our actual ideologies and psychologies. So I think people in general are struggling with this accelerating rate of change. Libraries are ideal places to discuss this and to deal with certain elements of it in practice.”

Cities big and small have established the goal of 100% digital literacy in their neighborhoods regardless of age, income or social status of those constituencies. Guided by federal and state initiatives and grant programs, libraries are being designated the main outpost in these literacy programs. Expect the libraries’ role to become even greater as the FCC retools its Lifeline program, which has a billion or two to contribute to the effort.

The Lifeline program was initiated to ensure that low-income residents in both urban and rural areas would have a $10 per month subsidy to keep basic phone service in people’s homes. The FCC has determined that broadband is equally as important as telephone service - in some cases both services are available through the Internet - and planning is underway to have Lifeline subsidize both. Where libraries fit in with this new world order is still to be decided.

Even those libraries without the resources to develop digital inclusion plans are aware of the issue. However, given the tradition of libraries being a great societal equalizer that provide the same services to rich and poor alike, the potential of libraries stepping in and stepping up to meet the challenge is exciting.

Mobile hotspot programs: Leveraging tech to increase digital inclusion

One particular technology innovation that holds significant promise for libraries are mobile hotspots. These are small devices that qualified low-income residences use to access LTE networks such as Sprint and T-Mobile, with an average download speed of 8-9 Mbps and no data caps. Mobile Beacon is a nonprofit organization that is limited to selling to other nonprofit organizations. Libraries, the primary market Mobile Beacon sells to (Sprint has coverage in 500 cities), loan these devices to their patrons for any time between several weeks to six or 12 months.

During the organization’s trial period, 75 libraries field-tested hotspots and found them to be very popular, according to Mobile Beacon, a non-profit organizations that distributes mobile hotspots. The New York Public Library (NYPL) system, with 92 locations in the Bronx, Manhattan and Staten Island, ordered 10,000 hotspots. In recent years, the NYPL prioritized technology with the addition of more tech labs and greatly increasing computer training to advance its patrons beyond digital literacy to digital fluency. New York City is articulating what a digitally inclusive community should be, with the library being an important part of that conversation.

"Millions of New Yorkers do not have Internet at home, even as so many of us take our connectivity for granted," said NYPL President Tony Marx in a 2015 press release. "It is a regular occurrence throughout our system to find folks sitting outside our branches before we open and after we close, because they have no other option." The grant funding for the NYPL's program was from Google, the Knight News Challenge, Open Society Foundations, and Robin Hood Foundation.

Because the NYPL program is almost entirely grant-funded, its financing model is vulnerable. Also, because the units have to be returned, at the outside within one year but usually within several weeks, it's not a long-term digital inclusion solution. But the willingness of libraries to alter the financing model by charging for the devices, coupled with the FCC's efforts to revise its Lifeline program, could elevate the role that mobile hotspots can play. The Lifeline program initially subsidized low-income families' $10/month basic phone use, and now the FCC wants to expand the program by subsidizing broadband access.

Mobile Beacon's Managing Director Katherine Messier observes that, "Mobile hotspots resolve a serious challenge because patrons many times can't satisfy their Internet needs in those 30-minute to 2-hour time allotments that libraries have to enforce. The hotspot-lending program has waiting lists at many of the participating libraries. NYPL is clearly our biggest customer, but we have library systems that circulate hundreds of devices. San Mateo County Libraries (California) has 190 hotspots and St. Paul Public Library (Minnesota) has around 130."

Re-defining "library space" to address digital inclusion

Kansas City, MO is also preparing to launch a small-scale mobile hotspot lending pilot in conjunction with HUD's ConnectHome initiative, itself a new program intended to address digital inclusion in publicly-funded housing. But mobile hotspots are actually just one facet of narrowing the divide between the haves and have-nots in the broadband age. Some envision the entire institution of the library as a vehicle to bring broadband into an underserved community. Kansas City library staff are working on a strategic plan for satellite locations in combination with other services, with broadband as an essential feature.

Perhaps one of the major future innovations will be how libraries think about the nature of their service. Similar to the concept of "software as a service" in which customers access software over the Internet rather buying physical software disks, Topeka is starting to envision the "library as a service." The Library has a third bookmobile on order that will offer physical and digital book lending all over town. The library co-locates in six community centers where they operate computer labs and run digital literacy classes. Library staff and technology that enable access to library services are embedded in several local businesses.

The rapidly growing need for space for all types of creative expression will likely inspire partnerships with businesses and nonprofit organizations as well as the potential for acquiring abandoned buildings that are in serviceable shape. Aside from makerspaces, libraries are finding significant interest in using their facilities for creating music and film studios, graphic design

studios, and electronic game production and testing. As the number of 100 megabit networks and gigabit cities grow, so too will the collaborative efforts between libraries and their patrons in different neighborhoods, cities and states.

Libraries' role in facilitating e-government

Ironically, it will be the halls of government rather than the office parks of technology that will drive transformations of our libraries. e-government was supposed to be a godsend in our technological age. Every major federal and state public service agency embraced e-government. "Almost level of government is expanding online applications," says Means. "But they don't look alike and they don't run alike. Even if you have some level of digital proficiency, it can be daunting to navigate these public services."

The downside of a Web-centric approach is that agencies want every citizen to use the respective agencies' tools, applications and processes, and they expect every citizen to have access of one sort or another. As Means states, "it's one thing for Amazon to create services that are only available to people that are connected, but it's quite a different matter for a local, state or even the federal government to create services without assuring access to those services. So the only solution these agencies have to address constituents with poor or no broadband is the libraries. That's it."

It is through the PCs, the wireless and the librarians that the breach in the promise of e-government is somewhat healed. Libraries are where there is a knowledgeable, competent, sympathetic human being who can help you navigate this very daunting array of online government services. "The librarian becomes the human face of the government," says Means.

Libraries are also becoming unofficial agents of the government's disaster response team. "Libraries are places that people think of the lights go out, as a place to go to find out what's happening, or maybe where they can charge their phone and get a connection if the cell system's out," says Means. During the Katrina disaster in New Orleans, even though the libraries didn't have backup communication capability, people started showing up there with Wi-Fi routers and portable generators to create hotspots that provided some level of communication capability. Libraries are starting to plan for these types of disasters by installing backup power and redundant communication capabilities.

Challenges to library innovation

While championing the role of libraries as innovative users of broadband as well as champions of digital inclusion, we have to point out there are daunting challenges to those roles. Where your state ranks in terms of average broadband speeds, and to what extent you have decent broadband adoption rates is often an indicator of how leading-edge your libraries are in their use of broadband.

"When you're not even meeting your basic broadband needs on a regular basis, to introduce a program that is going to put more strain on your ability to satisfy your customers maybe isn't a

wise move," states Susan S. Cassagne, Executive Director of the Mississippi Library Commission (MLC). "On one hand, I believe over half of our libraries are lending e-books. But on the other hand, we have libraries that still don't have Wi-Fi. They don't have the funds to purchase the equipment for new services or the expertise."

Coupled with the budgetary constraints affecting libraries' technology needs are the strains brought on with the lack of broadband in the state. According to Akamai's "State of the Internet" Report, Mississippi ranks in the bottom 10 states for speed with a statewide average of 7.6 Mbps, and according to Pew Research Center, 57% of Mississippi homes don't have Internet access.

"If you think about e-government, local, state and Federal agencies do business mostly or only online," Cassagne says. "Telehealth is increasing, kids are taking exams online, many companies' job applications are online. There are rural people out of work who have never touched a computer in their life. They might have smartphones but they don't have Internet at home. In many of our towns, the libraries are probably the only public place in town where they can get connected."

We spoke with several libraries that share the assessment of Lyn Meek, Director of the Cambria County Library System in Pennsylvania. "Sometimes we get so overwhelmed with the daily activities that that it's difficult sometimes to focus on all that the library is capable of doing," she says. "It's a challenge to find time to plan for even the basic enhancements such as makerspaces."

Where they can, libraries are fighting the good fight in the halls of state government to get more budget for libraries. Cassagne states, "MLC, in its role to provide advice and support to our state's public libraries, recognizes the importance of access to high speed broadband for all Mississippians, made available through their local public library."

With that in mind, MLC decided with last year's budget to include in its request for funding the amount (based on statewide E-rate discounts) that would allow MLC to assume the cost for providing improved broadband speeds to each public library building, thus freeing up local funding for library materials and services.

Libraries as pathways to broadband funding

When people talk about the library and broadband, it's usually from one of two perspectives: 1) the library as anchor tenant, meaning how much money can they contribute to the network, or 2) the library as facilitator of digital inclusion. These perspectives are both accurate and valuable in the broadband scheme of things. But what about libraries' direct and indirect role in funding the buildout of broadband networks?

Libraries have long been a contributor to the unique "community DNA" that each city or town has. You see this in the libraries we interviewed for this report, how libraries reach out and touch most of the people, businesses, organizations and local government. You get a collective sense that libraries are reaching new heights as drivers of communication, knowledge gathering and distribution, entrepreneurialism and unbridled creativity.

People and organizations with lots of money have recognized theses roles in the communities and have funded them: The Bill and Melinda Gates Foundation, the FCC, the Knight Foundation and many others. Broadband projects teams should carefully examine the role of libraries in their respective communities, and determine how they can leverage libraries' roles. "Libraries are a treasured resource in the community," observes Bates. "Researchers have found that libraries are the most trusted government agency among constituents, and elected local officials are very pro library. Library administrators, especially in bigger cities, consistently are skilled at securing funds."

Broadband teams may want to take a page from local officials and community activists that have partnered with libraries in the pursuits of bond measures, says the ALA's Clark. "Often a city or county hoping to pass a bond measure will want to create a joint-bonding initiative with the library out front because libraries have so much goodwill in the community and can bring that goodwill with them."

Look at what your libraries are accomplishing and how much they could accomplish with better broadband. Bates suggests that broadband planners meet with libraries that have used the Edge Toolkit. "Edge takes library staffs through an extensive assessment of their services and community programs, and helps them with recommendations, best practices, planning and establishing guidelines for maximizing technology. This information as well as benchmarks from libraries in other cities can spark ideas for solutions that broadband will produce with the libraries." Then ask yourself and your stakeholders, who's willing to pay for those solutions?

As you identify those solutions, make sure to take into account not just broadband within the libraries' four walls, but elsewhere in the community. For example, boosting the libraries' capacity from megabits to gigabits can make an impact on high school students' efforts to get into college, but only if there is a corresponding increase in capacity at the home. Organizations and foundations may be willing to support the complete solution. Similarly, a library-hosted program might improve the health and wellness of patrons who visit the facility, but creating a

wireless intranet with the library as its hub may produce significantly more benefits in the community. Again, will several organizations underwrite the infrastructure solution?

With that in mind, let's explore some various options for funding.

E-rate

Libraries have a direct role they can play in funding at least a segment of the community broadband infrastructure. The most obvious role is as an E-rate magnet. A lot of folks interested in broadband may not realize the importance of E-rate as a way to make a dent in broadband buildout cost. E-rate discounts range from 20-90% on eligible services, depending on poverty indicators, geography, and category of services being requested, and can help defray the cost of building broadband infrastructure to facilitate library operations.

There is the serious limitation that the FCC can only fund broadband that libraries offer on their physical property. The good news is the infrastructure that makes broadband possible includes the cabling connecting all of the library branches to each other and to the network center. The other good news is that E-rate funding was increased and funding set aside for wireless and other internal equipment that helps libraries add more bandwidth-intensive applications and services.

"Eligible libraries can receive support for the lease of fiber, whether lit or dark, from any entity, including but not limited to telecommunications carriers and non-telecommunications carriers, such as research and education networks; regional, state, and local government entities or networks; nonprofits and for-profit providers; and utility companies," states James Bachtell, Attorney-Advisor at FCC. Be advised that in addition to FCC criteria, the community entity owning the network may have to pass your state's requirements for being a telecom provider. Check with your legal counsel, but it may be advantageous to create a nonprofit entity to own the network as a way to deal with some of a state's eligibility criteria.

The process of the community network provider and the libraries qualifying for the FCC and your state funding programs may take a year or more to complete, so consider initiating them at the same time the community begins the needs analysis and feasibility study. Public utilities, co-ops and other community networks currently operating but aren't a part of the program should contact libraries to determine how to become their E-rate providers.

Broadband project teams can leverage libraries' eligibility for E-rate by one of three tactics: 1) they encourage libraries to apply and assist with preparing the application; 2) they can do the same for both libraries and schools; or 3) they can get the libraries and school to apply for E-rate, and also get the local healthcare and medical facilities to apply for the FCC's Healthcare Connect program, which provides funding for broadband in healthcare and medical facilities. Which tactic a community uses depends on its needs and other factors.

<u>Using E-rate to lower build out cost, increase revenue</u>

Typically, if a town only has one or two library branches, E-rate may have limited value outside of the facilities' four walls. If there are more branches, the potential impact of E-rate can be significant. The cables with fiber strands the libraries use and the conduit that holds them are covered by E-rate. You can add dozens of more strands to the conduit beside what the libraries require, though obviously these extra strands are not reimbursed in the program. What's more, communities can add additional fiber out from the conduit to businesses and homes.

We interviewed libraries that are in cities and towns that have their own broadband network. However, several have existing contracts with other E-rate providers before the public networks were built, such as the City of Salisbury, North Carolina that became a provider in 2016, and Springfield, Missouri libraries that get funding from a state consortium. Broadband teams can look to Danville, VA and its public utility's network (nDanville) to get an idea how libraries can proceed.

nDanville retained a consultant to help the school district secure funds from the E-rate program and then established nDanville as an E-rate provider. They submitted a proposal that won the competitive process, and continues to do so on an annual basis. They commit to a set of services and come in as the lowest bidder for the most part; other factors contribute to winning a bid.

Because E-rate requires that infrastructure built with this money only serve schools, nDanville created a "mini" infrastructure for the school district within the utility's network by segregating fiber strands within the conduit that just served the schools. Broadband teams can do the same with libraries. With luck, the FCC's further modifications and rules updates might continue to increase cities' ability to use E-rate-funded infrastructure to meet other constituent needs in the areas.

With the city's libraries as customers, E-rate subsidies in the years following the buildout could become a large part of a community network's total operating budget. Salisbury's libraries, for example, plan to use the new E-rate funds to upgrade libraries equipment and capacity. cities should consider using the FCC subsidies to leverage traditional bank loans, requests for foundation grants, donors to local economic development projects and other funding sources.

Libraries plus schools – a one-two E-rate knockout

The State of Alabama has a very interesting proposal on the table that combines libraries and schools in a bold plan for using E-rate funding.

"Our libraries provide an economic benefit to the communities," states Kathy Johnson,□ Director of the Broadband Development□ Office for the □State of Alabama. "Citizens have public Internet access to online job and other economic resources, such as Alabama JobLink, applications for employment and Social Security and other benefits, financial management tools and small business resources. Alabama Virtual Library provides databases on any subject of interest in many formats including periodicals, encyclopedias and newspapers. Homework Alabama provides online and on-call access to qualified tutors who provide homework help, job search assistance and includes STEM curriculum."

To ensure that schools and libraries have sufficient bandwidth for their ever-growing needs, as well as the prudent use of taxpayer funds, a state consortium of 39 school districts and 16 public libraries released an Invitation to Bid (ITB) seeking providers of this service. Following E-rate eligibility rules, this competitive bid process solicits quotes on the costs to provide fully lit fiber services including constructing, operating and maintaining a fiber network. Any participating school district in which ITB responses reveal it is more cost-effective for the district to provide this service as a fiber wide-area network (WAN) must select this "self-provisioned" route in order to be eligible for E-rate subsidies.

For a project of this scope, it's very important to keep a myriad of people in the loop. Even at the local level, once you combine efforts of libraries and school districts, team communication roles and responsibilities have to be spelled out in detail. The Alabama State Department of Education (ALSDE) E-Rate Office, Office of Broadband Development, and individual Local Education Agencies (LEAs), along with the Alabama Public Libraries, will collaborate on these projects. The ALSDE/E-Rate office will oversee and manage the State Master Contracts and procedures.

Quite a few cities around the country limit their goals for broadband to businesses and the anchor institutions, preferring to not address the issue of residential broadband or just wait for incumbents to act. Alabama is adamant that it is focused only on schools and libraries at the time, but they are working to identify rural needs. They, like most others states, have gaps in rural broadband access. Sector-specific funding from various private, nonprofit and public sources will help the state advance access to robust broadband in the most cost-effective means possible.

"There are many state and national education groups that are constantly asking, how can our students obtain affordable high speed Internet at home," says Johnson. "These organizations have expounded their question with much research and found that student access outside of the schools and libraries through broadband in their homes and the community has improved student performance. The E-rate opportunity for constructing fiber networks to schools and libraries is one that, with minimal state investment, will contribute to more affordable fiber overall with sufficient growth opportunities for many years to come."

This tactic of combining libraries and schools to pursue E-rate funding can garner significant money to offset broadband buildout costs, and as leverage to secure funds from various other sources. It's a viable option for midsize and larger cities, but in small cities that only have one or two libraries and a few schools, E-rate may not have as significant an impact. In these situations, the tactic may be more beneficial executed at the county level.

A new kind of broadband triple play

The third and most expansive tactic is to combine three keystone institutions –libraries, schools and hospital/medical facilities – into a fundraising triumvirate. It requires a lot of upfront coordination by the communities, as the FCC does not participate in these types of activities, but there can be some significant rewards.

An engineering design team can create a network infrastructure that ties together all three groups of facilities in a mini network, then apply for E-rate (libraries and schools) and the FCC's Healthcare Connect fund. Adding in the healthcare facilities enables you to cover more space with your "mini" network, and better leverage all three anchor institutions to further lower the cost of overall infrastructure buildout.

Communities need to realize that there is a small pot of gold available, a significant portion of which is seeking a place to rest. Healthcare Connect subsidizes health care providers in rural areas for high-speed broadband connectivity, telecommunication services and new construction. The program can pay up to 65% of the project cost; the community has to provide matching grants. FCC has set aside $400 million for the fund, but only $178 million was used in FY 2013 and $173 million in FY 2015.

"Communities can create a consortium of libraries, schools and hospitals to create a broadband network, and even if that is all that gets covered you have the beginnings of infrastructure that the rest of the community can expand," observes Justin Volker, an industry expert who spent 3 years managing the E-rate program for a rural K-12 school district. "You will have a hub that is funded with subsidies that were designed for this purpose, to get more people connected."

There are some recent changes to E-rate rules and exceptions that broadband teams should be aware of, regardless of which of these tactics they use. Before the FCC modernized the program, libraries had to spend the money with service providers for the buildout and services procurement and wait several months for reimbursements. This could create budget and cash flow problems, especially for smaller libraries. If the construction costs were more then $500,000, it could take up to three years to get reimbursed.

"With the new rules, whether it's a private or public entity building the network, that builder will have to invest the capital upfront to complete the construction project," states Volker. "Also, libraries and schools can amortize their contribution to the Network for four years." If the project costs $1 million dollars, for example, and if E-rate will reimburse 90% of the buildout cost, the provider can cover the 90% while libraries and schools can pay $25,000 a year for four years.

The community entity building the network, whether it be a local government, public utility, co-op or a public private partnership, has to front the buildout costs. That entity has to determine what options they want to pursue to find this cost, such as a bond measure, traditional loan, or fundraising drive. "Generally speaking, you're correct to assume that such an entity probably has a greater ability to front this cost than would a library or school," concludes Volker.

"The municipal, library, school district and healthcare facilities' IT staffs should scope out a multi-year technology plan that describes a complete, concrete vision of the technology future of these anchor institutions," states Richard Frank, an IT consultant that has been involved with many projects over the years. "We suggest using wavelength-division multiplexing (WDM), a way of multiplying the effective bandwidth of a fiber optic communications system by a large factor, and optimize the fiber coming into the facilities. This methodology provides a scalable

core network that will meet the anchors needs and could provide services to others." Loffreda agrees, "It really gets you the biggest bang for your buck by allowing you to squeeze the most out of your bandwidth investment while still maintaining a quality of the transmission signal."

Hypothetical anchor-centric fiber layout (Ciena, CapeNet)

The Lifeline gambit

The FCC's role in libraries and their use of broadband is typically restricted to E-rate. However, what if we could come up with a way to work in one of the other FCC funding programs? Lifeline, for instance.

The FCC's Lifeline program currently provides $10 subsidies to offset the cost of basic telephone service among low-income communities. For some time, the Agency has been planning changes to the program to incorporate broadband in some way. "Digital inclusion is increasingly one of the responsibilities of libraries," states John Windhausen, Executive Director of the Schools, Health & Libraries Broadband (SHLB) Coalition. "As libraries are trusted advisors within the community, I expect that there will be role for them in the changes that are expected to be announced by the FCC this March."

In a letter to the FCC, "SHLB supports allowing non-traditional providers such as schools, libraries, and other anchor institutions to participate in the Lifeline program even if they do not qualify as 'eligible telecommunications carriers' (ETC). Lifeline consumers will benefit by policies that encourage competition from a variety of broadband providers. The Commission can best stimulate such competition by creating a process for certifying Lifeline providers separate

from the ETC process and allowing nontraditional providers such as schools, libraries and other anchor institutions to offer Lifeline service to low-income consumers."

In a report titled "Digital Equity: Supporting Students & Families in Out-of-School Learning", published by the Consortium for School Networking (CoSN), there are examples such as Albemarle County Public School System and Beaufort County, SC schools offering wireless services. In summary, SHLB is making the case that we need to be open to libraries and other institutions that will come up with some new ideas for getting more broadband to more low income communities.

If Mobile Beacon's library and other nonprofits customers are allowed to use Lifeline, mobile hotspot deployment can accelerate short-term broadband adoption. "Hotspot lending can address constituents who previously avoided broadband because they don't see a need for it," says Messier. "Using the technology changes minds." For others who couldn't afford home broadband access, mobile hotspots' relative affordability (the devices retail to nonprofit organizations for $10/month) coupled with the Lifeline program would lead to increased broadband adoption. The pilot testing of mobile hotspots could morph into concerted efforts to make hotspot umbrellas covering low-income communities.

We can see organizations such as Mobile Beacon, community networks and others working together with Lifeline to facilitate a multi-prong effort. Libraries could team with a nonprofit reseller such as PCs for People, which currently serves about 8,000 low-income residents through these devices. Or with Richmond, CA nonprofit agency Building Blocks for Children, which offers mobile hotspot lending to families with students enrolled in the West Contra Costa Unified School District. Richmond is also served by Comcast's Internet Essentials program that offers low-income customers discounted home broadband connections. It will be interesting to review success metrics in a few years and see which type of program, or vehicle, does best at its stated goals.

Libraries as the foundation for philanthropic giving

In October we write a report that is addressed raising money for broadband, titled "Show Me the (Hidden) Money for Community Broadband." The gist of the message was, community supporters primarily rely on the usual suspects of government agency such as the FCC, bond measures and Google. When these do not materialize, disappointed people write off the hope of getting better broadband. We offered what we feel is a better alternative, which is focus on the community needs being solved and find those individuals and organizations that will fund the solutions. These funders may not know the difference between a gigabit and a giraffe. That's okay as long as their checks are real.

By way of example, we've presented the U.S. Department of Transportation (DOT). DOT is not in the business of funding broadband networks. It is, however, in the business of helping cities build, manage, use and maintain better streets and freeways. Bring them plans to better use streets and freeways, and the agency will listen.

The city of Columbus, Ohio got a grant from DOT for almost $8 million to replace its aging, proprietary traffic signal systems with a more flexible system built on the backbone of fiber optic cable and wireless technologies. The city contributed $750,000. Subsequently, the city's IT department now has fiber running to every traffic light in the city – fiber it couldn't otherwise have afforded. Besides having the Cadillac of traffic management systems, the city can now invite competitive providers to use the city's fiber to offer broadband to homes and businesses.

The Institute of Museum and Library Services (IMLS), with its Library Services and Technology Act (LSTA) Funding may be the only Federal agency with direct library funding options, but there could be state agencies to tap. There also could be Federal and state agencies that, like the U.S. DOT, aren't in the business of funding broadband buildouts, but maybe supportive of a clever library-driven application.

Cast your net wide! In the upcoming section of library interviews, there are numerous stories of human capital development, entrepreneurialism, music production and other creation activity and budding medical product design. Consider these idea generators. What are the potential rewards, including funding, of a city's libraries, community college and a national optics company collaborating on an optic design facility? How does the meeting of one need gives rise to additional needs or opportunities?

Loffreda observes that, "One of the issues that we see in rural and in lower income urban areas is students have higher speeds in school, but at night and on the weekends they are pretty much out of luck if they don't have access at home. Libraries are trying to step into the gap by creating hotspots, but we need students to have 24/7 access to learning curriculum at home." Are there philanthropic individuals and organizations who believe in education and can be convinced to add their dollars to expand broadband beyond the schools and libraries to the home? Are there groups of local business or economic development organizations that believe better-educated students are good for business, and will fund broadband to the home? You never know until you ask.

As you read about their expanding role in their communities and start generating ideas based on library-driven solutions, consider making the library the keystone of your broadband fundraising. In San Antonio, libraries have a 96% customer satisfaction rating. Quite a few other libraries have similar high standing in their communities. Leverage that advantage.

Almost every a library has a Friend of the Library support organization. Some of those Friends might know the kind of people who can write $25,000 or $50,000 checks. Dozens of cities have library tax districts, and every library has rules that govern their taxing authority. Determine if your city has one and if so, what are ways your library district can facilitate fundraising for the library-generated solutions involving broadband.

The Bill and Melinda Gates Foundation is stepping away from the library space, but possibly (hopefully) another foundation will match the Gates Foundation's generosity such as the Knight Foundation, which has been very interested in information and libraries.

Analysis

The library is one of the most vital government services and it touches people at every economic level and station in life from almost cradle to grave. Yet few people truly understand the full range of roles that libraries play in so many aspects of life, including some broadband project teams, advocates and champions. This has to change.

Given the many accomplishments within their communities that are directly or indirectly attributed to broadband, it is amazing how underutilized libraries are for assistance with planning, convening and funding community broadband deployment. Broadband advocates and city officials generally understand the value that libraries bring to digital inclusion efforts. Libraries also can be a direct source of funding for broadband from Federal and state organizations. Libraries can directly impact city- or countywide broadband funding from foundations, corporations and others, as well as generating local public support for these networks. Libraries partnering with schools and healthcare organizations can further facilitate network buildouts and customer sales.

Libraries are the information and communication hubs of most communities. In those roles, libraries can be key partners in building public consensus, enthusiasm, volunteers and focus that collectively get broadband projects off the ground. As broadband projects take shape and increase momentum, libraries are effective marketing allies. And as the libraries chronicled in this report show, they are often the crux of communities' broadband adoption and digital inclusion efforts. Libraries can have the fastest Internet access in town.

Before all else, needs analysis

Technology application follows need, need leverages money. Broadband teams should have this ingrained in their brain constantly.

There is a definite need for a game plan for using the needs assessment to find funders and customers for the network. Entities and individuals with money to invest are most swayed by the solutions that these technologies can produce.

Pay close attention to what library staff have identified as patrons' broadband needs. Some patrons want to use makerspaces and 3D printers to build the next six million dollar man or woman. Some libraries may plan to transform their facilities into high-tech incubators. So, are there local or national investors that are looking to fund libraries-as-incubators? If there are libraries that want to use broadband to spearhead workforce development or community wellness programs, can you find foundations other organizations willing to fund those solutions?

"I think there are opportunities to look not just to people who provide funds explicitly to libraries, like IMLS does," says the ALA's Clark. "If we are thinking about how to find new funding to support this, might it be sector based? Explore sectors such as healthcare, for instance, to support community-based health and wellness initiatives that are driven by libraries and local healthcare facilities and involve broadband. Blue Cross and Blue Shield in Minnesota are

examples of health-related organizations that have been working with libraries. Might the sector be economic development-based? When you're looking to meet a need that the community has, go to a funding body that is active in that space."

Libraries at the heart of broadband planning

Make the library the hub of your planning, communications and marketing. First, many libraries are conveniently located and with the increase a video and audio technologies libraries are adopting, libraries are great facilitators of meetings regarding broadband.

Furthermore, library patrons are a cross section of almost every type of demographic – gender, age, economic strata, education level, etc. As you get steering committees, volunteers, stakeholders, and others excited about project, the library is the great vehicle for getting spreading the excitement to constituents.

Libraries' various uses of broadband are great prototypes of what people can hope to achieve with citywide and countywide broadband. As you assemble and build consensus among stakeholders, city IT staff and elected officials, one of the best ways to get people to understand and champion the value of broadband is by giving them first-hand knowledge of its benefits.

There are libraries that know how to do broadband planning well. The Kansas City Public Library hosted Building the Gigabit City, for example, a brainstorming event hosted by the Social Media Club of Kansas City and Brainzooming, a local business-branding firm. At the event, industry leaders were brought together to come up with ideas for the implementation of Google Fiber in Kansas City. The library also hosted The Gigabit Challenge, a global business plan competition looking for new disruptive ideas for the Google Fiber network.

Currently Philadelphia has no plans to build its own citywide network, but if it did, the library would absolutely be part of a planning team. "Obviously libraries know a lot about content and broadband adoption, and we also know a little bit about building a high speed high fiber network," observes Reardon. Most of the library directors we surveyed indicated that they are willing and able play an active role if their community wants to build a network.

Libraries also can make a big difference in marketing communications, which means revenue for the network. Few entities besides libraries and utility companies have these organizations' regular entrée directly into homes and businesses. Given that libraries are always looking for ways to get more patrons into their digital and physical doors, partnerships with the broadband team can be a match made in heaven.

The role of Federal and state agencies money for broadband and libraries

Does your broadband project team and steering committee know about the FCC's E-rate program and how it works? Do they know if your libraries are receiving E-rate funds or even if your libraries are eligible for these grants? Does your engineering design team, or the one you

plan to retain, know how to integrate libraries and schools in your infrastructure design so that you take maximum advantage of E-rate?

Libraries in Salt Lake City, Boston and other cities find E-rate indispensable for their broadband funding, and there are many lessons these libraries can teach others. Someone on the broadband project team needs to become an E-rate expert, or team up with someone from the library or schools if they already receive E-rate (typically more schools than libraries use the program).

E-rate can represent a sizable amount of money, but broadband teams need to understand getting eligibility is an involved process that may require a year. The library and the project team should start the application as soon as the needs analysis or feasibility study starts. In addition, E-rate is a reimbursement program, so public organizations and co-ops have to be able to afford or borrow the funds and have the time to wait for the reimbursement.

It also requires dedicated effort to line up your ducks and resolve logistical challenges. Your broadband planning and management staff need to be in agreement with the library management team about using E-rate funds. Some libraries have a deep philosophical objection to accepting Federal or state funds if it means libraries must filter content. Smaller libraries can find the annual paperwork required by the E-rate program overwhelming for their small staff resources, so maybe city staff or contractors will have to prepare it.

Lifeline – a wild card on the buildout funding game

The FCC's Lifeline program is going through changes that will be announced at the end of March 2016. It may take several weeks to get a true handle on how modernization of this program will impact libraries – or vice versa. We will address this in more detail in our upcoming report on digital inclusion.

For now, suffice it to say that the library mobile hotspots pilot projects underway should result in some notable digital inclusion successes. Since city governments or other nonprofit organizations manage many community broadband networks, and are eligible to participate in the mobile hotspot programs, expect to see partnerships between network teams and libraries.

If SHLB is successful in their efforts to persuade the FCC to allow nonprofit organizations to participate in lifeline, even if the nonprofits are not Eligible Telecom Carriers, expect to see the mobile hotspot program take off. Buoyed by Lifeline subsidies, effective planning by libraries, schools and community broadband teams could result in concerted efforts to get 8-10 Mbps broadband into low-income urban and some rural communities.

It will be hard work to capitalize on this opportunity and requires neighborhood level supporters and advocates. Some community network teams are realizing that wireless infrastructure can bridge the gap in the short-term while more durable broadband solutions that offer more speed and capacity are put into place.

This tactic does have some shortcomings, the most obvious one being that mobile hotspots require a Sprint, T-Mobile or some other carrier to provide coverage and that is hard to find in rural and sparsely-populated areas. Economics can be a problem as well. The low-income constituents that Lifeline addresses are not providers' primary target market, which is why we need more public, co-op and public-private partnerships to be truly high-speed (at least 25 Mbps symmetrical) networks. To take advantage of the more bandwidth-intensive applications libraries are offering, communities have to create robust infrastructure that takeover where libraries and anchor institutions leave off.

Low-income people are economic development resources

Broadband advocates and city officials generally understand the value libraries bring to digital inclusion efforts. Angela Siefer is Director of the National Digital Inclusion Alliance, a support group that crafts, identifies and disseminates financial and operational resources for digital inclusion programs. She hopes that community broadband project teams unite with libraries to make low-income citizens profitable customers for the network.

Libraries are the biggest conveners of local and regional partners in digital inclusion efforts. The broadband teams can help by creating low-cost service options. "It seems that large ISPs don't understand this, I'm told, possibly because they feel that these low-income residents are more work, they call the Help Desk lines more, they can't afford ISP's pricier services and so on," Seifer says.

The lack of affordability hinders adoption, but it's not price but pricing schemes that are the problem. The giant providers want to sell cable TV packages, so they price Internet service high as an incentive to force cable sales. Subsequently, some low-income people can't afford neither Internet nor cable. What's more, because low-income people represent small or no profit margins, incumbents may be disinclined to upgrade or adequately maintenance infrastructure in their neighborhoods.

The same "profit & loss" mindset typically is not the case with public and co-op networks. Municipalities and co-ops offer Internet-only options, service packages priced affordably for low-income residents and cable is optional. After Chattanooga Public Library Director Corinne Hill moved to the city and later decided that she didn't want cable service anymore from public utility EPB, "all they said to me was, 'okay, what date do you want to turn it off?'"

We would like to see community network operators view and cultivate low-income people as economic development resources. The broadband teams and libraries are valuable partners in this endeavor both before and after the network launches. As Siefer observes, "libraries are increasing resources online thanks to public dollars. But without affordable, fast Internet access, the people most in need of the libraries' resources will not be able to reach them."

What libraries and broadband teams must never forget, though, is that the technology is a means to an end, but it isn't the end by itself. As Lazone Grays Jr, President/CEO of youth advocacy group IBSA, Inc. reminds us, "Anyone can bring Wi-Fi into a building and hook it up to a

computer, but it's what you do with the technology that matters. The libraries and other stakeholders must develop programs or services that raise the participation of neighborhoods and produce measurable results. It's key to have people from the neighborhood developing these programs. You can't take someone who's never lived in the neighborhood, or who hasn't even worked there, in charge of creating programs. All you get are very mediocre results.

To be a great marketing partner, do great marketing

The first day a community starts to seriously consider the idea of building a public or co-op network, that's the best time to think about the marketing of that network. This advice goes to libraries as well. Many libraries know that they are very popular with the community, even among people who don't visit the libraries. Broadband projects teams need to key in on this popularity so they can increase networks' odds for financial sustainability by recruiting libraries as strong marketing partners.

Libraries feel that community broadband networks can play a key role in their patrons' lives and businesses, so we expect that the directors and staff would welcome a marketing role that they can provide. To step into that role, libraries should raise their awareness within the community.

"Marketing departments, especially during the recession, probably were one of the first departments that libraries eliminated or chose not to grow because it's hard to justify the expense when you're down to a skeleton crew just to keep the doors open," stated Candelaria Mendoza, Library Services Administrator for the San Antonio Public Library. As economic times have improved, there is a renewed interest by libraries in increasing their market presence. Mendoza feels that "our director saw the power of what our marketing group can do for us. They send out press releases and make sure journalists know about us so we're in the news. Patrons hear about our databases, the Facebook page, digital collections and content that they didn't know we had."

Because mayors and city councils want their libraries to be a significant part of their broadband adoption and digital inclusion initiative, whether they plan to build a public network or invite Google Fiber and other parties, the library's marketing efforts are indispensable. Of significant importance is that early on, library patrons need to understand that the building of a public network increases the library's ability to bring all of its innovations and new technologies into people's homes and businesses.

Into the trenches - library interviews

In this section, we detail the library innovations discovered in the course of months of interviews of gracious and generous library staff.

Cambria County Library Systems (Pennsylvania)

There are 14 local libraries in the Cambria County Library System with 45 full-time employees (FTE). The libraries form a federated system, meaning each library is technically independent, not branches in the way that are familiar with many people. The system's headquarters is the Johnston library. As a whole, there are annually approximately 298,619 visits to the branches and items checked out total about 388,000.

About 50% of their total budget has come from mostly state funds for the past 12 years. Forty percent of their funding comes from local or county agencies, and community foundations and other private sources comprises the rest of their budget. "While the libraries aren't losing ground, we have to continually remind politicians to continue their support and nudge them along," says Meek. The money that funds the operation of their 50-meg network comes from a 90% E-rate subsidy.

In Johnstown, the main branch of the library has on its first floor a gathering space for teens and for seniors, as well as a used bookstore and a small coffee shop. On the second floor they have computers, kids games, presentation equipment and multimedia equipment. On the third floor the branch has devices for the vision and hearing impaired as well as services that help the mobility impaired. Other libraries in the system incorporate aspects of this layout.

"In terms of introducing innovative services, we are governed by demand and budget," states Meek. "We have the main things that our patrons want. However, any time that we want to introduce certain new technologies we not only have to budget for the devices, software etc., we also have to have staff who are able to able to operate and deliver the services."

The library does see the opportunity for innovation by engineering a network do-over. "On one hand, we are meeting our needs," says Joel Koss of Cambria Library's IT staff. "But if money was no object, I would like to start from scratch and replace the entire network with a more efficient and much faster network." For example, might be worth it to check out a system that

puts RFID codes on all of the library's titles, though that would be an undertaking since the library has 150,000 titles it would have to enter into the system.

As we found in our interview with Topeka, Meek believes that partnerships are good ways to increase libraries capability to provide additional technology services. One of the local technology companies' staff comes in one or two days a week to help library patrons with their smartphones and laptops. "We are open to arrangements in which a local company can provide space that we can convert to makerspace," states Meek.

Santa Monica Public Library (California)

The Santa Monica Public Library has 111 full time employees who work at the main branch and four neighborhood branches that serve this 8.5 square-mile city that's nestled next to Los Angeles. About 1.2 million patrons visit the library in person and 800,000 visit online.

The library's infrastructure is part of the city's broadband network that is administered by the city IT Department. The Santa Monica network services the city government needs and provide services to businesses via various private ISPs. However, the city is piloting services for low-income residents that will give those constituents much faster speeds.

The library plays a very strategic role in city government's mission to have Santa Monica be a jurisdiction whose constituents excel at civic engagement – people coming together for the betterment of the community. The library's gigabit speed enables many of the programs that contribute to the mission. "We want to make sure we support community problem solving and build community capital," states Maria Carpenter, Director of Library Services. "Information sharing locally as well as with experts nationwide is crucial and we are relying on video, multimedia, online conferencing and various broadband tools."

The library is positioning itself as the "third place of importance" in constituents' lives, following in order the home and their places of employment. The city and their constituents view this institution as a vital resource that should be owned, enjoyed and used by the community.

The library also positions itself as a vibrant learning center, "and to that end we see our gigabit capacity to support innovation, creativity, entrepreneurs and the 'creative' industries such as music and graphic designers," says Carpenter "In the Santa Monica and Los Angeles areas there are actors, animators and startup companies that service them who love our resources such as wrap-around 360-degree screens for animators and filmmakers."

Carpenter says that this focus goes beyond career development and entrepreneurialism to embrace lifelong learning by all patrons - hobbyist, seniors, students - through access to Internet applications, instructional videos, software technologies and so forth. The library expects to

facilitate learning not just by patrons reading and listening, but also by doing, such as generating simulations building prototypes and gathering feedback. And of course, having fun.

People come in who have a startup business and maybe don't have enough money to pay for a working space at a private working space but they can use the library for free till the business picks up. There's also the fact they have access to the library's 3D printers, broadband gig speed and various other technologies.

One of Santa Monica's strategy goals for the future is to increase strategic partnerships. They partner with the schools, civic groups, sustainability organizations and other groups and cities all the time. "Every year we have over 2,000 programs for 60,000 attendees at our programs, and they're all free to the public," states Carpenter. Broadband teams in other cities have this much clout and drawing power in their communities need to consider how their libraries can play a big role in driving broadband adoption.

The Free Library of Philadelphia (Pennsylvania)

Forty percent of the homes in Philadelphia (population 1.5 million) don't have an Internet connection. Needless to say, libraries are digital lifeline in this city. Furthermore, according to Siobhan Reardon, President and Director of the Free Library of Philadelphia, "there are plenty of people who have a computer at home but come in and use our computers because our connection is just so much better."

Somewhere in the range of six million patrons visit the 54 physical branches annually and 10 million visit the virtual Web branch to check out 1.1 million digital items and almost 5.4 million print materials or other physical items. This is actually low compared with other metropolitan libraries such as the Queens Library (NYC), which checks out 18 million physical and digital items.

FCC E-rate funds $1.5 million annually for the broadband network that connects each of the libraries with a 100 megabit per second pipe to the main server, while providing Wi-Fi within each library for patron use. The staff separately access their own infrastructure within the network for library operations. Without the E-rate funds the city might not be able to support the library's broadband budget.

The lion's share of the broadband usage is to support operations. "The biggest thing we do with it is run our Integrated Library System that manages our catalogue, our collections, our circulation data, all of our program data and all the patron activities," says Reardon. "There are at least a thousand public-access PCs we support throughout the branches in addition to laptops and gadgets. We have 15 technology labs around the city that provide digital training for our patrons."

Reardon encourages her staff to develop new services using the libraries' full broadband capabilities. "Creation services" – those services that enable patrons to invent, build or compose – are increasingly popular, particularly with Philly teenagers and young adults. Several libraries

have makerspaces. A lot of patrons use libraries to create podcasts. Some of the libraries are making space for music recording studios and filmmaking. One of her staff recommended that they put little libraries in the prisons in Philadelphia.

As far as a five-year plan goes, it's all about the video with the Philadelphia libraries. They believe video-related technologies are going to be the next big thing. One of Reardon's long-term goals "is to actually have all of our libraries connected via video so that we do a lot of simulcasting, have videoconferencing with fabulous authors and do more efficient training." The library system has 800 full-time and 400 part-time staff spread over 54 facilities in the city, so trying to get all of these people together at one time or distributing consistent messaging and protocols is a big challenge.

Essex Free Library (Vermont)

The Essex Free Library in Vermont might be the quintessential small-town library. Started in one of the Essex churches, in 1987 the town voted to renovate the structure to serve solely as a library with 6,000 square feet of air-conditioned space that contains 35,319 titles on three floors. The library employs three full-time staff.

Essex has a population of 21,000. The Library has 6,352 patrons in its database who collectively make approximately 115,000 visits annually and check out over 88,000 items. "We offer access to computers, Wi-Fi, printers and e-books," states Ann Paietta, Library Director. "In addition, patrons can participate in some of the 500 classes managed by the State of Vermont that cover a variety of topics including English-as-a-second-language courses."

The Library manages its own digital literacy courses, activities for kids, delivers books to homebound patrons and assist patrons with government forms. One of the most popular services is an online system called Mango, which offers 23 full language courses that are self-directed. "Our library is also popular because it's the unofficial community center for Essex, so just about any night there'll be meetings and gatherings here even though our space is somewhat limited," says Paietta.

Essex is fortunate because the city's franchise agreement with Comcast includes free broadband access for the facility. The city IT staff manages the broadband services.

Topeka Public Library (Kansas)

Topeka has 200 FTE staffers, with eight of them devoted to digital services. The library's director, Giga Milsap, is co-chair of the effort to build a community network. This makes sense given that the library's mission includes bridging the digital divide, increasing digital literacy and fostering digital entrepreneurship. Also, this involvement with planning the citywide Internet

network is consistent with the library's greater commitment to level the playing field among citizens, regardless of income or where those constituents live.

Though Topeka has around 130,000 people, the library has only one physical branch. However, it has had a digital branch for 10 years that offers all the services of the physical branch, plus additional features including audiobooks and e-books, theatrical releases and other "live" events. The library spent in recent years around $300,000 annually on digital content. Unfortunately, reaching all of its residents with this content is hampered by the lack of adequate broadband in the sparsely populated outer perimeter of this 500 square mile city.

The Topeka library has its own makerspace focused heavily on digital technology. It partnered with 712 Innovations, which is a combination makerspace/shared-workspace with equipment such as a laser cutter, soldering equipment and industrial-strength sewing machines. Now anyone with a library card can have an extended makerspace experience. Three or four days a week, library staff work at the 712 site assisting entrepreneurs with research. A separate program, called The Library at Work, allows local employers to place buttons on their intranets so employees can search library resources, and order books that the library staff delivers.

These days, the primary innovation desire seems to be the need for speed. In September 2015 the library increased Internet access from 300 Mbps to a gigabit per second, to better serve 3000 visitors per day. The library also installed self-checkout kiosks around the library to that have eliminated average 10-minute waits per patron. Library staff expect that capability to increase in a year or so. A lot of patrons come to the branch with two or three devices to connect. The library itself has 170 computers for the public, plus the computers the 200 staff uses. All of these devices collectively put great demands on the library's bandwidth.

The library experimented with TV white space, which has the promise of giving a greater range to the Wi-Fi coverage area of a single access point of up to one or two miles. However, Milsap and the staff were disappointed with the results of their 10-Meg pilot, with the requirement for a clear line-of-sight between access points and patrons' computing devices being the most problematic.

Kansas City Public Library (Missouri)

The Kansas City Public Library (KCPL), with about 2 million checkouts in 2013-14, is at an exciting stage in its evolution, preparing to greet change and meet change on a number of fronts. As of December 2015, the library was poised for connection to the much-vaunted Google Fiber, after a lengthy process to determine where the connected areas in Kansas City were to be located. The library was very involved in the process, from hosting workshops to proactively implementing strategies to sign up prospective customers.

The central library and nine branches have 190 FTEs, and pre-Google Fiber offered a broadband speed of 100 Mbps. With this capacity, it offers Minecraft times, homework apps, computer classes (open lab and specific trainings), e-books and various other digital media, administrative

inventory management system, and digitized archives of Kansas City's Civil War history completed as a first step to an online encyclopedia of Kansas City.

There are 700-800 public computers available from 10 AM-9 PM most days, and 24/7 Wi-Fi at their locations. New initiatives are a software lending library almost ready to launch, and a mobile hotspot lending pilot program with 25 families, hopefully growing to 600 in a few months. "You can check out everything else, why not the Internet?" asks Cheptoo Kositany-Buckner, Deputy Director of Strategic Initiatives

KCPL is also finishing up a strategic plan calling for digital inclusion through a variety of community based locations offering broadband access through the library's connection, to be located within walking distance of every child. In three to five years, Kositany-Buckner would like to have a pilot of this program launched, which is based on a similar program in Philadelphia. Local decision-makers are supportive but the funding is not in place. Library staff hope to assemble funding after the strategic planning effort is complete. The funding could be combination of local, foundation, and Federal sources.

KCPL uses E-rate with a 90% discount. Kositany-Buckner has been involved with the E-rate program since the 1990s, and feels like it's essential to what Kansas City can provide. KCPL is also involved with HUD's ConnectHome initiative at local public housing complexes. A local group has mapped community broadband resources. In some areas, the only place to access Wi-Fi is McDonalds.

The KCPL experience with the rollout of Google Fiber prompts Kositany-Buckner to note nuances within digital divide issues. For example, to sign up for Google Fiber, a credit card was required, whereas many people who are underserved for broadband also do not have bank accounts. There are related issues with Internet subscription models versus pay-as-you-go, and websites versus mobile apps. Another example that may come up during promotions of expanded service is distribution of free tablets or other hardware, but some schoolkids and their parents don't want "free" stuff due to fears of being targeted for theft walking home from school.

When creating new digital resources, advises Kositany-Buckner, be careful not to aggravate the digital divide and create more have-nots. Kositany-Buckner recommends that anchor institutions, especially libraries, must take the lead in broadband expansion. Even if they don't have a lot of resources, libraries can be the convener and bring the discussion; it can be a partnership, libraries don't have to do everything.

Boston Public Library (Massachusetts)

The Boston Public Library (BPL) is a large system, with a main library and 24 branches throughout the city. In 2014-15, there were 600,000 registered patrons and 3.7 million visits, with a circulation of 3.9 million system-wide, of which about one million were digital. The library has 470 staff, with about 30 FTEs in the IT group who maintain the existing network, devices, and software.

The library is connected to the Boston municipal broadband network, BoNet, with speeds of a gig on both the staff and public side. There are 170 servers system-wide. With that connection the library features public technology trainings (especially job training), iPads, laptop checkouts for in-library use, Hoopla (a digital media streaming service available both in library & at home), Wi-Fi, and drop-in device help. However, even with a gig, bandwidth can be an occasional issue, with patrons bringing two or three devices; wireless may fall behind unless upgraded. Interim President and Director of Administration and Technology David Leonard notes, "Patrons expect and demand technological services - if you can't provide them, you will be left behind."

The library is a city department; Boston has a capital improvement plan citywide that folds in library projects as part of the process. Local decision-makers are generally supportive of the library. The library also has an active foundation that financially supports some initiatives but couldn't fund a major equipment upgrade.

BPL is an E-rate user; BoNet bid on the connection in a competitive process, and was awarded it. The library belongs to the Urban Libraries Council, and found it to be a helpful organization for navigating the E-rate process.

The staff has had to acquire basic levels of technical competency; there have been changes in the job descriptions (and the jobs) of program librarian and reference librarians. They have had to shift capacity to technological areas, which works fine when there's less demand for traditional services, but occasionally there's a shortfall somewhere.

Leonard's advice to other libraries not connected to a high-quality broadband provider is that it's "critical [for libraries] to take leadership"; one avenue is to "be an advocate; build strategic relationships."

Salt Lake County Library (Utah)

The Salt Lake County Library (SLCL) system is large, with a main library, 17 branches, and 4.1 million visits and 15.5 million checkouts in 2014-15. SLCL has 550 FTEs, of which 19 are in the Information Technology group, and seven of those support the network. The current broadband speed is a gig.

SLCL uses the Utah Educational Network (UEN) as its ISP, E-rate liaison, and umbrella bidder organization. SLCL just was upgraded about a year ago from 200 Mbps, according to Skip Cordie, Infrastructure Manager. While the SLCL service area overlaps in places with the UTOPIA community broadband network, Cordie is not aware of any involvement or discussion with UTOPIA's planners.

Media streaming was causing bandwidth problems at the branches, such as slowing down checkouts, eventually leading to the upgrade. Now that the speed and capacity are so much improved, all sorts of online services, such as BrainFuse, an online tutoring service, and streaming media in-library are popular. Because streaming in-library is so popular, Cordie would like to improve selection of digital media available to patrons, now that they have the bandwidth to support it, but the packages are expensive.

In the county, their budget is generally flat. If some upgrade is needed, they have to make do or wait until the next fiscal year's budget process and work it out. They use E-rate for their connection, though UEN, and also used it for the recent upgrade to a gig.

Cordie's team has seven network IT staff, while the IT total of 19 includes Help Desk tech support by phone for staff and patrons, who may call for help using their e-readers, for example. "Those calls tend to be long," says Cordie. He makes recommendations for new technology through the chain of command.

SLCL has an internal training staff person, and they do regular live and online trainings for technology issues. Cordie's advice for libraries looking to upgrade their broadband service is to focus on the result for the public user. Better bandwidth and service will create a better experience for the user, either directly or indirectly, with staff being able to do more, and do it faster.

Chattanooga Public Library (Tennessee)

The Chattanooga Public Library currently has a main branch and three smaller branches that annually serve about 582,364 patrons in person and 770,233 online. The staff check out 867,313 physical and 60,618 digital items. The FCC's E-rate program and the library's operating budget fund the library's broadband services.

Chattanooga is a 10-gig city, and in 2010 was the first to offer gigabit services to the public citywide. That created an interesting technology evolution within the library. "It's as if I'm running two types of library systems," observes Library Director Corrine Hill. "We offer very traditional services such as Wi-Fi and computer access, and children's programming. But we also have a massive makerspace that has evolved into a 'collision space' where we're watching high tech and low-tech things collide. We're seeing some interesting things come from these collisions."

The Library's "4th Floor" makerspace has led and complemented the city's broadband revolution. The staff believe their ability and willingness to try out new things in an experimental lab like 4th Floor is huge. Patrons ranged from those who hear about particular technologies and

want to learn how the work to people on a mission to push the high tech envelope. One of the patrons happens to have a little boy who doesn't have any arms or legs. The father uses the library's 3D printer to build prosthetics for the boy as he grows. Every few weeks the patron returns to make changes or to design replacements.

As Chattanooga network's popularity increased, the libraries kept pace with the city's technology industry. Hill recalls when she came on board as Director four years ago and the library was the only game in town for concentrated tech activity. "I asked my staff what we were going to do in two or three years when the city came through on their plans to make Chattanooga into a tech hub."

In response, the 4th Floor morphed into an onramp to venture-funded local high-tech incubators and business accelerators, including the Lamp Post Group, CO.LAB and the Edney Innovation Center. "Three years ago I might've had a patron with plans to put a person on the moon, and we would have helped as much as we could," says Hill. "Today, people come here to experience and experiment with technology. If someone wants to put people on the moon and develop software for them to live on there, the person will go to Lamp Post from here where they can get money, staff, resources and an ecosystem."

A big frustration for the library staff is that there aren't very many gig cities with which they can link. "You're kind of like the only child in the house and you don't have anyone to play with, but you have the best games in town," remarks Hill. "Soon there will be more cities with a gig and it's going to provide us opportunities to do more things together in entertainment, medical care, in educational. Imagine a physician who can move really high-end, high resolution digital X-rays from one doctor's office to another in seconds."

Another challenge libraries have is that more people in the community are unaware the role they play in technology. Hill believes that libraries have a responsibility make more people in the community aware. "If we're not telling the story, who will?"

Contra Costa County (California)

The Contra Costa County (CCC), California Library, within the San Francisco Bay Area, has 26 branches. There is no main location, but administration is co-located with one of the branches, referred to as central although it is not the largest. In 2014-15 the system hosted 3,768,045 visits and processed 6,548,953 checkouts. There are seven IT staff.

All but two of the locations have fiber Internet connections; those two have a T1 line. Each branch with fiber is 10 Mbps to central, which has 100 Mbps to the Internet. The branch speeds are symmetrical. A couple years ago, they started the process of upgrading all the connections, which is now almost complete.

The library service area is geographically large, and does encompass a few local small public Wi-Fi networks, which the library doesn't use since it has its own high quality network.

Technology offerings include allowing patrons to download software onto one of the many public computers (which gets removed at rebooting). They have had a couple Minecraft servers for some months. The CCC patrons use an ever-increasing number of e-books. The library is preparing to do story times on YouTube, and a few branches offer drop-in help with e-readers. Staff is planning to increase bandwidth at the larger locations where demand is highest. The library uses E-rate funds, but no other outside funds for technology issues.

Library IT staff maintain their equipment with occasional support from County IT staff. The IT manager makes recommendations to Library Director, who in turn makes a recommendation to County Administrative staff.

Staff training to keep up with technology is not necessarily a barrier, but it does add an additional step and means that it takes more time to roll out innovations, since the staff understandably want to be able to support new technology in the branches. The IT division is preparing a "petting zoo" of devices for staff training on various personal technologies. Mostly the staff have to learn on the fly.

San Antonio Public Library (Texas)

The San Antonio Public Library has a key role to play in two important City initiatives: 1) lighting an existing fiber network that exists within the City of San Antonio that is currently dark, and 2) a major digital literacy program aimed at low-income areas in the city.

"One of our city council members is championing the idea of turning on our city's dark fiber that would serve primarily nonprofits and educational institution such libraries, universities and schools to extend access to broadband," says Library Director Ramiro Salazar. "Our digital literacy initiative is particularly challenging because many in our target areas need to be able to understand the English language as well as have good literacy levels in Spanish in order to access what's available in the Internet."

The library system has a large footprint in the community with 27 branch libraries and two more under construction that will come online later this year. Salazar reports that they have a gigabit connection going to each of their library locations. "The Library's aim is to get 100 megabits to each patron, but when it's busy we average about 19 Mbps per person."

The libraries are so critical because they are the only source for many of their patrons to access public computers and Internet. Dig a little, and you find that affordability is a big source of the problem. "In parts of the inner-city where generally there is high unemployment, the broadband adoption rates drop dramatically to between 20% to 40% or lower," says Ignacio Albarracin, Digital Services Coordinator for the Library. The libraries will be helped by the city's participation in the White House initiatives ConnectED and ConnectHome.

The Library also has positioned itself effectively as a small business "surrogate" office. Patrons have access to Wi-Fi, computers with an array of office productivity software, and later this year printers that patrons with library cards can access with their computing devices, both on-site and remotely. "Our new facilities opening this year will have collaborative telepresence technology in meeting rooms that let people collaborate on 55- or 70-inch touch-screen computers with video conferencing capabilities," states Albarracin.

The Library has pursued its school age and young adult audiences with equal vigor. They created eReading rooms, which are virtual environments for children and teens to browse within the digital library, each customized to display content only for the particular browsing audience. Another service is the Eastside Promise Neighborhood initiative that includes a library van equipped to deliver technology equipment and activities for children and teens in the community including free WiFi, iPads and iMacs.

An ace in San Antonio's corner is "we rank as the highest local government agency with a 96% customer satisfaction rate," says Mendoza. "It helps us when we have to ask for project dollars to know that the community backs us up. I think it's a key ingredient to the success of a library that the community really does appreciate, respect and love their library branches."

Springfield-Greene County Library (Missouri)

The Springfield-Greene County Library District (Missouri) has one main library with nine branches throughout its service area. In 2014-15, there were 217,000 patrons and 3.6 million checkouts system-wide. The system had 250 employees in 2013-14.

There is a community broadband network (SpringNet) available, but the library system is not connected. It bids its connection through a statewide consortium called MoreNet, which bids about 100 connections at a time, using E-rate funding. The Springfield system's current broadband speed is 70 Mbps.

With that connection, the library features e-books, "The Edge" (a community technology center/lab), a well-used public Wi-Fi, with 350,000 connections per year and it's not even available 24/7. Currently there's a limit on the bandwidth per computer (the exact limit varies by location) If money were no object, that could be lifted or at least increased. They have a Minecraft server at one location, and a Makerspace.

The system's financing is in an enviable position: It receives local property tax funding, controlled by its own taxing district - it doesn't have to compete with other local priorities. They generally get what they need, and can always go to the voters for more; bit-by-bit the library staff are working on increasing connection speeds at the facilities in turn. Six years ago the library got a federal Institute of Museum and Library Services (IMLS) grant to fund The Edge.

There is an IT Department within the library administration that maintains most of the technical equipment, while MoreNet maintains the routers, etc. The IT Director and Executive Director

make decisions with staff input. The library provides staff technology training using a training lab.

Indianola Public Library (Iowa)

Indianola has a small library system that is part of the city government, and it uses the city-run community broadband network, run by Indianola Municipal Utilities. In 2014-15, the library had 74,600 visits and 114,901 checkouts, with six FTE staff.

Its current broadband speed is 30 Mbps down, and 10 Mbps up. Some of the digital services it provides are Bridges (Iowa's e-library network), e-magazines, e-music, online catalog, and 10 public computers. On the whole, states Library Director Joyce Godwin, they are in recovery mode after a 20% budget cut about a year ago. They lost staff and hours; and now are working on rebuilding those, plus building the materials collection back up. Technological innovation is a lower priority than these classic library services right now.

On the plus side, the library's Internet connection is basically included with the municipal utility network, so service is not an issue and maintenance of the network is provided by the City of Indianola. The library does not receive any other significant state or foundation support, other than from the Friends of the Library.

The library does not have a training budget currently, but Godwin has been able to hire technology-savvy people; beyond that, they must learn on the fly. She has re-written job descriptions to include more technology skills. Her experience in running a library connected to a community network leads Godwin to advise other libraries to "be involved in [broadband service] planning; the more you can be, the better it will be for the service you can provide."

Thomas County Public Library System (Georgia)

The Thomas County Public Library (TCPL) (serving Thomasville), Georgia, has a main location and five branches around the county. In 2014-15, there were 22,000 patrons and 186,000 checkouts system-wide, with 30 FTEs.

The library uses a commercial provider (Windstream) for broadband service, although there is a community broadband network available, called ThomasNet. The speed is 100Mbps at the main location, and 20-30 Mbps at the branches. ThomasNet was not the lowest cost provider at the time of the last contract, and the feeling was that use of E-rate made it difficult to select the community network. The TCPL is funded with local money, a sales tax (1/12th of one cent), which has been in a holding pattern of around $900,000 per year.

TCPL offers its patrons e-books and other digital media, a computer lab with classes, and participates in a statewide partnerships for more databases and online resources. There is a makerspace in the works, thanks to a federal/state library grant for equipment. Director Nancy Tillinghast says their patrons always want more audio and video streaming, among many other things.

Tillinghast feels that staff training is not a barrier to technological innovation, but rather just another issue they have to keep up with. (The new 3D printer is a current challenge.) They use Lynda.com for online training. The library's job descriptions were rewritten a few years ago, but could be updated again to add more technical skills.

Sandy and Hoodland Public Libraries (Oregon)

The Sandy and Hoodland Public Libraries have one main location and one branch, with 16,575 patrons and 402,826 checkouts in 2014-15. There are 12.05 FTEs, with 58 volunteers rounding them out. The library has been connected to SandyNet, Sandy's community network for six years, offering downloadable e-books and audiobooks.

The library's budget is stable, funded by a Library District with a dedicated tax rate. If money were no object, Director Sarah McIntyre would like to offer 3D printing, and music download stations, among other broadband-enabled enhancements, and she hopes that there will be additional offerings over the next three to five years. The library's network is maintained by SandyNet staff, LINCC Network staff, and IT contract support. The Library Director, Assistant Director, Reference Librarian, and Children's Librarian are all involved in making decisions about new technologies to introduce.

Lafayette Public Library System (Louisiana)

The Lafayette library system has one central location and eight branches, together hosting 860,000 visits and 1.6 million checkouts in 2014-15. There are 150 FTE staff.

The library is in an interesting situation for broadband service, with five locations using the local community broadband network (LUS), and the other four on Cox. The current broadband speed ranges from 10-200 Mbps per person depending on location; demand tops out at 100 Mbps most days. Lafayette uses E-rate, and gets modest financial support from the Friends of the Library.

The library has two makerspaces, Tech Lab, e-books, Wi-Fi, and public computers. Danny Gillane, Librarian IV, one of the library's point people for technology, notes that the only issue they've ever had with capacity has been when they opened a new location and demand increased faster than expected. (But they have since caught up with it.) Gillane feels like the current speeds and service are more than adequate for patron and staff needs. Library staff maintains the network and library technical equipment.

Why should libraries be at the forefront of the discussion about improving access to broadband? Gillane feels it's important because traditionally, "libraries have been a societal equalizer [with access to books]. Now it's Internet access. A lot of patrons don't have broadband at home, so they come to the library. This is part of making lives better."

Salisbury (North Carolina)

The Rowan County Public Library (serving Salisbury), North Carolina, has a main library and two branches. In 2014-15, there were 314,569 total visits and 644,455 checkouts. The system has 46.23 FTE staff, about 90 total employees.

Salisbury has a community broadband network, Fibrant, but as of late 2015 the library was not yet connected to it; although plans were in place to make the switch by January or February 2016, pending contract approval. The November 2015 speed was 100 Mbps.

With its existing broadband service, the library offers its patrons 24/7 Wi-Fi, multiple computer labs, videoconferencing, and a Minecraft server. If money were no object, there is interest in 3D printing, and the staff would like to finish digitizing services at their genealogy center. Rowan County has a significant amount of Civil War history, of interest to its patrons

The current bandwidth gets thin for streaming services, and the presumption is that after connecting to Fibrant, the library will have access to a gig (for free, per the tentative agreement between the city and county) and this problem will go away. Time will tell what future improvements or enhancements will be made once the gig is in place.

The library is planning to use E-rate for upgrading equipment necessary to support the switch to Fibrant (routers and switches). They've had public Internet access in the library since 1995, with the connections maintained by a combination of county IT staff and library staff. While they have had to increase staff technical training for technology expertise, it's become common for most of the newer staff graduating from college with library-related majors to have the tech skills in place.

Burlington (Vermont)

The Fletcher Free Library, a city department, has one location serving Burlington, Vermont. In 2014-15, there were 13,500 patrons and 385,000 checkouts, served by 19 FTE staff.

The library is connected to the local community broadband network, BT, and has been since BT's inception, although the library wasn't formally involved in the planning of the network. The library has two servers in place, one for the library's use and the other for patrons or the community to use. The current broadband speed for staff is 40 Mbps, and a gig for the public.

The library has used its gig for a videoconferencing facility, computer center, audiobooks, and a set of nine portable laptops for training. A permanent training lab is on the wish list for the future. There isn't any plan or perceived need to increase capacity, given they are already at a

public gig. The funding is local, very well supported at the city/community level; the decision-makers are generally supportive of the library's requests. Staff and patrons together are still figuring out what awesome things they can do with that gig, with lots of potential including a project in conjunction with the University of Vermont to do musical collaborations with Chattanooga musicians.

The library doesn't use E-rate. They got a Google grant via the state about six years ago that provided the videoconferencing equipment. They also got a grant from a Vermont organization for A/V equipment in their meetings rooms.

Technical projects and maintenance are mostly done by library staff, with more complicated projects getting an assist from a city staffer or occasionally contract support. The programming librarian, technology librarian, and director are the internal team making technology decisions.

Burlington has not had to formally increase staff training to support increased technology in-library, although the A/V equipment has been the biggest recent challenge; public users are supposed to make an appointment to learn how to use it before booking a meeting room. Each reference librarian can troubleshoot one kind of e-reader.

Jackson (Tennessee)

The Jackson-Madison County, Tennessee library has one main location and one branch. In 2014-15, there were 60,907 cardholders and 285,236 checkouts. There are 20 staff in the system, serving a population of about 98,000; Jackson is a college town with a strong arts community. As of November 2015, the library was poised on the edge of an upgrade to a gig, via community broadband network E-Plus, run by the Jackson Energy Authority. Meanwhile, the current broadband speeds were 50 Mbps upload and 100 down.

With those speeds, the library features wireless printing, video conferencing, and scanning to USB drives; staff dedicated to assisting guests with technology; weekly computer classes; and one-on-one assistance with electronic devices upon request. The main library has a computer lab with thirty computers, and the branch has eight. Wi-Fi is accessible at both locations 24/7.

A Minecraft server is on the horizon after the gig is in place. makerspace & minecraft server. If money were no object, patrons would also love a makerspace and a recording studio (with more video editing capacity). Digital programs and services are expanding all the time; the library already bought Treehouse, a subscription-based online coding program in anticipation of the gig. Also, they recently received a state grant for four new computers loaded with video editing software, again needing the gig for best functionality.

The library's support comes from an interesting situation. In January 2013, the library was brought back as a county-staffed function after six years of outsourcing that was unpopular; as a result the re-in-sourced library has enjoyed strong support from the county commission, and increased funding. The library uses E-rate funding, supplemented by occasional state grants.

There are state restrictions that they can't charge for services/programming other than to cover costs (copies, etc.).

Director Dinah Harris notes that the library staff really "get" technology issues; many of them have associate degrees in technical areas. One staffer wrote a program that aggregates daily all the local job openings, to provide a localized job search database. They get inspiration from Chattanooga (an older gig city) and other places, through library networks. Harris and her staff have rewritten job descriptions to look for technology experience/backgrounds; the library conducts inservice trainings, with incentives for continuing education. There is a focus on front-end staff's ability to help with e-readers and e-books.

Harris's great advice to other libraries at the beginning of planning broadband community networks, or other broadband service enhancements, is threefold:

1. The director has to be sold on it herself.
2. Make the case for the economic development connection (job searches, workforce development, online degree programs, etc.)
3. Tell the story of the virtually limitless potential to change lives - Harris cites a customer example of the woman who used the library's computers to do an online weight loss program and lost 100 pounds.

This report does not contain all that can be written about business organization structures and funding options for broadband networks. But it should be enough to motivate project teams and community stakeholder to get off the dime and aggressively explore these options and opportunities, find options that work for your specific community and move forward.

About the author

For over 25 years Craig Settles' workshops, consulting services and books have helped organizations worldwide use technology to cut costs, improve business operations and increase revenue. Author of the broadband business guide, "Building the Gigabit City," his blog by the same name and many in-depth analysis reports, Mr. Settles is a prominent thought leader on executing appropriate broadband strategies. He currently hosts Gigabit Nation, an Internet radio talk show, and is Co-Director of Communities United for Broadband, a national grassroots effort to assist communities launch their networks.

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Appendix A

A Selection of Further Reading on Community Broadband and Libraries

"Libraries' Increasing Role in Broadband Adoption" Angela Siefer, Katherine Bates, Colin Rhinesmith January 2016, Benton Foundation
https://www.benton.org/initiatives/libraries-broadband-adoption

"Broadband is Coming - Is Your Library Ready?", Marijke Visser, November 9, 2015, American Library magazine online.
http://americanlibrariesmagazine.org/blogs/the-scoop/e-rate-broadband-is-coming-is-your-library-ready/

"City Council Speaker Melissa Mark-Viverito Joins New York Public Library Officials To Launch Second Round Of Wi-Fi Hot Spot Lending", NYPL, April 23, 2015.
http://www.nypl.org/press/press-release/april-23-2015/city-council-speaker-melissa-mark-viverito-joins-new-york-public

"How the KC Library Got Google Fiber", Jason Harper, September 12, 2012, Kansas City Public Library blog post. http://www.kclibrary.org/blog/kc-unbound/how-kc-library-got-google-fiber

"How New York is bringing Internet-deprived homes out of the digital dark", Hari Sreenivasan, April 25, 2015, PBS NewsHour online transcript of video segment.
http://www.pbs.org/newshour/bb/internet-scarcity/

"Mobile Hotspot Lending Finally Gets National Press", Jim Lynch, July 11, 2014, Tech Soup for Libraries online blog post.
http://www.techsoupforlibraries.org/blog/mobile-hotspot-lending-finally-gets-national-press

"Show Me The (Hidden) Money for Community Broadband", Craig Settles, October 2015.
http://cjspeaks.com/wp/wp-content/uploads/2015/10/snapshot-10-15.pdf

"Statement From Public Libraries on the FCC's Proposal to Include Home Broadband in the Lifeline Program", NYPL press release, June 18, 2015.
http://www.nypl.org/press/press-release/june-18-2015/statement-public-libraries-fcc%E2%80%99s-proposal-include-home-broadband

Libraries' Increasing Role in Broadband Adoption