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WI-FI and WIRELESS NETWORKING for COMMUNITY ANCHOR INSTITUTIONS

By supporting robust Wi-Fi and wireless networking for community anchor institutions, policymakers can help enable a wide range of 21st century Internet applications for improved education, learning and medical care.

by Amelia Bryne

The SHLB Broadband Action Plan includes the following:

Connecting Anchor Institutions: A Vision of Our Future

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Introduction

For community anchor institutions (CAIs), robust broadband connections, teamed with Wi-Fi and other wireless networking, are the essential elements of a critical infrastructure. In schools, wireless connectivity enables students and teachers to access a variety of online learning resources and pivot towards the educational models of the future that help learners develop the skills to succeed in technology-integrated workplaces. Wireless can help libraries significantly extend their public Internet access capacity and spawn new community activities. In hospitals, these networks are key to supporting wirelessly-enabled medical devices, helping staff transfer patient data and assisting families in navigating the hospital, understanding medical conditions, and obtaining support.

Despite the importance of Wi-Fi and wireless networking, many community anchor institutions do not currently have the capacity and coverage they need. The technical and human elements involved in creating and maintaining wireless networks are often more complex than meets the eye. These elements include ensuring network capacity and quality in an environment of constantly-evolving technology, complying with privacy and security regulations, assessing different technology options, addressing funding challenges, and understanding how CAI wireless networks can help meet universal service goals.

This policy paper explores these core issues in detail and offers examples of successful policy interventions that have addressed these challenges. The second part of the paper suggests how policymakers at federal, state and local levels can support wireless networking in CAIs.

CAIs Need Technical Assistance to Deploy Enterprise-Grade Wireless Networks

For many CAIs, achieving sufficient, reliable wireless access in their facility remains an elusive goal. According to a recent Consortium for School Networking (CoSN) survey, more than one third (36 percent)

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of schools were not confident that their Wi-Fi could handle a 1:1 initiative (one device per student).[1] As of 2014, nearly 98 percent of public libraries across the country offered public wireless Internet access, but as demand for bandwidth has increased, connection quality at libraries that have not had the opportunity to add capacity has suffered.[2] Recognizing the critical need for robust wireless networks in schools and libraries, the Federal Communications Commission (FCC) prioritized "closing the Wi-Fi gap" in its recent reforms to the E-Rate program.[3]

Why do anchor institutions have inadequate Wi-Fi networks? For some institutions, like the Ligonier Valley School District in Pennsylvania, wireless network quality and capacity issues are, in part, a result of ad hoc networks that were built only as resources permitted.

> Despite growing demand, the district over time had acquired many unmanaged, autonomous wireless access points from different vendors. Dispersed across facilities without a comprehensive plan, the access points were designed for small business use rather than the enterprise-scale requirements of a large school district. As a result, the district, and especially the high school, suffered from spotty, unreliable wireless coverage and manually intensive troubleshooting and maintenance.[4]

Before the district completed an overhaul of the network, connecting to online applications often took a sizeable part of class time. These kinds of delays negatively affect teaching and learning:

Any classroom teacher will tell you that when the technology fails, it significantly impedes instruction because you have to spend more time making sure the students remain engaged. It is a distraction from the message. Teachers will shy away from integrating technology into their curriculum if they are not confident it will work.[5]

Managing wireless networks is an especially challenging endeavor because of the speed at which related technology is evolving, and the number of technical components that need to be considered and aligned for optimal performance. Wireless networks depend upon the quality of available wired networks, which have their own technical challenges. Beyond this, network engineers need to account for changes in physical wireless infrastructure (access points, etc.), as well as in technical standards (such as the new IEEE standard 802.11ac, which helps offer gigabit speed without the wire).

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The growing "bring your own device" (BYOD) trend poses additional challenges. At Houston Methodist Hospital, 60 to 70 percent of the hospital's clinical staff use their own devices – such as tablets – for mobile electronic medical record (EMR) access and other applications, and visitors bring devices as well. The result: the hospital's network needs to be able to support 10,000 wireless devices at any one time. Adding to the complexity, the variety and number of wireless-based devices with medical applications are growing quickly. The hospital evaluates three or four new devices each week. According to Armand Stansel, Director of IT Infrastructure Services at Houston Methodist,

> [M]ost medical device manufacturers don't have Wi-Fi expertise beyond basic wireless configuration … and they tend to use off-the-shelf components. It's up to us to determine if they comply not only with public standards [regulatory requirements regarding patient privacy and data security] but with our standards, as well.[6]

Considering how institutionally-owned devices interplay with wireless networks is a challenge for other types of institutions, as well. A donation of a fleet of laptops or tablets to a library may seem like a windfall, but depending on the device specifications, these devices may actually further burden an already taxed wireless network. Many lower end devices operate in the 2.4 GHz spectrum band for which there are currently only three non-overlapping channels (thus relatively easily clogged), while other devices are capable of operating in the 5 GHz band for which there are twenty-three available channels, each of which can carry more capacity than the 2.4 GHz channels.[7]

CAIs Face Procurement Challenges

Because of the technical complexity of designing and maintaining institutional-scale wireless networks, many CAIs – especially small ones – need to bring in outside expertise for at least part of the process. This can be helpful in two ways:

● A good technology partner can help reduce congestion with strategic placement of access points designed to respond automatically to spectrum issues, and can give advice on when technology upgrades are truly necessary.

● A high-quality, managed service can actively monitor a wireless network as well as integrate the privacy and security requirements of CAIs into network design.

Yet, getting the right help can be a challenge. Vendors have an incentive to sell institutions more technology than they may need – leading to "rip and replace" scenarios that are not as cost-effective as reworking existing equipment.

Each institution faces unique hurdles in setting up and maintaining wireless networks. Each institution faces unique hurdles related to the particular physical characteristics of its building(s), how and by whom the network will be used, and issues related to legacy network configurations. Across a state, for example, library, school, medical and other CAI buildings may have been built in a variety of eras with different materials. Some locations, such as public libraries located where fewer people have home broadband access, may have much higher Wi-Fi demand than others. Additionally, these CAIs may be starting out with many different wireless network setups.

Requests for proposals (RFPs) based on only very general information, combined with the difficulty of choosing the right technology partner, can lead to several issues. After a vendor has won a bid for a wireless network contract, its more-detailed assessment of the network may reveal the need for a more substantial budget. This can be difficult for public institutions that have applied for funding based on the RFP estimate. (When making use of the E-rate, for example, requests for additional funding can be a challenge.)

One significant way to improve the procurement of wireless network equipment is for state and local governments to offer due diligence support to anchor institutions. An action as simple as hiring an independent expert to conduct a needs assessment at the outset of an initiative can result in a better RFP and a more accurate proposal. E-rate rules restrict the involvement of potential commercial bidders early in the process to avoid unfair advantage, but state and local governments can provide some guidance on how to find relevant experts. Independent experts can also help those acting in procurement roles to analyze and choose the best proposal – a few thousand dollars invested at this stage of the process can help save many headaches and additional spending down the road. States might also provide more general support for this process by producing help documents with basic due diligence questions that CAIs should ask when considering working with a technology partner.

Policymakers can also assist CAI wireless network development by ensuring that district and state procurement contract processes are up to date. Arizona, for example, recently updated its procurement process to harmonize state contract terms with the FCC's E-rate program, to simplify applications for federal funding, and to offer support for the creation of buying consortia with the goal of lowering costs for diverse, participating institutions (e.g., schools, state and local agencies, non-profits, etc.).[8] Procurement guidelines could also note the importance of needs assessment. Involving the people who will actually be making use of the technology – such as doctors, teachers and librarians – in the design phase can help lead to more relevant network design and facilitate stakeholder buy-in.[9]

CAIs Face Funding Challenges

Community anchor institutions need funding to purchase wireless network equipment, as well as for maintenance and upgrades over time. Fortunately, the FCC recently decided to make available $5 billion in funding over the next five years for Wi-Fi and internal broadband connections for schools and libraries in the E-rate program.[10]

Additionally, E-rate funding can now be used to pay for managed wireless services. According to the FCC, managed Wi-Fi services:

can provide substantial benefits and cost savings to many schools and libraries, particularly small districts … without a dedicated technology director available to deploy and manage advanced [networks] quickly and efficiently.[11]

While schools and libraries now have the potential to obtain E-rate funding for wireless networks, other anchor institutions, such as community colleges and community centers, are not eligible for E-rate funding. These CAIs may need assistance to access other sources of funding, whether public or private.

The E-rate program alone cannot solve all the funding needs of schools and libraries. Mooresville Graded School District in North Carolina is one example of a district that has needed to find creative solutions to fund its wireless network because its E-rate discount rate is relatively low. Among other things, Mooresville has tapped the power of community partnerships – receiving an investment of $250,000 from Lowe's Home Improvement, whose corporate offices are located in Mooresville. The school district also uses the proceeds from an educational technology conference to help pay for professional development. And, in 2015, Mooresville passed a large bond referendum that will provide funds for education technology in future years.[12]

Expanding Wireless Access Is a Critical Component of Internet Equity

Ultimately, communities without adequate access to broadband – including robust Wi-Fi networks in CAIs – are increasingly at risk of being left behind. According to the Council on Foreign Relations, if communities do not have "adequate ubiquitous broadband to support mobile education applications, then their local school districts won't be able to make that pivot, which will quickly create an educational and ultimately an economic disadvantage for the community."[13]

Community anchor institutions can also play a role in extending wireless Internet access to residents in the surrounding community who lack sufficient access.

This concern drove Idaho state officials to choose to offer a statewide, managed wireless contract to all public high schools. Idaho wanted all students to have equal access to technology, independent of where they lived, with the knowledge that some school districts in the state have extremely limited resources. The state contracted with Education Networks of America (ENA) to "ensure that each high school has the same quality of service for its local [wireless] network." Idaho also used bulk pricing discounts. The state pays about $21 per student, per year, for a managed Wi-Fi contract with ENA, which supplies wireless network services to all public high schools in Idaho that have opted into the contract (now more than 80 percent of schools).[14]

Globalstar, a low Earth orbit satellite constellation for satellite phone and low-speed data communications, has proposed a service that could help to relieve some Wi-Fi congestion in anchor institutions. Globalstar has offered to provide Terrestrial Low Power Service (TLPS) over a combination of licensed and unlicensed spectrum. TLPS would enable use of Channel 14 in addition to the existing Wi-Fi channels 1, 6 and 11 operating in the 2.4 GHz band. While TLPS could be helpful to some anchor institutions, especially those that encounter congestion in the 2.4 GHz band, the precise terms and conditions under which TLPS will be made available on a retail basis are not yet known, and there are some important public interest considerations that must be taken into account when combining licensed and unlicensed spectrum. Nonetheless, Globalstar has offered to provide 20,000 access points free of charge to schools, libraries and health providers, and TLPS could offer an additional option for anchor institutions.

CAIs Can Provide Wireless Internet Access Capabilities to the Community

Community anchor institutions – notably public libraries, but also community centers, schools, and others – can also play a role in extending wireless Internet access to residents in the surrounding community who lack sufficient access. Some institutions also partner with companies to help their constituents obtain broadband at home. Libraries provide public access wireless networks, and libraries and schools are experimenting with loaning community members (students, patrons, etc.) cellular-enabled devices. Among others, public libraries in New York, Kansas City, Chicago, and Seattle have piloted loaning thousands of wireless hotspots for up to a year to patrons who do not have broadband at home and who are taking part in library programs and adult learning programs.[15]

Community anchor institutions have also played roles in developing municipal and community wireless networks. Through unused TV "white spaces," anchor institutions may be able to extend basic wireless Internet access to the wider community. The low-frequency, white space spectrum makes it possible for wireless Internet signals to extend over much greater distances – up to 10 kilometers – and penetrate more easily through buildings, vegetation, and other barriers.[16] The Gigabit Libraries Network has worked with several libraries to test the use of white space technology to provide wireless Internet access to their neighborhoods.[17] This technology is still on the cusp of success, but federal policymakers have the potential to make more white space spectrum available in the future.

Albemarle County, Virginia, school officials are in the process of installing a broadband wireless network so that students across the county's 726-square-mile area can access the Internet from wherever they are. Albemarle is creating its own wireless service because commercial companies were unwilling to make the investment to serve these rural consumers. The school system is partnering with police and fire departments. Vince Scheivert, the school district CIO, says "We're extending our network … into this broadband realm. [Students'] machines won't know the difference whether they're sitting at home or sitting in the classroom."[18]

Recommendations

To support robust, well-designed Wi-Fi and wireless broadband networks for community anchor institutions, federal policymakers can:

- Continue to provide E-rate funding that supports wireless networks and continue consulting with schools and libraries on what is working and what is not in terms of E-rate funding for Wi-Fi networks.

- Consider allowing E-rate-funded networks to provide off-hours access to local communities, e.g., through the use of white spaces and school buses with routers.

- Allocate more white space spectrum for unlicensed use by CAIs.

- Consider how privacy and security laws related to broadband networks (including Wi-Fi networks) impact CAIs, and ensure that these regulatory obligations are clear, purposeful, and not burdensome.

- Consider approving Globalstar's proposed TLPS in a manner that does not create interference to other users and operates under the right conditions to serve the needs of anchor institutions and the public interest.

- Increase the amount of unlicensed spectrum available for Wi-Fi use (e.g., sharing and use of the 5.9 GHz band).

State policymakers can:

- Consult CAIs about their wireless networking needs. If the state is acting in a procurement role for CAI wireless networks, the state should work to provide detailed RFPs that include specifications and use cases.

- Help CAIs hire independent wireless consultants that can assist with needs assessment.

- Produce or assemble due diligence-related help documents for CAIs and local procurement offices.

- Ensure that state procurement procedures and telecom policy are up to date.

- Support schools and libraries in applying for E-rate and other funding sources.

- Offer state-level funding for CAI wireless networks when federal funding is not available.

- Offer the possibility of statewide, managed wireless contracts to CAIs as one way to reduce costs and offer equal quality access across the state. Contracting with a single company for managed wireless (versus allowing contracts with several different companies) can offer the benefit of aggregate, comparable data on CAI wireless networks across the state.

Local policymakers can:

- Work with local CAIs to understand the benefits of strong wireless infrastructure.

- Include CAIs in broadband planning.

- Encourage district decision makers working in a procurement role to consult CAIs about their broadband and wireless needs, and provide detailed RFPs that include specifications and use cases.

- Assist CAIs with due diligence when selecting technology partners.

- Help CAIs to find creative funding solutions for wireless networks, such as local corporate sponsors.

Resources for Further Reading

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"Grow2Gig+: Anchors Advance Communities" is the SHLB Coalition campaign to make gigabit speeds for anchor institutions a national priority. "Connecting Anchor Institutions: A Broadband Action Plan" is a crucial component of the Grow2Gig+ campaign, which also includes an interactive website that provides a hub for discussion, updates, and information to guide these national efforts. Gigabit broadband for community anchor institutions is an attainable goal, but only if we reach together. Help us Grow2Gig+! www.shlb.org/action-plan

The **Schools, Health & Libraries Broadband (SHLB) Coalition** is a 501(c)(3) advocacy organization that supports research and public policies that promote open, affordable, high-capacity broadband connectivity for anchor institutions and their communities. Founded in 2009 in Washington, DC, the SHLB Coalition receives financial support from its non-profit and corporate members and from the Bill & Melinda Gates Foundation. For more information, visit www.shlb.org/.

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