



# Broadband Planning Study Executive Summary

City of Columbia, University of Missouri & Boone County

May 12, 2014

## Introduction

As more of our lives transition to the digital world, access to the Internet and its multitude of applications becomes increasingly more important. Where Internet access was once just a complement to our physical lives, the virtual world of the Internet has become a crucial part of what we do every day. Online applications for business, health, education, security, and entertainment have all become integrated into our daily lives. These applications and new ones continue to grow at an amazing pace.

A high-speed, reliable, broadband infrastructure is required for these applications and future ones to function properly since broadband is indeed the highway of the electronic world. The City of Columbia's understanding of the importance of next-generation broadband has developed and advanced with its recent participation along with the University of Missouri in the Google Fiber solicitation, and the "GigU" project. Since participating in this study, the City has recognized that next-generation broadband infrastructure is essential to attracting and retaining the tech-savvy residents and businesses that will drive civic and economic growth into the future.

The City of Columbia, Boone County, and The University of Missouri have commissioned this Broadband Planning Study to understand the options they have in improving current and future broadband services within their communities. With a particular focus on W&L's fiber-optic network, this Study examines potential opportunities for the City of Columbia to expand use of this network to foster next-generation broadband services for the residents, businesses, and community anchors in Boone County.

The Study's goal is to assess the current broadband environment and plan a next-generation broadband infrastructure that would meet the needs of all stakeholders in the region. The Study conducted a comprehensive needs assessment across all stakeholders to determine how the community utilizes broadband currently and how it will be used in the future. In response to these needs, the Study assesses how stakeholders' broadband needs are currently being met by broadband providers and identifies the key issues that impact the community. It also focuses on how future needs will or will not be met as broadband speeds continue to increase from new applications used by stakeholders.

The Study analyzes W&L's network in effort to understand its capabilities to address the broadband issues in the community. Based on this analysis, a comprehensive broadband expansion plan was developed for W&L's network that will enable it to provide a platform of next-generation broadband services to the community. Finally, the Study recommends the most feasible options to expand W&L's network in conjunction with key public policy tools that the City and County could implement to expand broadband in the region and develop the Columbia region into a next-generation broadband community.

## Key Broadband Issues Facing the Region

Three key broadband issues were identified that impact local stakeholders in the region:

- 1. Columbia lacks widespread availability of high-speed broadband services that are accessible by the majority of businesses and anchors in the region.*
- 2. Columbia lacks affordable high-speed broadband services that its businesses and anchors can utilize to support their needs.*
- 3. Columbia lacks widespread reliable high-speed broadband services that its businesses and anchors can leverage to support their goals*

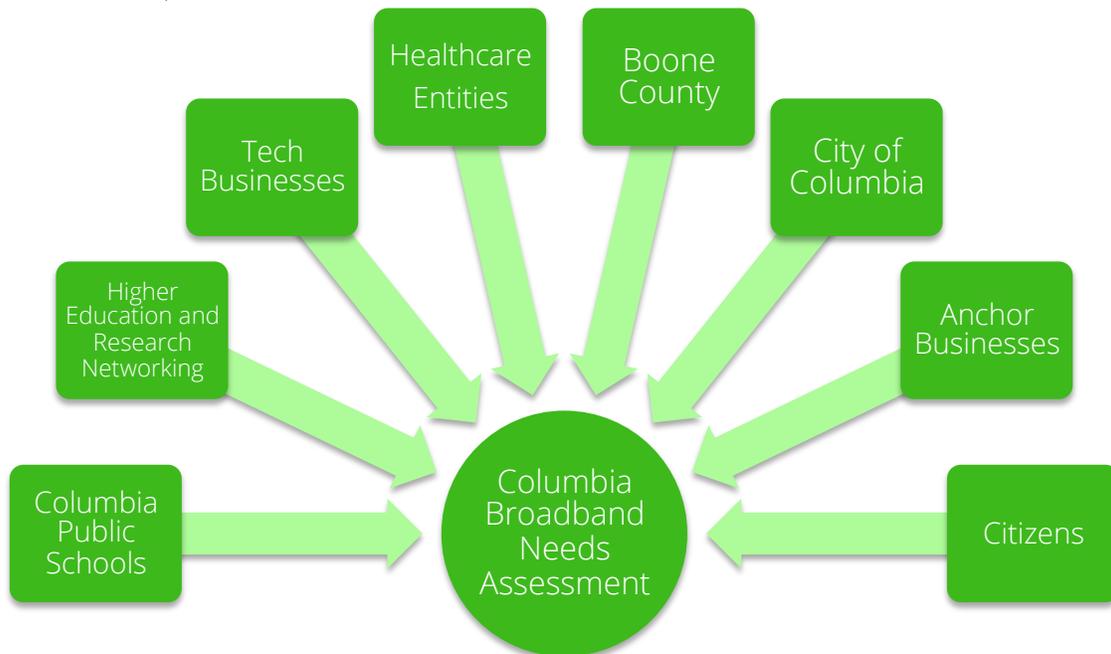
Issues one and two are intertwined. Columbia lacks significant density of fiber broadband services that are available to the community. Fiber distribution networks are beginning to replace traditional copper-based networks as providers overbuild their older infrastructure. Carrier decisions to build these networks are often tied to many factors that include capital allocation and national business plans, construction costs, density, market size, demographics, and competition. The introduction of fiber distribution networks enables greater availability and affordability of high-speed broadband services by increasing the overall density of fiber-optic infrastructure in the local area and lowers the cost of deployment. In Columbia, this Study found case-by-case deployment of fiber distribution networks being implemented by current providers, but little widespread deployment. As a result, providers build fiber to subscribers on a “one off” basis individually, which results for higher construction and access costs that are passed on to the subscriber.

There are a variety of reasons why providers are not making investments in this infrastructure. The capital cost of doing so is significant and it is important to remember that private service providers operate under corporate capital budgets and allocations, and must be able to make a reasonable rate of return on their investments in these networks. This is balanced against the fact that providers must also continue to invest in their existing networks to remain competitive and ensure they meet their customers’ requirements, otherwise they will experience high rates of customer attrition as more competitive providers offer substitute products and services.

The third key issue concerns the reliability of broadband services in Columbia. Businesses have reported severe downtime experiences on existing private networks. These reports came from businesses small and large, the largest being Carfax, who has moved its data center facilities to another City, in part because of the reliability of local broadband services. Columbia’s business community focuses heavily on redundancy of their broadband connections. Businesses reported that network diversity issues exist in Columbia with a number of the existing providers. Consistently throughout the stakeholder interviews and business surveys, respondents indicated a great need for reliability.

## Community Needs Assessment

The community needs assessment for broadband services sought input from a wide range of stakeholders in the Columbia region. It addressed each stakeholder's needs and incorporated these into a comprehensive assessment of the Columbia region's current and long-term broadband needs. The diagram below illustrates the stakeholders included in the assessment process.



In summary, the assessment found that broadband is a fundamental aspect of Columbia's long-term sustainability and growth that impacts nearly every part of the community. Columbia needs access to affordable, reliable next-generation broadband services to continue to thrive and prosper as a community. Below is a summary of stakeholder needs.

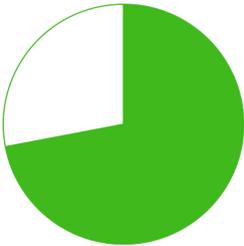
## Business & Economic Development

For Regional Economic Development, Inc. ("REDI"), it means the ability to attract and retain more businesses that rely on broadband to support their needs. REDI needs the tools to differentiate Columbia from other communities in order to attract the right companies. Affordable high-speed broadband should be a crucial aspect of that strategy and a component of REDI's economic development incentive programs. The question posed to Columbia's economic development leaders follows:

*"Will Columbia's broadband services keep pace with the growing needs of its businesses which compete in a global economy?"*

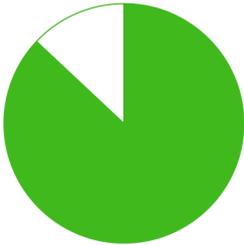
As businesses grow their use of online applications, their access to high-speed broadband becomes even more critical, regardless of their industry. Much of Columbia's business community struggles with its current broadband services and these issues will only grow as they use more online applications. Beyond the large business segment, many small and medium businesses have expressed their issues with the availability of broadband services at prices they can afford. Small and medium businesses account for roughly half of all jobs

and GDP in Boone County<sup>1</sup> and their impact is critical to overall economic growth. The information below reports some key issues reported by Columbia's business community through survey data collected in the project.



72%

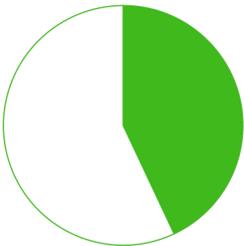
*Of Columbia businesses reported moderate, severe or total disruption of their business from Internet problems related to reliability or speed.*



87%

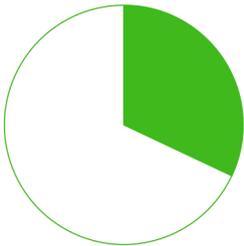
*Of Columbia businesses reported that their current Internet services are insufficient for their business needs due to reliability and speed issues.*

*Of the 87% of Columbia businesses that reported their Internet services being insufficient for their business needs:*



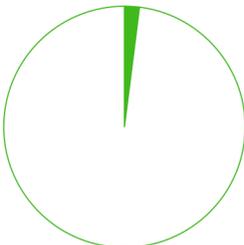
43%

*Of Columbia businesses reported that they have not upgraded their Internet services because the price is too high*



32%

*Of Columbia businesses reported that they have not upgraded their Internet services because the service is not available*



2%

*Of Columbia businesses reported that they have not upgraded their Internet services because they don't know what options are available*

<sup>1</sup> Composition of Columbia County GDP and Jobs By Establishment Size, 2011 – 2012. [www.youreconomy.org](http://www.youreconomy.org).  
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Columbia needs a solution that improves the affordability and access to business broadband services that allows them to receive high-speed, reliable, and affordable broadband connections. For new startups that emerge from the University ecosystem, it means having nearly limitless speeds at rates that small businesses can afford. Next-generation broadband will ensure that the University's technology transfer program is not impeded by local broadband access and affordability issues. For general business in Columbia, it means more access to applications and technologies that drive efficiency and competitiveness. Next-generation broadband will help to reduce the cost of doing business in Columbia and make local businesses more competitive while competing in the digital economy.

## Healthcare

Broadband is crucial for Columbia's healthcare providers that are interested in meaningfully leveraging electronic health records as many of the capabilities of health IT such as tele-health and electronic exchange of health care information require high performance broadband capability. Columbia's major hospitals currently maintain access to high-speed broadband services but outside of these organizations, few healthcare providers maintain this type of access. Doctor's offices, clinics, and imaging centers all have growing broadband needs to ensure they stay connected as their organizations transition to the digital healthcare environment. For these smaller organizations, high-speed broadband becomes a critical need to fulfill their mission and long-term success.

There are a variety of trends and applications in the health care field that drive the need for broadband infrastructure. The arrival of medical instrumentation and measurement at home will be here much sooner than many people realize. This rapidly emerging field will require substantial bandwidth and an "always on" broadband connection. Medical records billing and coding often is done from home based teleworkers which also require substantial bandwidth. Both the University of Missouri Health System and Boone Hospital use W&L fiber for connections among hospitals, clinics, and doctors' offices. Boone Hospital uses W&L fiber to connect the hospital with clinics, doctors' offices, imaging, and operations/administrative functions. There are many doctors' offices that desire better connection and would like to be on fiber for the capacity. While a few are already on gigabit connections, much better connectivity and bandwidth will be required in the near future for the bulk of Columbia's healthcare organizations.

## Education

Availability of broadband for education is critical for communities such as Columbia. As more curricula migrates to an online format and programs such as distance learning and online testing are developed and implemented, high-bandwidth and reliable broadband services become a fundamental asset for schools, libraries, and universities. Columbia's public schools currently maintain satisfactory broadband services over dedicated fiber-optic connectivity however, the question remains:

*"Will these services scale over time to meet the future demands of the community?"*

As schools utilize more and more bandwidth, scalability of their broadband services will be critical to maintain connectivity with electronic resources, other educational institutions, and students; whether they are on campus or remote. This requires not only dedicated, high-bandwidth connectivity but also symmetrical connectivity as much of the traffic transmitted by schools is upload rather than download. High-bandwidth upload traffic includes connections into online applications hosted by schools, distance learning programs, and online testing programs therefore; accessibility to symmetrical, high-bandwidth broadband service will continue to be a critical need for Columbia's schools.

Connectivity to the University of Missouri ("MU") drives demand in nearby residences, apartments, and single-family homes. Faculty and staff need the same level of connectivity off-campus as they have on-campus. MU sees a need for more widely available broadband to facilitate connections with businesses to interact with researchers and students. These relationships result in important technology transfer from MU into the commercial world. Stephens College is also experiencing significant broadband growth with bandwidth doubling every year. Columbia Public Schools have significant future needs for bandwidth for online testing and blended learning applications. Best practices in education have identified bandwidth targets for which CPS's estimated need is as follows:

- Internet Service Provider connection to provide 20 Gbps capacity per 1000 students and staff for the 2017-18 school year
- Wide Area Network (internal CPS) to provide at least 10 Gbps per 1000 students and staff for the 2017-18 school year

Consistent with best practices in education, CPS is targeting/reaching a 2:1 ratio of students to devices or better. Currently there are 10,000 computing devices of which 5,500 are Apple iPads. Provisioning of computing devices has highlighted the lack of adequate broadband services in different residential communities as there are students who have marginal to no Internet connectivity at home.

## City and County Initiatives

At the City and County level there are many long-term needs that can be met through the development of widespread high-speed broadband. The need for a regional community broadband network will create a high-speed, redundant and scalable network environment that will support further efficiencies and functions in provisioning of municipal services that rely on electronic resources. As more City and County operations are conducted electronically, the network will become increasingly essential to meet the requirements of civic applications. Additionally, this new community broadband network platform will potentially facilitate greater collaboration between local government entities within the Boone County region. These organizations will potentially benefit in the following ways:

- New opportunities to collaborate with local government organizations across a common communications platform
- Gain economies of scale by sharing critical needs across multiple local government organizations including Internet, voice services, backup services, and others
- Gain economies of scale by sharing municipal applications across multiple local government organizations including GIS, expanded public safety dispatch/records management systems, and web applications
- Gain economies of scale and promote enhanced public safety by development of shared disaster recovery and business continuity programs utilizing common infrastructure
- Support future deployments for integrated and smart metering across electric, water, and sewer utilities
- Reduce taxpayer spending across all participating public organizations in the Boone County region

## Outreach to Citizens and Businesses

An integrated community broadband network would allow the City to provide new communication channels to citizens and businesses in the City. Complementing a backbone network with wireless access-points, Columbia could enable public wireless ("public WiFi") selectively to reach specific areas of the community. These could be used to disseminate information to the community, provide local advertising for businesses, and provide greater availability of e-Government services. A broadband network would also allow broad distribution of civic content including online information, emergency response, streaming video, stored video, and Go-Live broadcasting across multiple locations in the City in near-real time. This would allow Columbia to deliver content to citizens and businesses more efficiently through its own internal infrastructure.

## Available Options to Columbia

The City of Columbia has many options available to promote the expansion of next-generation broadband in the region. The three options for the City of Columbia to consider in expanding the W&L network include the following:

- Continue the dark fiber leasing program
- Expand the dark fiber leasing program with last-mile deployment
- Develop an open-access wholesale utility

### *Option 1: Continue the dark fiber leasing program*

Analysis of the W&L network indicates that there is a shortage of fiber capacity and that this shortage will limit W&L's capability to expand its dark fiber leasing program without significant costs to upgrade network capacity. Making these investments will provide more fiber for service providers however; this business model limits the overall impact the W&L network has on expanding broadband availability in the region. Fiber leased by service providers enables only a few additional broadband connections to subscribers and is not a strategy that will result in a significant improvement in overall availability of local broadband infrastructure.

### *Option 2: Expand the dark fiber leasing program with last-mile deployment*

To address the lack of local broadband infrastructure, the W&L network could be expanded to provide last-mile dark fiber connections to service providers. In this option, the City would build new fiber connections to each subscriber in range of the W&L network based on service provider needs. Doing so would improve the availability of local broadband infrastructure in Columbia; enabling service providers to lease dark fiber to each customer premise instead of just within the Columbia middle-mile network. Option 2 would require the same upgrades as Option 1 because new fiber capacity in the middle-mile network would be required to service last-mile connections. Although this option would improve the overall availability of local broadband infrastructure in Columbia, it would not improve the competitive environment significantly. Subscribers would continue to pay high prices for broadband and have access to the same options previously available.

### *Option 3: Develop an open-access network*

An open-access network would enable the City to transform the W&L network into a broadband platform that delivers connections to service providers over a lit fiber network. An open-access network would alleviate the need for the City to make investments to upgrade the network as described in Option 1 however; last-mile fiber investments would still be required as described in Option 2. This option would also require new investment in equipment and management to administer the open-access network. Implementing an open-access network would provide the greatest impact to increasing broadband availability and affordability in the region for residents, businesses, and community anchors. It could significantly lower broadband costs and increase competition in the market. It would also enable the W&L network to become a platform for long-term development of broadband, energy, public safety, and e-Government applications.

## Recommended Option for Columbia

The City of Columbia's broadband strategy should create the greatest impact to expand the availability and affordability of next-generation broadband for the benefit of the community. To do so, Columbia's best option is to implement an open-access network that will meet the requirements of the community and the City itself. Through Implementation of an open-access network, Columbia will achieve its foundational goals of expanding broadband in the community, including:

### *1. Utilization of public-private partnerships and assets to reduce the digital divide*

Columbia's network already interconnects with multiple service providers who use the City's dark fiber assets. An open-access network will allow Columbia to expand public-private partnerships with these providers to make greater use of the network and extend service providers' reach into more of the community.

### *2. Support for an open-access architecture*

The network will enable multiple service providers to utilize Columbia's network on a nondiscriminatory basis; ensuring the City remains a neutral party to all service providers. Open-access will promote competition by allowing users to access multiple providers over Columbia's network; increasing choice and creating greater price competition among service providers.

### *3. Establishment of a network that will meet the community's growing needs*

An open-access network will ensure that users have access to scalable bandwidth, including 1 Gigabit and 10 Gigabit services. Columbia's investment in network electronics will provide a platform to deliver reliable, high-speed broadband services to customers across the residential, business, and community anchor segments.

### *4. Compliance with Missouri's state and local regulations*

Implementing an open-access network will ensure that Columbia maintains compliance with Missouri State statutes regarding municipal broadband. Columbia will provide open access wholesale services to telecommunications providers on a nondiscriminatory, competitively neutral, basis and lease these services to telecommunications providers at a price that at a minimum covers Columbia's cost of providing the services.

### *5. Establishment of a platform to meet long-term community needs*

A lit network will enable Columbia to immediately begin improving broadband access within the community. It will first be deployed into the business districts to provide a new source of broadband to Columbia's business community. Long-term, the network has the capabilities to serve the residential community through deployment of a fiber-to-the-home architecture. Further, the network will become a strategic community-wide asset that can be used as a foundation for additional municipal and civic benefits including potential smart grid projects, public safety applications, educational benefits, and e-Government programs.

## Network Overview

The diagram below shows a conceptual plan for the Columbia open-access network; building on the foundation of W&L's existing fiber infrastructure. Orange lines below depict new fiber connections into Columbiab's key business districts, enabling next-generation broadband to buildings and tenants throughout the City. Its open-access architecture would allow multiple service providers to interconnect and deliver a variety of broadband services to businesses, anchors, and potentially residents at lower cost and higher quality than is currently available today. Although residential services are not planned currently, the network would be capable of serving these needs through implementation of fiber-to-the-home. It would also integrate with the City's and W&L's long-term needs supporting future smart grid applications, water and sewer metering integration, e-Government services, and public safety applications. It would become a "Smart Community" platform for the Columbia region to reduce cost, improve services and develop new capabilities across multiple community functions.



## Next Steps

The following next steps define key action items that the City of Columbia and Boone County should undertake to expand broadband services in the Columbia Region.

### 1. *Implement Public Policy Tools To Reduce Costs of Broadband Infrastructure*

- Develop comprehensive broadband standards that can be incorporated into City or County land development code promoting lower cost of broadband infrastructure construction in conjunction with City and County capital projects.
- Streamline the broadband permitting process within public rights of way to ensure broadband providers to not face obstacles to building infrastructure. Evaluate and reduce permitting fees to lower broadband provider construction costs in the City and County.
- Develop joint trenching agreements with utility companies and broadband providers to reduce the cost of broadband infrastructure installation.
- Educate and partner with local developers to ensure new buildings or retrofits are equipped with basic broadband infrastructure to reach the property line.

### 2. *Develop a Broadband Utility Business Plan*

The first step in implementing an open-access network will be the development of a Broadband Utility Business Plan for the W&L network. The Business Plan will outline all capital and operating costs of building out and operating the W&L network as well as potential take-rates, customer growth, and system revenues. In addition, the business planning process will establish the open-access system architecture and services which can be delivered across the network. Technical, operational, and marketing plans will also be developed at this time. A detailed financial plan should also be vetted within the Business Plan ensuring the network is sustainable over the long-term.

Extensive service provider outreach must also be conducted during the Business Planning process as it will be important to form strategic partnerships for use of the open-access network. Network architecture, rate schedules, service level agreements, and other contractual documents should all be developed collaboratively with these potential private sector partners.