

COL003



An Update to the Comprehensive
Strategic Telecommunication Plan
(2002) for Columbus, Indiana

Final | December 2005 | Version 1.1

Update of Strategic Telecommunication Plan

CONFIDENTIAL & PROPRIETARY

Prepared by:

Brent Engle, Jim Goldman, Matt Ryan

InfoComm Systems, Inc.
3000 Kent Avenue
West Lafayette, IN 47906
(888) 734-6888
www.infocommsystems.net





Table of Contents.

REVISION HISTORY..... 3

EXECUTIVE SUMMARY..... 4

SECTION 1. INTRODUCTION..... 8

SECTION 2. CURRENT STATE REASSESSMENT..... 9

 SECTION 2.1. INTERNAL ANALYSIS..... 10

 SECTION 2.2. EXTERNAL ANALYSIS..... 11

 SECTION 2.3. COLUMBUS AREA TELECOMMUNICATION MARKET..... 18

 SECTION 2.4. SWOT ANALYSIS..... 29

SECTION 3. MULTI-PHASE STRATEGIC NETWORK DESIGN..... 32

 SECTION 3.1. CREATING “WORLD CLASS”..... 32

 SECTION 3.2. A PHASED APPROACH TO DEPLOYMENT..... 33

 SECTION 3.3. MIGRATING TOWARD “WORLD CLASS”..... 50

SECTION 4. CONCLUSION & NEXT STEPS..... 53

APPENDIX A. COLUMBUS AREA TOWERS..... 54

APPENDIX B. COLUMBUS COMMUNITY CONSTITUENTS..... 56

APPENDIX C. TECHNICAL ADVISORY TASK FORCE MEMBERSHIP..... 57

APPENDIX D. PUBLIC RIGHTS-OF-WAY RESOLUTION EXAMPLES..... 58

APPENDIX E. WIRELESS, RECOMMENDED READING..... 61

APPENDIX F. MARKETING Q & A..... 65



Revision History.

Version 1.0a. 09/20/2005. *R.Draft*. Delivered to sub-committee of Mayor's Technical Task Force for initial review and feedback.

Version 1.0b. 09/27/2005. *Proposed Draft*. Delivered to Mayor's Technical Task Force for review and feedback incorporating all requested sub-committee changes.

Version 1.0. 10/06/2005. *Final Draft*. Official delivery of deliverable to Mayor's Technical Task Force incorporating all requested changes.

Version 1.1. 12/08/2005. *Final Draft (revised)*. Incorporation of new route design and requested changes from the Mayor's Technical Task Force.

Last Updated: Wednesday, December 07, 2005.



Executive Summary.

Introduction.

In April 2002, InfoComm Systems (InfoComm) delivered to the Columbus Economic Development Board (Columbus) a telecommunications strategic plan (Strategic Plan) including current state assessment, desired state assessment, gap analysis, migration plan, and specific recommended next steps. The overall goal of the strategic plan was, and still is today, the achievement of a “world class” advanced telecommunications infrastructure.

While progress has been made in improving the telecommunications infrastructure in Columbus, the vision of a “world class” telecommunications infrastructure remains largely unfulfilled.

With broadband availability becoming paramount in attracting and retaining businesses, cities of all sizes understand that these services are no longer a luxury, but a necessity to remain competitive and therefore attractive. Columbus is no exception. The Mayor’s Technical Advisory Task Force and the Columbus community at large share a view that a “world class” telecommunication environment is a requirement for stimulating and accelerating new economic development and retaining core businesses that have been a cornerstone of the community for decades.

Aside from the clear economic development and commerce opportunities that come with a “world class” telecommunication environment, the following are examples of technical applications that could best utilize such an environment in Columbus.

- **Converged Service Delivery.** (e.g. phone/voice, television/video, Internet data)
- **Private Network Service.** (e.g. private data, phone, and video conferencing networks)
- **IP-based Content Delivery.** (e.g. television)
- **Telecommuting.** (e.g. remote students and employees)
- **Telemedicine.** (e.g. pathology, radiology, and patient consultation)
- **Community Information Exchange.** (e.g. resource for local tax payment, news, activities, and visitor information)
- **Public Safety/Homeland Security.** (e.g. real time mobile voice, National Crime Information Center images and data)
- **Private Security Systems.** (e.g. security cameras)
- **Utility Tracking Systems.** (e.g. SCADA)



Current State Reassessment.

The purpose of this current state reassessment is to refine and develop a clearer understanding of the current status of telecommunication related assets as well as constituents, demands, and requirements before proceeding with further analysis and strategic network design for the Columbus region. The following list provides a high level summary of new findings discovered during the reassessment process:

- Telecommunication service providers within the community continue to update their infrastructure and service portfolio within the community at a pace that is not on par with all telecommunication consumers within the community;
- Telecommunication consumer needs for advanced telecommunication infrastructure and services within the Columbus area continue to increase; and
- The community has assets that it is not yet fully leveraging (conduit/fiber optics, tower location, and potential partners).

After completing a reassessment of the current state of telecommunication within the Columbus area, it is the continued opinion of the CONSULTANT that while progress has been made in improving telecommunication within the Columbus area, the vision of a “world class” telecommunications environment remains for the most part unfulfilled.

Multi-Phase Strategic Network Design.

The following is a summarized list of five recommended initiatives (phases) in an overall effort to revitalize the Columbus telecommunication environment into one that is characteristic of “world class” stature. These initiatives are referred to herein collectively as “eCOLUMBUS”.

1. Greater Columbus Conduit System (Section 3.2.1)
2. Wireless Columbus (Section 3.2.2)
3. Fiber-to-the-Curb (Commercial) (Section 3.2.3)
4. Fiber-to-the-Home (Residential) (Section 3.2.4)
5. Inter-Community Fiber (Section 3.2.5)

When existing and the eCOLUMBUS initiatives are cross-referenced against the vision the Mayor’s Technical Advisory Task Force has chosen to define their requirements for “world class”, it becomes clear that not only are the eCOLUMBUS initiatives realistic, but when they are coupled with existing progress to date, Columbus is well on its way to becoming “world class”. The table below details how each proposed initiative aligns with Technical Advisory Task Force requirements for “world class”.



	Greater Columbus Conduit System	Wireless Columbus	Fiber-to-the-Curb	Fiber-to-the-Home	Inter-Community Fiber
Reasonably priced voice, video, and data services	X	n/a	X	X	X
Readily available network services (connected within hours)	X	X	X	X	n/a
Redundant high bandwidth telecommunication network services	X	X	X	X	X
Highly reliable telecommunication infrastructure with no single points of failure	X	X	X	X	X
Multiple gateway options for connecting the Columbus area to other communities	n/a	n/a	n/a	n/a	X

Columbus “World Class” Initiatives. (n/a=not applicable)

The following table summarizes the high level costs, where available, associated with each eCOLUMBUS initiative. Additional details regarding cost categories are available in Section 3.2 of this deliverable.

Initiative	Estimated Cost
PHASE 1: Greater Columbus Conduit System	\$511,400.00
PHASE 2: Wireless Columbus	< \$39,700.00 (for 16 downtown locations)
PHASE 3: Fiber-to-the-Curb (Commercial)	TBD
PHASE 4: Fiber-to-the-Home (Residential)	TBD
PHASE 5: Inter-Community Fiber	TBD

Estimated Cost of eCOLUMBUS Initiatives.

Conclusion.

Through a careful reexamination of the Columbus telecommunication environment, the findings of this report yield that while progress has been made in improving the telecommunications infrastructure in the Columbus area, the vision of a “world-class” telecommunication infrastructure remains largely unfulfilled. The only way to move forward toward a “world class”



telecommunication environment is to identify realistic goals for achieving “world class” and executing those goals according to a carefully detailed plan.

Through telecommunication service provider partners and community constituents represented by the Mayor and the Technical Advisory Task Force, Columbus is poised for forward progress. It is the goal of this deliverable to serve as the vehicle or spring board that will move planning efforts toward execution and implementation.

It will be through further development and careful execution that Columbus will enjoy success with each initiative. It is recommended that each initiative detailed herein be set aside and developed into an inclusive initiative that the community can support and reap the benefits of appropriately. Only then will Columbus achieve the “world class” status for its telecommunications infrastructure commensurate with its other “world class” attributes.



Section 1. Introduction.

In April 2002, InfoComm Systems (CONSULTANT) delivered to the Columbus Economic Development Board (Columbus) a telecommunications strategic plan (Strategic Plan) including current state assessment, desired state assessment, gap analysis, migration plan, and specific recommended next steps. The overall goal of the strategic plan was, and still is today, the achievement of a “world class” advanced telecommunications infrastructure.

While progress has been made in improving the telecommunication infrastructure in Columbus, the vision of a “world class” telecommunication infrastructure remains largely unfulfilled.

On May 17, 2005, Jim Goldman of InfoComm Systems offered to spend a day in Columbus and meet with leaders from Columbus including a newly appointed Mayor’s Technical Advisory Task Force. This document is the output of an executed proposal submitted by InfoComm Systems at the request of Mayor Fred Armstrong, Brooke Tuttle from the Columbus Economic Development Board, and Tim Tarnowski, CIO of Columbus Regional Hospital.

Key findings of this deliverable will encompass the following:

- Updated information regarding the current state of telecommunication within Columbus;
- A strengths, weaknesses, opportunities, and threats analysis as related to telecommunication in Columbus;
- An illustrative plan detailing an overall vision for “world class” telecommunication in Columbus; and
- A clear, detailed, and phased plan for how such a “world class” telecommunication implementation should proceed.

Section 2. Current State Reassessment.

The purpose of this current state reassessment is to refine and develop a clearer understanding of the current status of telecommunication related assets as well as constituents, demands, and requirements before proceeding with further analysis and strategic network design for the Columbus region. Furthermore this reassessment includes a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis whose output will aid in focusing attention on proper initiatives for realizing a “world class” telecommunication environment.

Figure 2.1 illustrates a roadmap for the current state reassessment. The internal analysis examines the factors affecting the overall organizational effort to revitalize the Columbus area telecommunication environment, while the external analysis provides insight into outside factors affecting the telecommunication environment itself. Then both the internal and external analyses put in proper context the current telecommunication market for the Columbus area. Finally, providing a summary of all of this information is a SWOT analysis that creates a lens that, from this point forward, will be used to formulate a revitalized telecommunication environment for the Columbus area.

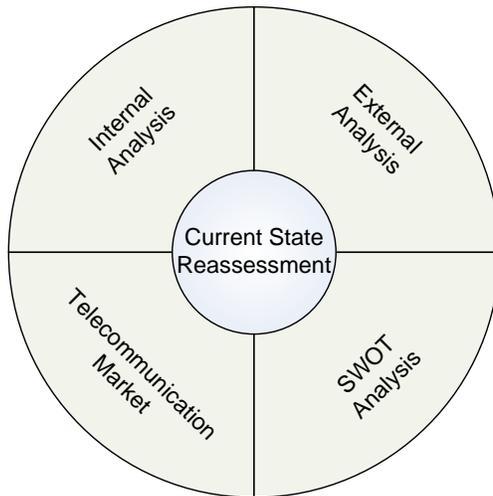


Figure 2.1. Roadmap for Current State Reassessment.

After completing a reassessment of the current state of telecommunication within the Columbus area, it is the continued opinion of the CONSULTANT that while progress has been made in improving telecommunication within the Columbus area, the vision of a “world class” telecommunication environment remains largely unfulfilled.



Section 2.1. Internal Analysis.

The focus of an internal analysis for Columbus, with respect to their pursuit of a “world class” telecommunication infrastructure for the Columbus area, is to provide a brief examination of the vision for, as well as the strengths and weaknesses within, the Columbus telecommunication environment.

Section 2.1.1. Mission, Vision, and Goals.

The goal of the 2002 Telecommunication Strategic Plan for Columbus was, and remains, the achievement of a “world class” telecommunication infrastructure for the Columbus area. Columbus, through the Mayor’s Technical Advisory Task Force, has chosen to define their vision of “world class” with the following requirements:¹

- Reasonably priced voice, video, and data services;
- Readily available network services (connected within hours);
- Redundant high bandwidth telecommunication network services;
- Highly reliable telecommunication infrastructure with no single points of failure; and
- Multiple gateway options for connecting the Columbus area to other communities.

Furthermore, both the Mayor’s Technical Advisory Task Force and the Connected Community Partnership (CCP) are grounded in the following guiding principles pursuant to forward progress:

- Discussions are grounded in a concern what is in the best interests of the community – all inclusive;
- Open and honest discussion;
- Seek “win-win” outcomes;
- Investigate cooperation and/or competition with local telecommunications providers when seeking a solution; and
- Help accelerate the creation of a “world class” telecommunication environment for the Columbus area.

Section 2.1.2. Strengths.

The most significant current strength for Columbus is its continued commitment to creating a “world class” telecommunication environment. Columbus, through efforts from the Mayor and his Technical Advisory Task Force, as well as the

¹ Referenced from the 2002 Telecommunications Strategic Plan for Columbus, Indiana, authored by InfoComm Systems, Inc.



Connected Community Partnership and the Bartholomew County Telecommunications Commission, is committed to creating an exemplary telecommunication environment within Columbus.

With the Mayor's full support, the Technical Advisory Task Force is in the position to make policy recommendations that will stimulate telecommunication growth and opportunity within the Columbus area. The Mayor's Technical Advisory Task Force, and the Columbus community at large, views a "world class" telecommunication environment as a requirement for stimulating new economic development and retaining core businesses that have been a cornerstone of the community for decades.

In addition to community support and an active local government, Columbus offers the following strengths:

- Well positioned in proximity to robust Internet connectivity in Indianapolis; and
- Educational and business resources that continue to donate their time and expertise to revitalizing telecommunication throughout the Columbus region.

Section 2.1.3. Weaknesses.

While it is clear that Columbus is positioning itself to become a leader with respect to telecommunication infrastructure and services for all its constituents, efforts could be limited by the following:

- All municipal bodies are limited in some fashion or another by budgets and ready availability of funding;
- Incumbent Local Exchange Carriers (such as SBC) could be potentially limited by the inability to justify continued substantial investment; and
- Obtaining buy-in at the community level for investment in the revitalization of the Columbus telecommunication market.

Section 2.2. External Analysis.

It is important for Columbus to consider its external environment. Factors such as political, legal, government, technological, economic, market/competitive, as well as social/demographic factors interact with one another and together will influence the development of a "world class" telecommunication environment for the Columbus area.



Section 2.2.1. Political/Legal/Government Factors.

In order to ensure equal access to basic telephone service for all Americans, the Federal Communications Commission (FCC) and state Utility Regulatory Commissions (URC) established territories for individual phone companies. Within each of these territories a single phone company was responsible and subsidized for providing universal access to all residents requesting such a service. In Indiana, each of these companies was registered with the Indiana Utility Regulatory Commission (IURC) and became known as the Incumbent Local Exchange Carrier (ILEC) for their assigned territories.

Until 1996 this designation basically established monopolies within each territory. Those phone companies wishing to compete with the ILEC in a given territory were required to register with the IURC as a Competitive Local Exchange Carrier (CLEC) and were given the ability to build their own phone network. The capital intensity of such a proposition was so high that CLECs were uncommon. However, the Telecommunications Act of 1996 (TA96) established regulations that mandated ILECs to open portions of their networks to CLECs at discounted rates established by state URCs. This was done by the FCC in hopes that competition would drive down prices.

During the late 1990s, CLECs become extremely prevalent. Many CLEC business plans focused solely on using ILEC infrastructure to offer the exact same service as the ILEC at an insignificantly lower price. By the end of the 1990s most CLECs failed to make it on the thin margins received solely from offering phone service. However, at about the same time, Internet technology and demand was increasing exponentially. With the development of Digital Subscriber Lines (DSL) and increased utilization of point-to-point T-1s, CLECs finally had the potential to increase their margins. They used the ILECs network to reach the customer (through DSL or T-1) and then their own Internet Service Provider (ISP) to reach the Internet. With enough customers, quantities of scale enabled several CLECs to operate successful businesses.

Most recently, the FCC decided, during its triennial review of TA96, that phone companies were no longer required to lease their lines to competitive providers at discounted rates established by state URCs. Additionally, any new fiber optic infrastructure placed in the ground was also protected.

During this lengthy battle between the ILECs and the CLECs, technology enabled another type of competitor to enter the market. This competitor is unregulated in the State of Indiana and is known as a Competitive Access Provider (CAP). CAPs are companies offering unbiased access to service providers using newer unregulated technology.



With broadband availability becoming paramount in attracting and retaining businesses, cities of all sizes understand that these services are no longer a luxury, but a necessity to remain competitive and therefore attractive. Where there has been an unfulfilled gap between the community's telecommunication requirements and the infrastructure and services offered by telecommunication providers, communities (especially small and rural communities) are starting to leverage their resources and access to funding to improve telecommunication within their own community – very similar to rural electrification in the late 1800's. In many cases, municipalities have viewed telecommunication as essentially the "new utility."

This new phenomenon is not without controversy, however. In certain cases, providers view the community competing in the free market as anti-competitive as they have unfair advantages to tax abatements and resources off-limits to private companies. Ultimately, it will be up to the courts to decide and, as recently as 2005, the Indiana General Assembly struck down HB 1148, a bill that strived to make competition within the broadband market by a community affiliated entity unlawful.

Section 2.2.2. Technological Factors.

Telecommunication technology factors are broken into two significant categories, infrastructure and services. Infrastructure is the physical medium by which data is transmitted. Infrastructure is characterized by both the material it is constructed from and its data carrying capacity or bandwidth. Infrastructure is an undifferentiated product displaying commodity characteristics where price is directly determined by cost. Services, on the other hand, are the functional uses of data as information. Services are characterized by their general category of use (voice, video, or data); however, there is significant overlap. Services are highly differentiated where price is determined not only by cost but also by features, quality, and reliability.

Historically, infrastructure and services have been undeniably linked. Cable television was transmitted over the "cable" wire and telephone service was transmitted over the "phone" wire. Additionally, services and their companies have been undeniably linked. Cable television was provided by the "cable" company and telephone service was provided by the "phone" company. Technological innovation, especially the Internet, has broken every one of these links.

The rise of the Internet has significantly changed the way we view infrastructure and services. The basis for the Internet revolves around sharing digitized data with anyone in the world. In order to do so, common ways of packaging data have emerged so that the transmitting equipment knows where and how to send the data and the receiving equipment knows how to communicate the data as



information. Understanding and applying these standards, any network (infrastructure and equipment) can transmit and receive data from any source (phone, TV broadcast, web page, etc.) as long as the data from the source is digitized in compliance with the standards.

Focusing first on services, this separation has led to the race to develop ways in which traditional services can be transmitted in newer more cost effective ways. One of the major focuses at present is Voice over Internet Protocol (VOIP). Due to the regulations placed on traditional phone services and on the traditional phone networks, technologists have been working to transmit phone calls as Internet Protocol (IP) data streams. This technology allows phone calls to traverse private and public IP capable networks effectively bypassing the majority of the private phone networks significantly saving costs. This technology is also allowing most cable companies to enter the telephone business.

Moving on to the infrastructure aspect, the separation of infrastructure and services has led to the race to develop the highest capacity, most cost effective medium over which to transmit all data. There are currently several options vying for market share in the infrastructure world. These include copper, coaxial, power lines, the atmosphere that all wireless transmission utilizes, and fiber optics. Almost all of these technologies will have a place in different portions of the networks of the future. However, fiber optics is proving to be the most reliable, highest capacity, and most future proof technology of them all. As such, even the phone companies are scrambling to deploy fiber optics, as can be seen in the quote that follows from Standard & Poor's 2004 analysis of the telecommunication industry.²

"In a move that began to pave the way for virtually limitless bandwidth for home and business Internet users, three of the nation's largest telecom service operators, Verizon, BellSouth, and SBC Communications, agreed in May 2003 on a set of common technical specifications and standards for building fiber-to-the-premises (FTTP). FTTP utilizes fiber optic connections, instead of copper wire, directly into homes and businesses to enable a broad array of voice, data, and video applications.

In the fourth quarter of 2003, Verizon completed the selection of equipment manufacturers and suppliers for its FTTP project. In June 2004, the company confirmed that it is on track to reach one million homes with its FTTP builds in nine states and 100 wire centers by the end of 2004. Fellow RBOC SBC announced in June that it might spend up to \$6 billion over the next five years to push fiber for delivery of IP-based digital TV, super-high-speed broadband, and VoIP services to 300- to 500-home nodes.

² Bensinger, Ari. Standard & Poors. "Industry Surveys Communications Equipment." July 31, 2003. Pg. 5.



The transition to bandwidth-rich FTTP will allow the Bells to bundle video along with voice and high-speed Internet services to better compete with the cable and satellite operators. The eventual launch of video will likely include competitive enhanced services such as video-on-demand (VOD) and high-definition television (HDTV). The FTTP initiative should eventually benefit the vendors that focus on fiber cable and hardware, optical components, HDTV hardware and software management, and personal recording set-top boxes.”

Section 2.2.3. Economic Factors.

As money becomes tighter, competition accelerates, and the economy expands globally, the benefits of broadband become increasingly significant to gaining a competitive advantage. According to New Age Media in London,³

“Broadband is helping businesses to recover 52 days a year in lost productivity, according to research conducted by cable company NTL. In a nationwide survey, a high-speed Internet connection was found to save workers more than 90 minutes a day. Time and making money were cited as the key benefits of broadband, and two-thirds said it improved their ability to communicate with customers.”

Time and making money being broadband's key benefits mean that productivity is not directly related to having or not having broadband. Instead, according to the International Telecommunication Union (ITU),⁴

“The level (or degree of sophistication) of information transportation is positively correlated to the level of productivity. Any action to increase the level (or degree of sophistication) of information transportation or to eliminate those inefficiencies serve to increase the productivity.”

Knowing that an increase in information transfer, in other words an increase in bandwidth available through broadband connections, has a direct impact on productive capacity, it is hard to believe the following data obtained from the Wall Street Journal:⁵

“Despite making significant headway with tens of billions of dollars in investment and several recent deregulatory moves, America still lags far

³ Net 4 Nowt. “Broadband Saves Workers 90 Minutes a Day.”

http://www.net4nowt.com/isp_news/news_article.asp?News_ID=2071. Accessed: 02/27/2005.

⁴ CENIC. One Gigabit or Bust Initiative. <http://www.cenic.org/gb/pubs/gartner/report/economicOpp.htm>. Accessed: 09/01/2005.

⁵ The ITU study is cited in Yochi J. Dreazen, “What’s Slowing Us Down,” Wall Street Journal, Oct. 13, 2003, R4



behind several other countries in the effort to create a broadband economy -- a goal that many believe is critical to the health of the communications and entertainment industries, and the U.S. economy as a whole. A recent study from the United Nations communications agency, the International Telecommunications Union, found that South Korea leads the world in numbers of high-speed Internet connections per capita, with 21.3 broadband subscribers per 100 inhabitants. Hong Kong was second, with a per-capita rate of 14.9, and Canada third, with 11.2. The U.S. ranked a distant 11th, with a per-capita rate of just 6.9."

Additionally, according to the 2003 Indiana Broadband Summit, 3 in every 10 Indiana residents have broadband access at home or work.

Section 2.2.4. Market/Competitive Factors.

Generally speaking, competition in the telecommunication industry will intensify in the coming years for a number of reasons. First, there is an increasing willingness by consumers to adopt new technologies. Today, the majority of adults use both a mobile phone and the Internet, and the adoption of intermodal forms of communications is becoming increasingly widespread across the population. Even children are using intermodal services. A survey of children's use of computers and the Internet completed by the U.S. Department of Education in 2001 shows that 31 percent of five-to-seven year olds use the Internet, and 11 percent use email or instant messaging. Of eight-to-ten year olds, more than half use the Internet and 27 percent use email or instant messaging. For a growing number of children, intermodal communications is commonplace. With each passing year, the population becomes more oriented toward intermodal communications.

Second, the deployment of new technologies will continue to drive change throughout the industry. For example:

- VoIP, with substantially lower prices and more features than traditional phone service, will be available to nearly 60 percent of households within the next two years.
- Mobile wireless providers are making substantial investments in their networks to increase the speed of transmission, spurring additional competition for wireless messaging. Moreover, the capabilities of mobile phones continue to expand, creating additional benefits to consumers and additional reasons to substitute mobile services for traditional landline services.
- Telecommunication equipment manufacturers are developing hybrid cellular-Wi-Fi phones that can switch between mobile wireless and Wi-Fi networks. This new capability will enable more businesses that have



Wi-Fi networks in their buildings or on their campuses to reduce their use of traditional wirelines.

- Standards for WiMax, which will extend the reach of high-speed stationary wireless service by miles, are under development. WiMax has the potential of significantly increasing competition for broadband services.

Third, the integration of two or more intermodal services is increasing competition. The ability to attach voicemails to email messages, the “do not disturb” capability, and the ability to forward calls to mobile or wireline phones, are examples of integrated voice and Internet services offered with VoIP. These services provide consumers with greater flexibility in managing their communications and customizing their phone services to meet their individual needs. The hybrid cellular-Wi-Fi phones will provide users with the convenience of mobility and the cost savings of VoIP delivered over wireless LANs.

Because integrated services increase the value of services for consumers and extend the range of services over which carriers compete, the competitive effects of intermodal service integration are greater than the effects of an individual service.

Fourth, wireline, wireless and cable companies have invested, and are continuing to invest, tens of billions of dollars in their networks to expand capacity and provide new, innovative services to businesses and consumers. These investments include services outside of carriers’ traditional offerings as the companies vie for a larger share of the consumer’s wallet. For example, SBC now offers service packages in San Francisco, for example, that include local, long distance, broadband and cable TV service, which compete with similar packages offered by cable companies.

These dynamic forces will continue to drive change and increase competition in the telecommunication industry into the foreseeable future. The rapid expansion of intermodal services was not foreseen at the time that the Telecommunications Act was passed. In the same way, it is almost certain that changes in the industry will go well beyond what we can imagine today.

Therefore, if Columbus is to achieve its goal of a “world class” telecommunication environment, it is important that the City’s infrastructure support next-generation services. Beyond the wired infrastructure however, a robust wireless presence is also important. This will stimulate the use of intermodal communications as well as provide service options that will lead to competitive pricing.



Section 2.2.5. Social/Demographic Factors.

For obvious economic reasons rooted in profitability based on a give take rate, telecommunication providers must invest differently in larger cities than in smaller communities and rural areas. The availability of infrastructure and competition for service delivery in larger more metropolitan areas creates an environment where robust telecommunication services are available at reasonable prices. Smaller communities have traditionally lagged behind in this area, creating what's known as the "Digital Divide." The "Digital Divide" separates the have and the have-nots, with respect to those with access to telecommunication infrastructure and services, and affects those of low income as well as those living outside urban areas.

In many cases, without government subsidization or a local government effort to get services to the populace, smaller communities have continued to lag farther and farther behind in service availability. This can be not only a hindrance to economic development, but in some cases can cause existing businesses to relocate to more attractive markets where such telecommunication options are available.

Section 2.3. Columbus Area Telecommunication Market.

In a general sense, the aforementioned external factors of the overall market will all have an impact on the telecommunication environment in the Columbus area. However, this section outlines factors which pertain exclusively to the telecommunication market within Columbus. Only after a careful examination of both internal factors (Section 2.1) and the external factors (Section 2.2) affecting Columbus, as well as the updated findings documented in this section, will a true understanding of the current state of telecommunication within the Columbus area will be attainable.

The findings in this section pertain to both telecommunication providers and consumers. The information herein provides an update of the findings discussed in the 2002 Telecommunication Strategic Plan document authored by InfoComm Systems. These latest findings were gathered not only through primary and secondary research, but also through interviews with members of the Mayor's Advisory Task Force as well as with various telecommunication providers and consumers within the Columbus area.



Section 2.3.1. Telecommunication Providers.

Section 2.3.1.1. Incumbent.

SBC is the Incumbent Local Exchange Carrier (ILEC) for Columbus and the surrounding areas. Beyond being the primary provider of traditional telephone service in Columbus, SBC provides a variety of data, internet, and professional services as well.

The CCP’s work with SBC in 2004 has yielded positive results towards achieving the goal of a “world class” telecommunication infrastructure. SBC now offers DSL service to over 81% of the Columbus area residents and business.⁶ They also funded a redundant connection from Columbus’s main switch site to its south switch location.

Other initiatives in the effort to gain “world class” status such as switch redundancy at the Columbus central office and a diverse route to the Elizabethtown central office were deemed economically unfeasible by SBC (Table 2.1).

<u>Fault</u>	<u>Resolution</u>	<u>Current State</u>
Single path out of Columbus through Columbus South office	SBC Funded Projects to Provide Alternative Path from Columbus South to Columbus Main	<u>Corrected.</u> SBC funded project to provide alternative path from Columbus South to Columbus Main
Switch redundancy at Central Office (Columbus Main)	None	<u>Not corrected.</u> SBC concluded this to be cost prohibitive. Nashville switch is the closest switch (20 mi)
Columbus South and Elizabethtown lack of redundant fiber to inter-office public switch	None	<u>Not corrected.</u> SBC concluded this to be cost prohibitive

Table 2.1. Switch Redundancy Current State.⁷

Figure 2.2 shows the two Columbus central offices (420 E 7th Street, and 6190 W 300S Road) as well as the Elizabethtown site (CR 450 and SR-7).

⁶ CCP’s Review of SBC Response to Gaps in Current State. 2004. Pg. 38.

⁷ CCP’s Review of SBC Response to Gaps in Current State. 2004. 39-46.

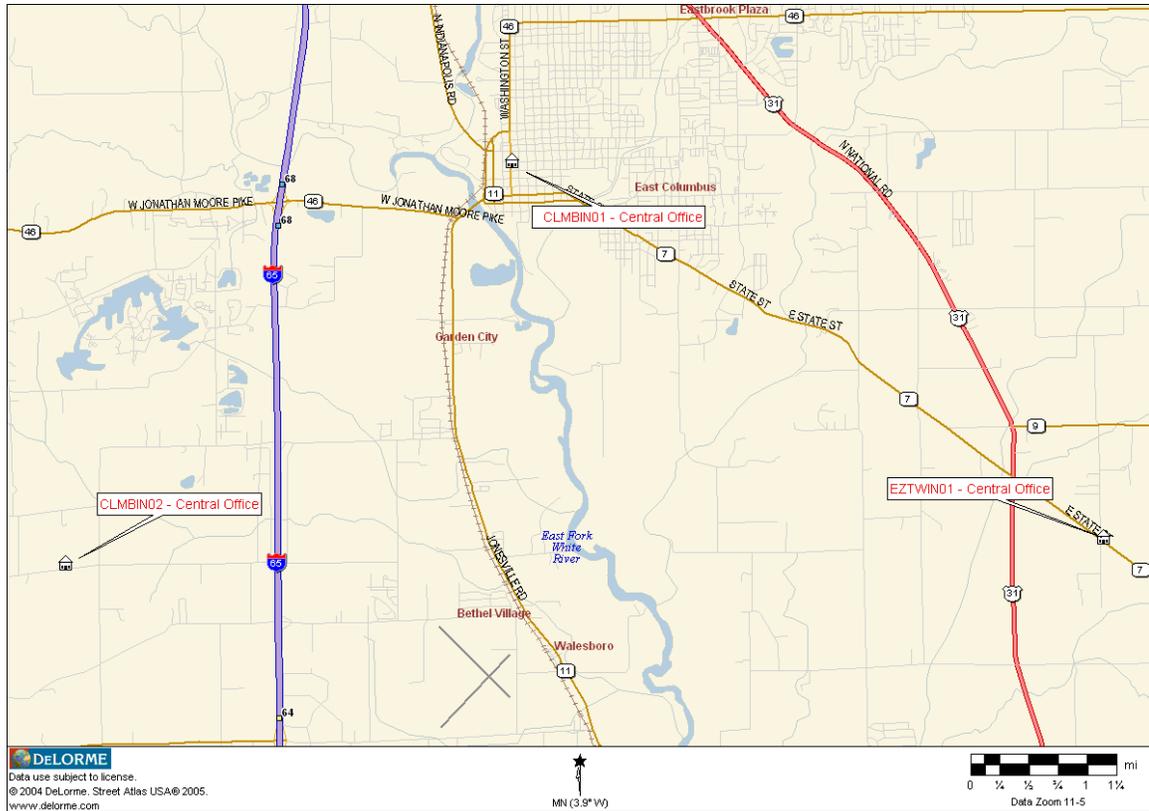


Figure 2.2. SBC Columbus Central Offices.

Section 2.3.1.2. Competitive Providers.

In addition to SBC, there are a host of service providers that provide service in Columbus ranging from dark fiber to cable television. Each brings capabilities and expertise that, if used effectively, can also assist Columbus in accomplishing its goal of achieving “world class” infrastructure.

Indiana Fiber Works (IFW) owns private fiber in the City of Columbus and Bartholomew County. IFW operates and maintains a fiber optic network in central Indiana connecting to the Indy Telecom Center, as well as other major connectivity points in Chicago, Cincinnati, and Indiana. They are capable of serving all geographical areas of Columbus and Bartholomew County. IFW fiber comes in from the west (Bloomington), proceeds through downtown Columbus, and turns north to Shelbyville. Their current “service” in Columbus is to CLECs and ISPs, who provide local services in the Columbus area.

IFW, through its Competitive Access Provider (CAP) status with the Indiana Utility Regulatory Commission, offers dark fiber services to all telecommunication service providers, all public institutions (municipalities, the State of Indiana, etc.), and large commercial/industrial enterprise customers. In this case, the term dark



fiber refers to the need for IFW’s customers to light their own fiber by purchasing the appropriate electronics.

Figure 2.3 illustrates the Indiana Fiber Works Indiana network, while Figure 2.4 illustrates the Indiana Fiber Works network within Bartholomew County (noted with a solid blue line).

Indiana Fiber Network (IFN) serves Columbus via their own private fiber optic network, which currently consists of a SONET protected OC-48 in Columbus. IFN also has the additional advantage of being built into Bartholomew County REMC, who also offers local broadband services. IFN’s focus is on commercial customers, but they also partner with local providers to improve their existing services.

The OC-48 can easily be upgraded to OC-192 as needs dictate. IFN’s “lit-fiber” services include private line and Ethernet transport, Internet Access, local and long distance service. IFN also offers Voice over IP and video services.

A touted capability of IFN is that they operate their own resilient packet-ring network that is self-healing. This can provide customers with true diversity as they are not sharing physical facilities with any other area provider.

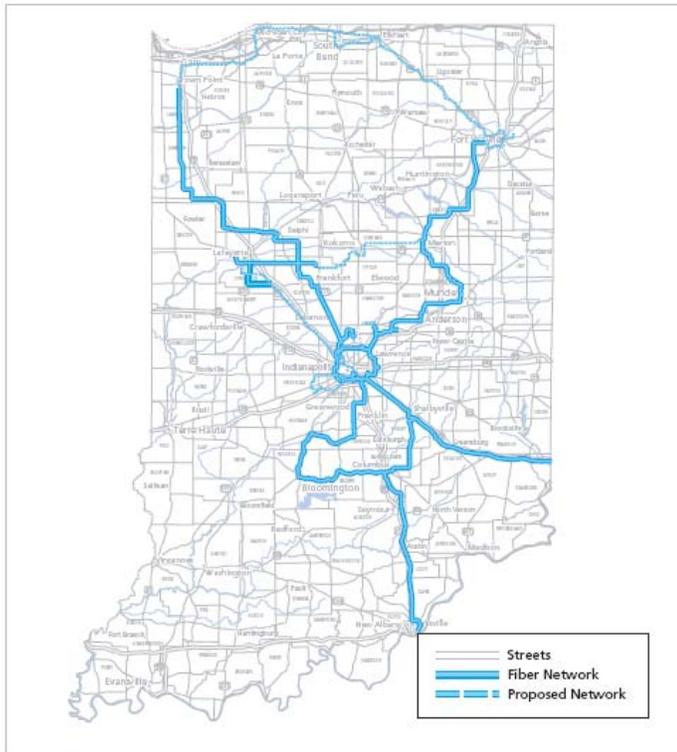


Figure 2.3. Indiana Fiber Works Indiana Network.

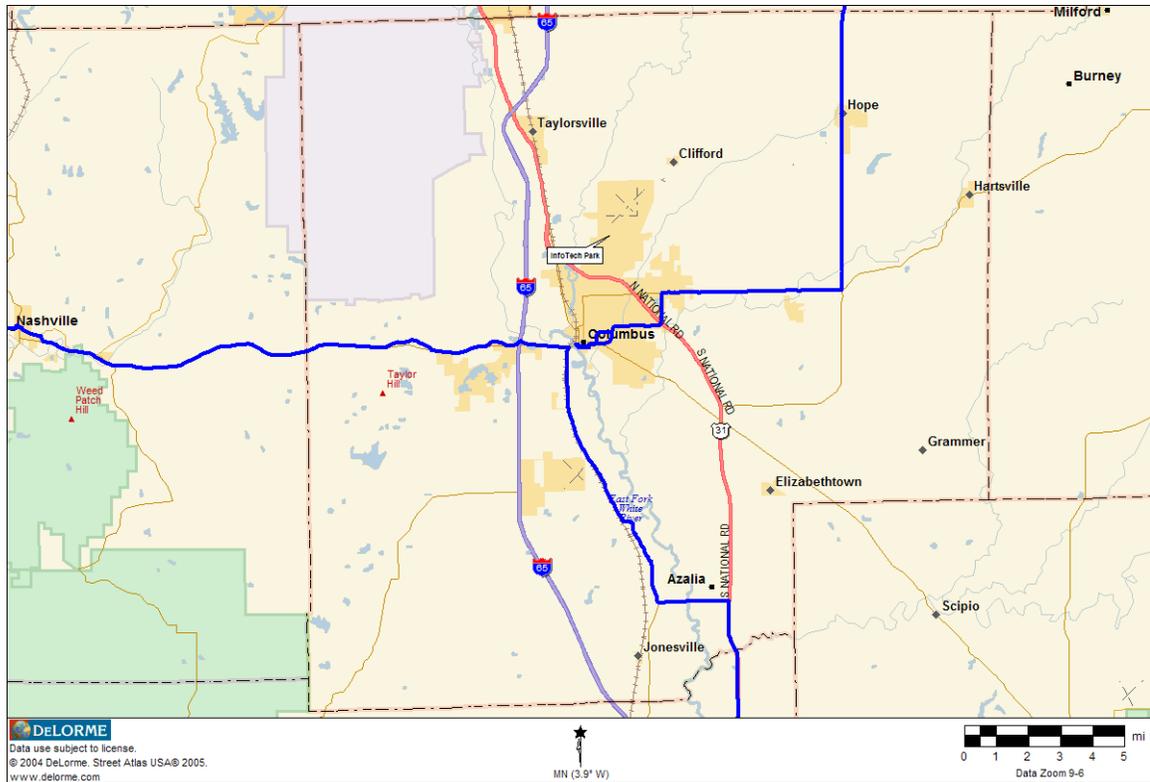


Figure 2.4. Indiana Fiber Works Indiana Network (Bartholomew County).

IQuest Internet is another Indiana-based vendor with a strong presence in Columbus. IQuest Internet has been providing Internet services in Indiana since the mid-1980's. They are not a provider of dark fiber, but have focused on application services such as Internet bandwidth, DNS, web-hosting, and email among others. IQuest Internet currently has an Ethernet connection from the Indianapolis Henry Street C.O. directly to Columbus. This affords them the opportunity to offer up to 100 Mbps of Internet bandwidth as needed.

TLS is a full-service information technology provider with a long history of service to the Columbus area. Currently located in the InfoTech Park, serve Columbus through two OC-3 connections with delivery methods that include DSL, T-1, Bonded T1, DS3, and direct fiber services. Broadband wireless has also been offered to selected areas that are/were underserved by conventional communication facilities. In addition to bandwidth, TLS offers a complete list of web and information services such as VPNs, voice over IP, and on-site technical consulting.

Looking ahead, TLS plans to finish a 1 Gbps link to their co-location space at Indianapolis's Henry Street POP. Once connected to Henry Street, TLS plans to offer even faster and more reliable Tier 1 connectivity to the Columbus area. They are also in the process of continually upgrading their infrastructure (fiber and conduit) in the Columbus area to more effectively serve the community. Of



particular interest to TLS is Phase 1, Greater Columbus Conduit System, of the eCOLUMBUS initiatives proposed later in this deliverable (Section 3.2) as it will aid in significantly reducing their costs for construction of conduit facilities between their facility at the InfoTech Park and the Indiana Fiber Works fiber hut.

Comcast is the incumbent local Cable Provider. Comcast currently serves all residential and commercial buildings as outlined by the (current month to month) franchise requirements. Commercial is typically categorized as business, whether from the house or an established commercial building.

Comcast currently provides both cable television services and high-speed cable internet to the Columbus Community. Their infrastructure consists of fiber to the serving area (FSA) in some areas, which provides Internet data service as well as DVR and digital programming guides for their cable users. According to Comcast, they also plan to offer high definition, digital voice service, and digital simulcast services within the next five years. The Comcast central office is located at 1470 Jackson Street.

Section 2.3.1.3. Utilities.

Bartholomew County REMC currently provides dial-up internet service to residential or business customers out of five Columbus area exchanges. The REMC has also offered a satellite broadband through Hughes technology for over two years. They are currently deploying Wild Blue satellite technology to offer higher end services to homes and business. The Wild Blue service offers three options from 500 Kbps up to 1.5 Mbps. IQuest Internet also has a presence in the REMC's facility.

Cinergy PSI is providing dark fiber services to many large clients through their subsidiary, Kentucky Data Link (KDL). The Cinergy site in Columbus is a major node on their statewide network. The local Cinergy office is served out of the Plainfield office, which serves as the ISP and main hub on their network.

Section 2.3.2. Telecommunication Consumers.

Section 2.3.2.1. Education.

Bartholomew Consolidated School Corporation (BCSC) has been at the forefront in the State of Indiana in terms of public school districts utilizing telecommunication infrastructure and services. They are currently served by SBC and use DS-1 connections to connect their 20 buildings in a star wide area network topology. This infrastructure carries BCSC's video and data applications back to a DS-3 that is provided by ENA via a partnership with the Indiana Department of Education.



Voice services are currently provided via a combination of SBC PRI ISDN lines and analog circuits. BCSC is currently satisfied with SBC's services, especially once they are operational. They have traditionally had some problem with circuit startup however, as they bring on new buildings or add capacity.

Pending e-rate commitments, BCSC plans to upgrade their existing DS-1 infrastructure to a 100 Mbps MAN service from SBC. This will provide them with ample bandwidth for present and future data and video applications. The infrastructure will also be suitable for Voice over IP transmission should they choose to move in that direction.

IUPUC currently receives the majority of their telecommunication services through university systems. The IUPUC campus building runs two T-1s for data and voice, respectively. These are provided and managed at the University level in Indianapolis. IUPUC's future requirements remain unknown, but will be driven by whichever education applications are implemented into the curriculum.

Ivy Tech Columbus sees the need for dedicated fiber connectivity as their bandwidth needs continue to grow exponentially. They are currently served by IHETS with three T-1s, which are used for data services and videoconferencing. However, they see their bandwidth needs approximately doubling each year for the next three years. This makes the bandwidth and services which are available through dedicated fiber paramount for their telecommunication needs. Ivy Tech sees the potential in I-light 2 fiber, but has also been in conversations with TLS who could offer a fiber solution in conjunction with their service to the InfoTech Park.

The Columbus Learning Center is owned by the City and spaces are shared by the community's higher education institutions. It is served by the three T-1's which are paid for by the higher education institutions.

Section 2.3.2.2. Government.

The Connected Community Partnership (CCP) is a body consisting of members of the Columbus Community representing business, residential, government, education, and social service interests. Of the CCP's many initiatives in recent years, a significant one has been their strategic network planning group. The planning group has been active in working with SBC, TLS, and various community partners to expand and enhance the telecommunications environment in Columbus.

Their activities have focused on areas such as an expanded wireless presence, additional redundancy, co-location space, and fiber capacity into the Info-Tech Park among others. Additionally,



1. Dial-up reliability and bandwidth availability to older parts of town as an issue to be addressed; and
2. Affordable broadband or Wi-Fi is not available where needed - to lower-income families.

Beyond having the technology available, CCP also sees the need for providers to address Columbus's multi-cultural community through making multi-language helpdesk services available (English, Spanish, and Hindi minimum).

Though CCP is a facilitator and proponent of telecommunication development, they are also a user, and were contacted in that context for the purposes of defining the current state. TLS serves most of CCP's Internet needs today. Computer Solutions of Indiana, through the United Way, also provides Internet access and web-hosting capabilities via a server located at CCP's facility.

The Mayor's Technical Advisory Taskforce has now been appointed to assist and build on the work accomplished by CCP's strategic network planning group. The Taskforce also consists of members representing all sectors of the Columbus community who have concerns about telecommunication related issues. For the purposes of this engagement, the Task Force is the CLIENT of InfoComm Systems.

The City government in Columbus is also a large telecommunication user. They currently run 100 Mbps links between their downtown Columbus facilities via jointly owned fiber with the County. They connect their outlying areas with SBC T-1s. Such areas include: the Fire Dept HQ facing 11th Street and Washington Street (1 T-1), Donner Center - Parks Headquarters located at 22nd Street and Sycamore Street (2 T-1's).

Figure 2.5 illustrates existing aerial fiber optic infrastructure owned by City and County governments (approximately 1 ½ linear miles).

The City's emergency dispatch center is the mostly likely candidate to continue to increase its bandwidth demand. Being that this particular location is on privately owned fiber, they will simply need to switch out equipment as bandwidth needs increase. They do, however see a problem with procuring enough affordable bandwidth to their remote areas.

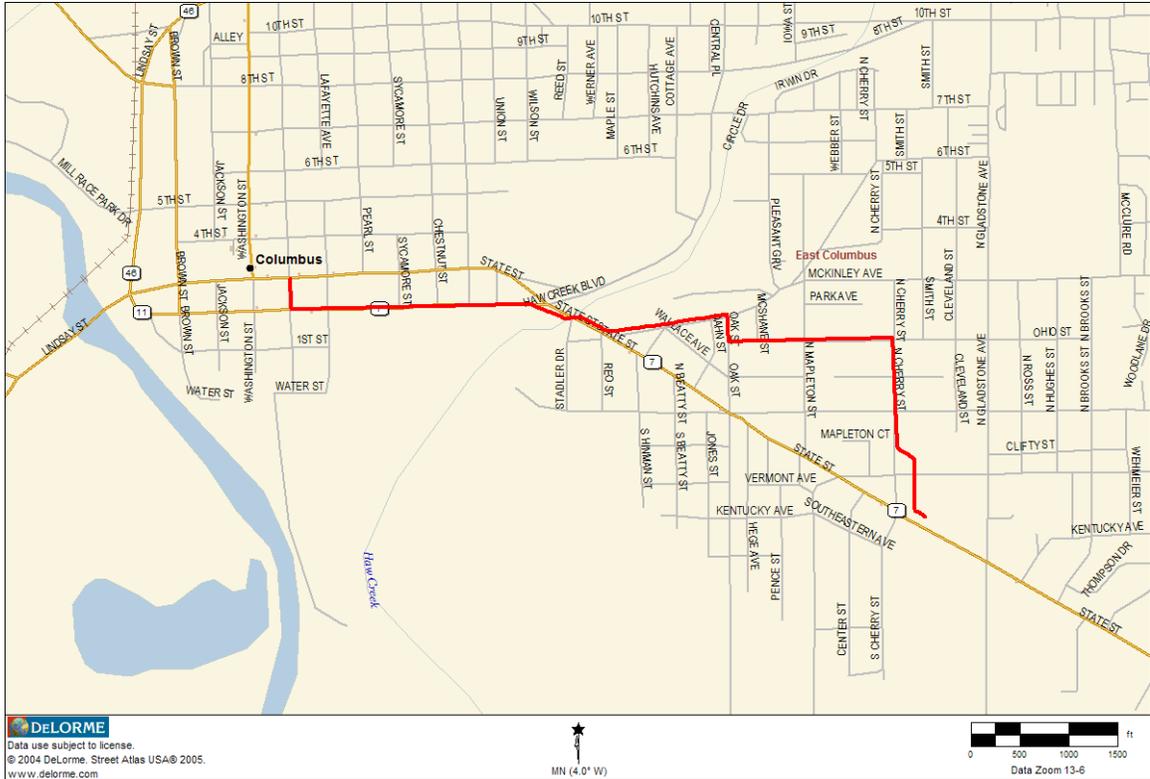


Figure 2.5. Existing City of Columbus and Bartholomew County Conduit Infrastructure.

Section 2.3.3.3. Industry.

Cummins, Inc. is one of the largest businesses in Bartholomew County. Today, they run fiber-optic links between all facilities at speeds of either 100M or 1G, which meet their current capacity needs. Most of this infrastructure is provided by SBC, which includes cabling and premise equipment. Cummins also has a DSL connection to the Internet for testing purposes, also provided by SBC.

One area where Cummins has concerns is regarding the continued provision of tariff-based services. If the opportunity presented itself, Cummins would prefer a dark fiber scenario, where they could install and manage their own equipment. This would allow much more flexibility to increase or decrease capacity as business needs grow or shrink. Cummins would make an extremely valuable anchor tenant on any public/private fiber network. Their business needs would drive service levels on the network, creating a robust, high quality network environment. Leading by example, Columbus could also have a positive effect on the adoption rate of the new network infrastructure.

As technology continues to improve, Cummins is always looking at ways to lower cost as well as add redundancy. Therefore even if bandwidth availability itself isn't an immediate concern for Cummins's core sites, a private fiber scenario that could lower costs and increase productivity is still a very valuable commodity.



Arvin Meritor is a large automotive supplier based in Columbus and one of the businesses located at the new Info Tech Park. For their Columbus facilities, they currently make use of an SBC SONET infrastructure in the form of both an OC-12 and an OC-3 ring. They are preparing to upgrade to DS-3 based Internet connectivity via SBC and are satisfied with the service and performance offered by their SBC services. On the voice side, Sprint remains their long-distance carrier.

LHP Software; KPIT Cummins Infosystems, Ltd.; and TATA Consulting are three growing high-tech business with a strong presence in the Columbus area. LHP currently uses two T-1's provided by Cinergy for Internet access. Due to LHP's size and bandwidth intensive applications, they say that acquiring sufficient bandwidth is a problem. For this reason, they plan to move into InfoTech Park, which has plans to one day service tenants with fiber-to-the-curb facilities.

KPIT is also a growing software solutions provider that plans to make use of the InfoTech Park as a base of operations. Respondents from both KPIT and LHP mentioned that they were satisfied with services from a residential perspective, but that the affordable high-bandwidth (industrial) services were not readily available.

TATA Consulting is also establishing a presence in the InfoTech Park, in large part due to the available and planned telecommunications services. TATA currently conducts video conferencing and transfers large client files between their local presence and off-shore sites in India. Due to the size and sensitive nature of the client files, the utmost in security and available bandwidth are a necessity to TATA. TATA has experienced significant growth in recent years and expects to see more of the same in the coming years. As growth continues, it is crucial that their telecommunication needs are met at a reasonable cost.

Section 2.3.3.4. Social Services.

Columbus Regional Hospital (CRH) has established itself as a premier medical facility with its commitment to the use of broadband technologies in the provision of health care. In terms of broadband infrastructure, the hospital has an OC-12 connection to SBC's central office. T-1 circuits connect the CO to the CRH remote site, and DSL and Cable modem connections are also utilized at smaller locations in the area for data and imaging applications.

Though CRH has been more than successful in their use of information technology, they still have concerns in that several of the smaller physician offices are not able to get adequate bandwidth to view images in a timely manner.



As clinical technology improves, the bandwidth needed to transmit detailed images quickly will continue to grow. CRH will continue to position itself to be able to make the most of their IT capabilities.

Project Connect is another initiative of the CCP that provides computers and Internet access to low and moderate income families in the Columbus area. The standard service through Project Connect is a dial-up service through TLS for \$9.95 per month. This affordable service is available in most areas with the exceptions being on-premise technical issues or financial constraints.

As the dial-up customers become accustomed to faster broadband speeds at the workplace, schools, and libraries, the need for pervasive broadband coverage also increases. In areas where it is available, some Project Connect customers have elected to procure their own broadband service to replace dial-up.

Section 2.3.3.5. Residential.

Through the course of the interviews performed by CONSULTANT in reassessing the current state, the respondents provided helpful information regarding the state of residential telecommunication service in Columbus. Overall, the interviews showed that Columbus residents are satisfied with the services available to them residentially. Between the increased DSL coverage by SBC and cable internet available through Comcast, there are very few areas in the Columbus area that do not have access to a broadband service.

One documented concern, however, was with the lack of Wi-Fi enabled areas in Columbus. Consumers would like access to either an increased number of hotspots or even a metropolitan area hotspot to provide them the capability to access business and personal applications while on the go.

Consumers are also looking more and more at converged services as valuable offerings. Regarding marketplace factors, as was mentioned in Section 2.2.4, more customers are looking for one service package to take care of their information needs – including television, voice, Internet, and even mobile phone services.

Finally, many users with smaller children are looking to have a filtered Internet service option. Though application services are available from online providers, many parents do not have the time or technical inclination to make use of these options. A provider-level filtered service would be a welcome option.



Section 2.4. SWOT Analysis.

The purpose of the SWOT analysis is to summarize the strengths, weaknesses, opportunities, and threats as they pertain to Columbus acquiring a “world class” telecommunication infrastructure. A SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis will yield output that will aid in focusing the appropriate attention on proper initiatives for realizing a “world class” telecommunication environment in the Columbus area.

Section 2.4.1. Strengths.

Strengths identify advantages and resources the Columbus area has that could be beneficial in their pursuit of a “world class” telecommunication environment. The following are strengths as they relate to the Columbus area.

- **A Motivated Community.** Columbus has an active, concerned community. Many have donated their time to the community’s public sector efforts to contribute to its well being. This continued support will be of great benefit to the City’s efforts to build a “world class” telecommunication environment.
- **Organization.** Between the work completed by the CCP, and now the continued progress of the Mayor’s task force, Columbus has enough civic organization to identify initiatives and make solid progress.
- **Proximity to Indianapolis.** Located directly south of Indianapolis and Indy’s Henry St. central office, Columbus has proximate access to multiple carriers and tier one internet access.
- **Business Resources.** Community business leaders are all donating expertise and information to aid the Mayor’s Technical Advisory Task Force (Appendix C)
- **Educational Resources.** Like the business resources, educational entities such as BCSC, Ivy Tech, and IUPUC are also donating time and expertise to the initiative.

Section 2.4.2. Weaknesses.

Weaknesses identify disadvantages and/or areas that could be improved. The following are weaknesses as they relate to the Columbus area.

- **Available Funding.** As with any public sector initiative, availability of funding is always in question. In addition to telecommunication, there are always other initiatives in which the community would like to devote resources.



- **Other Competitive Communities.** Throughout the state and the country, other municipal governments are seeing telecommunication as an economic necessity. As such, many are moving forward with the planning and procurement of infrastructure and services in an effort to spur economic development and attract new business similar to Columbus.

Section 2.4.3. Opportunities.

Opportunities identify prospects and/or trends that could be beneficial in their pursuit of a “world class” telecommunication environment. The following are opportunities as they relate to the Columbus area.

- **IFW and IFN Fiber.** Both companies own redundant fiber infrastructure in Columbus. This could allow either of them to serve the Info Tech Park with fiber-to-the-premise. Either company could also partner with existing ISPs, such as IQuest Internet to provide high-bandwidth services in Columbus.
- **SBC Infrastructure/Resources.** SBC’s size and resource availability make them a valuable partner to Columbus in becoming a “world class” telecommunication community. Their actions over the past two years show that they are committed to working with Columbus as well.
- **TLS Infrastructure/Resources.** TLS’s service offerings, resources, and history of providing to the Columbus Community make them a valuable partner for the city in achieving “world class” status.
- **Other Infrastructure/Resources.** The I-Light 2 initiative, Comcast infrastructure and services, as well as other non-fiber technologies such as broadband over power line (BPL) will also be key opportunities for driving both the supply and demand for broadband services further into the Columbus community.
- **Vertical Real Estate.** Columbus has a wide range of towers and other elevated facilities that could be leveraged to implement network infrastructure. A list of these locations is provided in Appendix A.

Section 2.4.4. Threats.

Threats identify detriments to the Columbus area that could introduce failure in their pursuit of a “world class” telecommunication environment. The following are threats as they relate to the Columbus area.

- **Politics.** There are a number of providers in the community in addition to various citizens with specific interest in how the Mayor’s task force moves forward. Though this is an advantage in the amount of resources and expertise it brings to the table, it can have the potential to cause some gridlock.



- **Time.** Time is of the essence. Every day that is spent not executing a plan to realize a “world class” telecommunication environment puts the Columbus community further at risk for lack of progress. It is important that initiatives are identified and moved upon quickly in order to build on the momentum already created.

Section 3. Multi-Phase Strategic Network Design.

As described previously in the 2002 Strategic Telecommunication Plan for Columbus, IN, Columbus is widely considered as a “world class” city in many regards, one being its distinctive architecture. In keeping with other “world class” attributes of the community, Columbus would like their telecommunication capabilities to also be classified as being “world class” as well. The focus of this section is to characterize the vision for “world class” telecommunication environment within Columbus and, using a phased approach, describe how this vision can be realized in the future.

Section 3.1. Creating “World Class”.

Section 3.1.1. Guiding Principles.

The following list summarizes recommendations that should be considered guiding principles for success as the City of Columbus moves forward toward creating a “world class” telecommunication environment.

1. Stay focused on achieving “world class”.
2. Stay focused on doing what is best for the community and its constituents.
3. Always partner where at all possible.
4. Use community assets and resources to fill gaps that cannot be filled by partners.

Section 3.1.2. Components.

A “world class” telecommunication infrastructure is not comprised of one telecommunication provider or one type of technology. There is not a magic bullet. Instead, creating such an environment is a collaborative and supplementary effort on the part of many partners utilizing an array of resources and technologies.

The systems diagram illustrated in Figure 3.1 details the key constituents, their resources and assets (inputs), as well as their expectations for returns (outputs). More specifically, the Columbus “world class” telecommunication environment will be comprised of

1. Network technology elements, providing the telecommunication infrastructure and services;
2. Partners, providing assets in exchange for some kind of return on their investment;



3. Governance, which will add layer of vision and strategic design to the efforts and overall environment to ensure both continue to be focused on the best interests of the community; and finally the
4. Constituencies, which are the community members that will utilize the telecommunication environment to further business and generate commerce within the Columbus area.

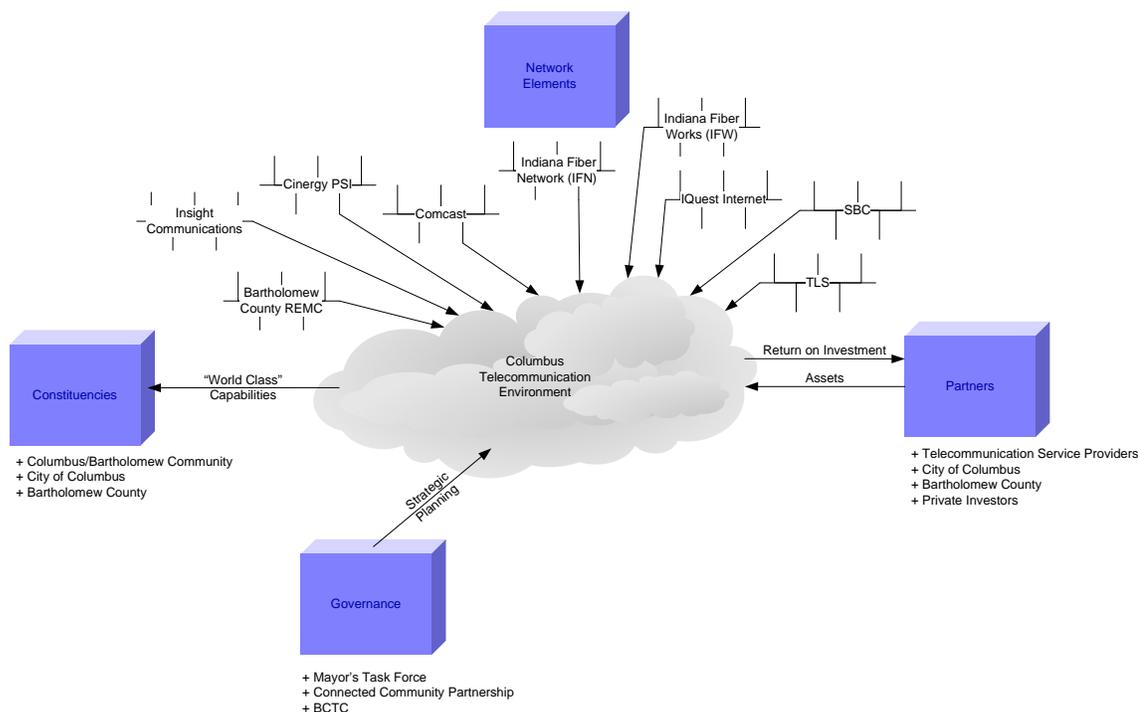


Figure 3.1. Columbus Telecommunication Systems Diagram.

Technologies that will continue play a key role in creating a “world class” telecommunication environment for Columbus are comprised of (at least) the following known technologies: DSL, cable modem, T-x and OC-x carrier services, Wi-Fi, broadband wireless access, dark fiber, and conduit infrastructure.

Section 3.2. A Phased Approach to Deployment.

The deployment of a “world class” telecommunication environment is not one that should be attempted all at once. Instead, a prioritized and phased approach to deployment will ensure success through incremental progress. This section provides the description and rationale for each phase of the multi-phase strategic network design for creating a “world class” telecommunication environment for Columbus. The following is a summarized list of five recommended initiatives (phases) in an overall effort to revitalize the Columbus telecommunication



environment into one that is characteristic of “world class” stature. These initiatives are referred to herein collectively

1. Greater Columbus Conduit System
2. Wireless Columbus
3. Fiber-to-the-Curb (Commercial)
4. Fiber-to-the-Home (Residential)
5. Inter-Community Fiber

When existing and the eCOLUMBUS initiatives are cross-referenced against the vision the Mayor’s Technical Advisory Task Force has chosen to define their requirements for “world class” (pg. 9), it becomes clear that not only are the eCOLUMBUS initiatives realistic, but when they are coupled with existing progress to date, Columbus is well on its way to becoming “world class”. Table 3.1 details how each proposed initiative aligns with Technical Advisory Task Force requirements for “world class”.

	Greater Columbus Conduit System	Wireless Columbus	Fiber-to-the-Curb	Fiber-to-the-Home	Inter-Community Fiber
Reasonably priced voice, video, and data services	X	n/a	X	X	X
Readily available network services (connected within hours)	X	X	X	X	n/a
Redundant high bandwidth telecommunication network services	X	X	X	X	X
Highly reliable telecommunication infrastructure with no single points of failure	X	X	X	X	X
Multiple gateway options for connecting the Columbus area to other communities	n/a	n/a	n/a	n/a	X

Table 3.1. Columbus “World Class” Initiatives. (n/a=not applicable)



Section 3.2.1. PHASE 1: Greater Columbus Conduit System.

Section 3.2.1.1. Description.

The focus of Phase 1 is to establish a conduit system that will, in the long-term, serve as the foundation for accelerating the delivery of “world class” telecommunication services to the Columbus area, and, in the short-term, connect InfoTech Park to the Indiana Fiber Works fiber hut. With connectivity to IFW, InfoTech Park attendants will have the capability to reach the Indianapolis Carrier hotel as well as any other locations within the IFW network to purchase bandwidth and/or services from a host of Tier 1 and Tier 2 telecommunication service providers or create a metropolitan or regional private network between two or more locations.

Phase 1 has been given priority by the Mayor and the Technical Advisory Task Force, as there are existing park tenants that require such facilities for continued operation in the short to near term. This connection will require leveraging public rights-of-way for the construction of conduit facilities from the park at Central Avenue and Poshard Road to the Indiana Fiber Works fiber hut at Central Avenue and 7th Street. More information on leveraging public rights-of-way is available in Appendix D.

The CONSULTANT was directed to create a route for a conduit path that would, in addition to providing conduit between the IFW fiber hut and the InfoTech Park, better serve community constituents long-term as well as a sub-set of constituents that would utilize the infrastructure in the short- to near-term as part of an eCOLUMBUS Fiber-to-the-Curb initiative. This sub-set of “early adopters” includes:

- Arvin Meritor;
- Columbus Regional Hospital;
- Cummins; and
- InfoTech Park.

This system of conduit and handholes will originate at a handhole set in the utility easement at the intersection of Brown Street and 5th Street. Conduits would be directional bored in the utility easement heading east down 5th Street to California Street, head south on California Street to Hawcreek Boulevard, head north on Hawcreek Boulevard to the IFW fiber hut at the intersection of 7th Street and Central Avenue, head north on Central Avenue to Arnold Street, and end on Arnold Street at a contractor provided handhole set in the utility easement just before Kelly Street.



Additionally, conduits would originate at a handhole set in the utility easement at the intersection of 17th Street and Central Avenue, head east and stop in a handhole set in the utility easement at the intersection of 17th Street and Gladstone Avenue.

Figure 3.2 illustrates the path of the Greater Columbus Conduit System in proximity to Columbus area community constituents (listed in Appendix B). It should be noted that the locations listed on the maps herein are not exclusive and they serve only as an example of the potential demand for fiber optic services within the community.

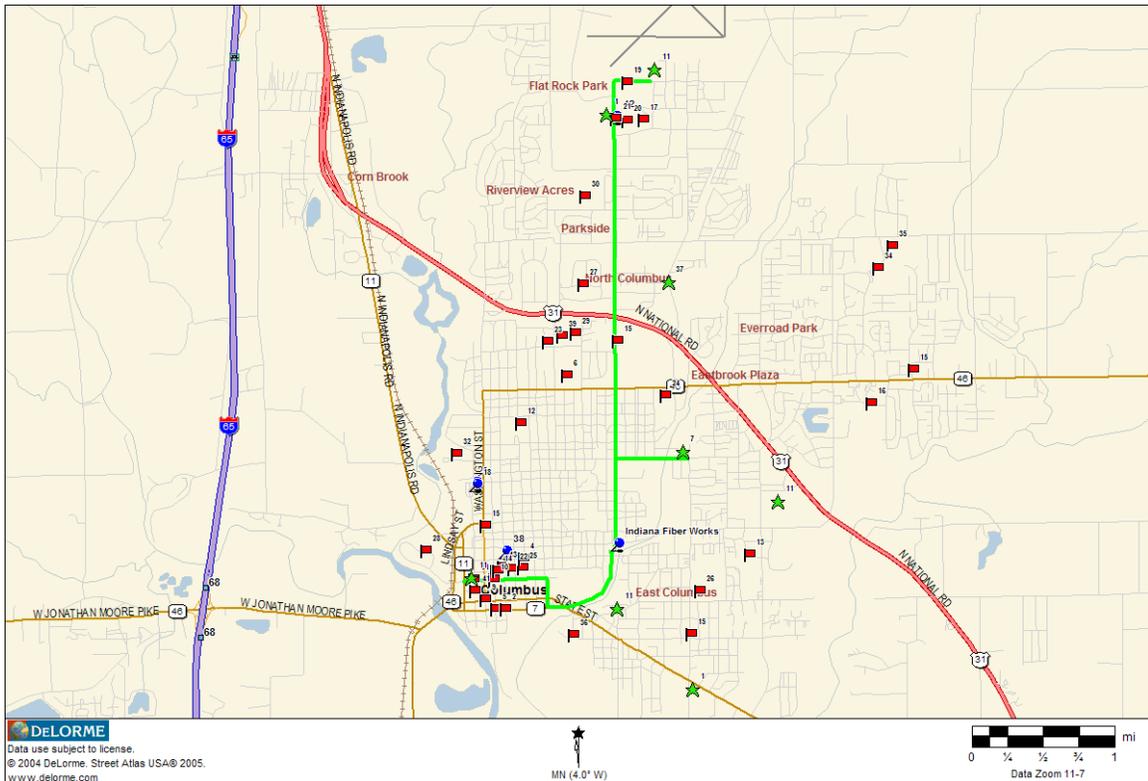


Figure 3.2. Community Constituents Proximity to Greater Columbus Conduit System

It should be noted that there are portions of Phase 1 that overlap with existing Indiana Fiber Works infrastructure. As this infrastructure is already in the ground and sources at Indiana Fiber Works have confirmed that there is spare conduit available in where the two overlap, construction costs could be reduced by utilizing this existing conduit infrastructure. Listed below is a key contact at Indiana Fiber Works familiar with infrastructure specific to Columbus and Bartholomew County.



Patrick Opelt
Vice President of Business Development
Indiana Fiber Works

141 East Washington Street, Suite 200
Indianapolis, IN 46204
(317) 524-5711 Fax: (317) 524-5721
popelt@indianafiberworks.com
www.indianafiberworks.com

First, Figure 3.3 illustrates existing Indiana Fiber Works infrastructure (noted as a solid blue line) and City and County conduit and fiber infrastructure (noted as a solid red line) that could be beneficial to Phase 1 and eventually Phases 3 and 4.

Next, Figure 3.4 sheds light on how Phase 1 could be built upon to extend the Greater Columbus Conduit System further into the community to reach even more Columbus area constituents by building new conduit infrastructure (noted as a dotted orange line) or leveraging existing IFW or City and County conduit assets.

It should be noted that Indiana Fiber Works has empty conduits between its fiber hut on 7th Street and Central Avenue and E 450 S near the Walesboro Industrial Park. With a conduit build from the Indiana Fiber Works conduit infrastructure to the Walesboro Industrial Park (< 2 miles), similar to that of the Phase 1 build to the InfoTech Park, the Greater Columbus Conduit System could reach two of the flourishing industrial/technology parks in Columbus. Indiana Fiber Works discussed no specific terms regarding the lease or purchase of said conduit, but did express interest in talking with the Columbus community about ways in which they could be a partner.

Finally, Figure 3.5 provides is a closer view of Figure 3.4 with community constituents overlaid to put in the proper context the proximity of potential future expansion of Greater Columbus Conduit System to said constituents.

Section 3.2.1.2. Rationale.

Phase 1 makes sense within the context of a “world class” telecommunication environment because of its ability to uniquely serve as the foundation for accelerating the delivery “world class” telecommunication services to the Columbus area, and in the short-term connect InfoTech Park to the Indiana Fiber Works fiber hut for Internet and private network connectivity. Just as a new road or sewer line would be an easily justifiable investment for most any community; such a telecommunication duct system could also be a sound and easily managed investment.

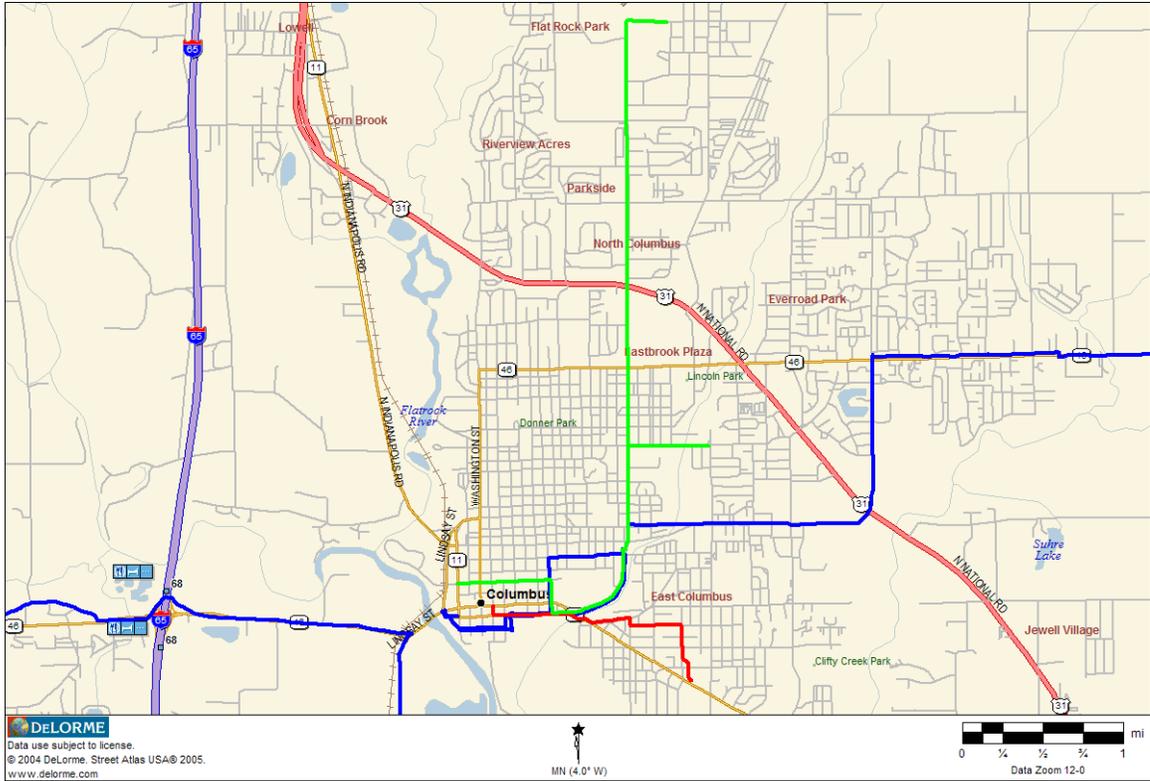


Figure 3.3. Overlap with Existing Indiana Fiber Works Infrastructure.

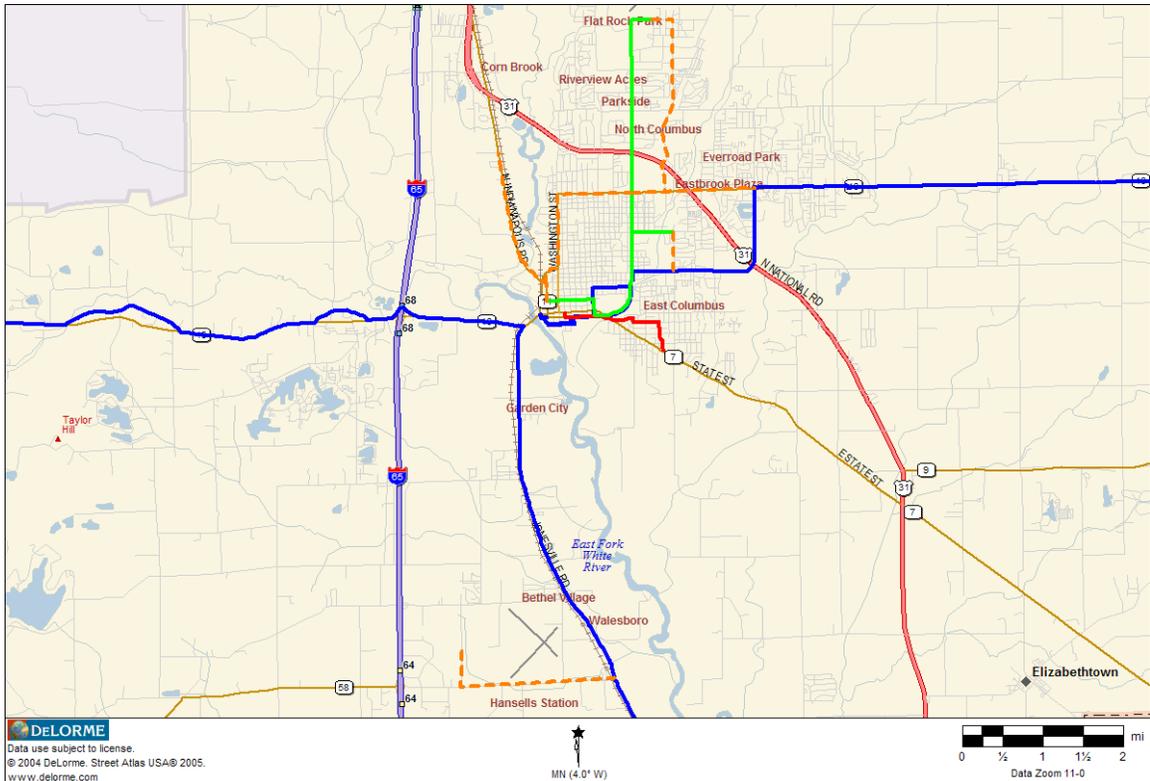


Figure 3.4. Potential Future Conduit Expansion.

CONFIDENTIAL & PROPRIETARY



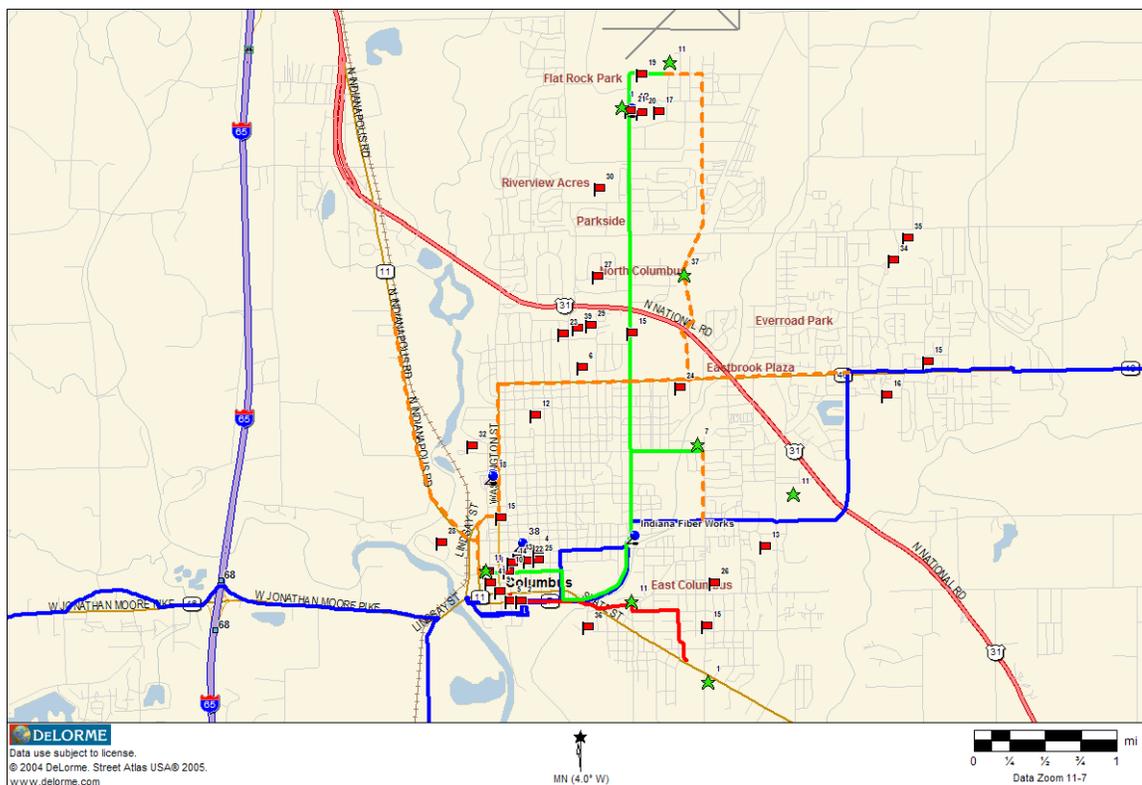


Figure 3.5. Potential Future Conduit Expansion (Zoom).

Section 3.2.1.3. Budgetary Figures.

It is estimated that it will require an estimated \$511,400.00 of initial capital required to deploy the Greater Columbus Conduit System. The underlying assumption is that these facilities would be buried and would not contain fiber optic facilities. By deploying empty four (4) inch conduits and handholes, the community is not getting itself into the telecommunication service provider business, but is instead lowering the barriers keeping telecommunication providers and (in some cases) private industry from deploying high bandwidth infrastructure and services within the Columbus area.

There are two recurring cost components associated with deploying fiber optics that Columbus would be responsible for if it one day chose to own fiber optics: maintenance, emergency response and repair. Ongoing maintenance for the facilities by a third-party could be in the range of \$300.00-\$400.00 per year per route mile. Emergency response and repair would be on a case by case basis and, depending on the circumstance, may be covered under insurance should someone else be at fault. The cost to repair a fiber cut is relative to how difficult it is to repair. Repairs in urban settings are much more expensive than those done in rural settings because of additional concrete and numerous utilities in the right-of-way.



Additionally, if Columbus chose to get into the “fiber business” by deploying and leasing/selling fiber it would also be responsible for recurring costs associated with marketing, customer service, billing, accounting, and system management.

In the interest of full disclosure, should Columbus be interested in deploying fiber and choose to move forward with an aerial fiber optic solution instead of deploying empty conduits, the community should be aware of an additional recurring cost for pole attachments in addition to the aforementioned recurring maintenance and emergency response and repair expenses. A pole attachment fee is a per pole cost charged by the utility pole owner to hang facilities in the telecommunication easement on the pole. Pole attachment fees are typically in the \$18.00 per pole per year range. Most poles are placed approximately 250 ft apart from one another. For a rough estimate of the yearly pole attachment fee, the following an example:

- The route is ~31,500 ft (5.97 mi) and the poles are \$18.00 per pole per foot and each pole is place approximately 250 ft from the next pole, a yearly pole attachment fee could be in the range of ~\$2,268.00.

By deploying conduits exclusively, independent of fiber optic facilities, the community’s responsibility stops at maintaining the conduit and handhole infrastructure, which could be handled using existing utility departments (e.g. street, water, and/or sewage).

Section 3.2.1.4. Revenue Creation.

The following details an example for Phase 1 to create revenue and become self-sustainable:

- **Own Conduit.** As it would not be in the best interest of Columbus for the community to get into telecommunication service provider business, it is recommended that the community own the buried conduits and lease, sell, give away access to the facilities on a case by case basis. Under this model, the community would utilize existing utilities (e.g. street, water, and/or sewage) to maintain these facilities in addition to their own.
 - For example: “Example Company” of Columbus needs exclusive access from the InfoTech Park to the Indiana Fiber Works facility to construct a private wide area network between two of their facilities. The community would have a per route mile fee associated with leasing access to the conduit (\$1.00 per day per conduit per route mile, for the sake of example) and could collect about \$97.00 per month or \$1,168.00 per year per conduit lessee.



Section 3.2.1.5. Recommendation for Mayor's Technical Advisory Task Force.

The following detail recommendations for next steps associated with implementing the Phase 1 Greater Columbus Conduit System.

1. Designate project manager and project team
2. Determine role of Mayor's Technical Advisory Task Force in this initiative
3. Perform detailed network engineering
4. Secure potential partners and funding
5. Develop, administer, and manage contractor/proposal selection process
6. Select qualified contractor(s) and proceed with construction

This initiative and its aforementioned next steps are currently underway. InfoComm Systems was selected as the project manager for this initiative and presented the technical details of this initiative in their October 6, 2005 presentation of the "Greater Columbus Conduit System Initiative".

Section 3.2.2. PHASE 2: Wireless Columbus.

Section 3.2.2.1. Description.

The focus of Phase 2 is to make Columbus a "world class" wireless community. By strategically leveraging vertical real estate (radio/television/cellular/water towers, building façades) within Columbus and Bartholomew County (more information available in Appendix A), it is possible to create the following:

- **Wi-Fi hot spots in and around Columbus common areas.** Locations that should be considered for potential hot spot deployment include: Government locations, library, hospital, airport, parks, malls, schools, cafés, museums, information kiosks, any location where people might congregate for business or pleasure.
- **Columbus-wide broadband wireless.** As broadband wireless technologies such as WiMAX become commonplace, coupled with a steady increase for broadband wireless access (BWA), Columbus may be in a position to leverage its assets to create a community-wide broadband wireless access solution.

Figure 3.4 illustrates examples of wireless hotspots that could be deployed throughout Columbus. Figure 3.5 illustrates a more detailed view of downtown wireless hotspot deployment – an excellent first step in rolling out Phase 2. For the sake of example, a 400 ft radius for a hotspot (represented by a dull orange circle) was used assuming the wireless technology utilized would be 802.11b or 802.11g standard compliant.



It should be noted that a potential broadband wireless access solution was not illustrated in this deliverable, as it is a longer-term solution that will likely be better served by an emerging and yet to be standardized technology (e.g. WiMAX).

Additional reading regarding communities that are deploying wireless services to improve the overall quality of life of their citizens is available in Appendix E.

Section 3.2.2.2. Rationale.

Blanketing key Columbus community common areas with Wi-Fi is a very cost effective means for reaching "world class" status. With partners such as SBC and TLS eager to partner with the community for Wi-Fi deployments throughout the Columbus area, it is easy to see the community is in a unique position to assist in such a deployment with minimal risk and investment.

It should be noted that Wi-Fi could be cost effective means for connecting Columbus government facilities in a private (intranet) network configuration.

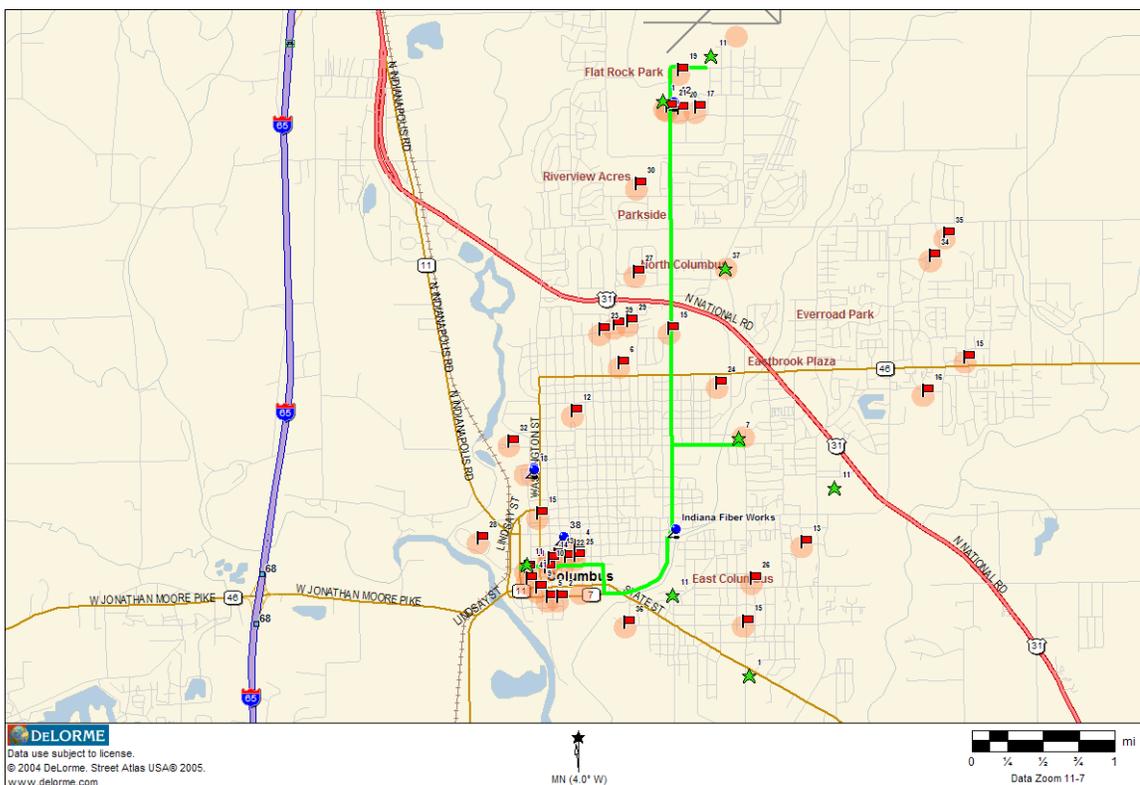


Figure 3.4. Sample Wireless Hotspot Deployment (Overview).



A recurring cost associated with deploying Wi-Fi wireless access points would be ongoing maintenance, monitoring, and user/system administration, services that would be best provided by a third-party Internet service provider type organization.

Section 3.2.2.4. Revenue Creation.

Should the community choose to not provide free wireless service to community constituents, the following detail examples for Phase 2 to create revenue and become self-sustainable:

- **Own Wi-Fi Hardware.** Similar to the Phase 1 conduit build, it is recommended that the community own the wireless hardware and lease it to a third-party (e.g. TLS) to operate the wireless service. In addition to this, the community would receive a portion of the revenue from the wireless service.
- **Third-party Wi-Fi Deployment.** Another alternative is to not own any hardware and to partner with an Internet service provider (e.g. SBC) to offer a packaged Wi-Fi solution to key locations in the community. The community would fund the site survey and installation and would receive daily revenue from unique users that use the SBC FreedomLink wireless service.

Section 3.2.1.5. Recommendation for Mayor's Technical Advisory Task Force.

The following detail recommendations for next steps associated with implementing Phase 2, the Wireless Columbus initiative.

1. Designate project manager and project team
2. Determine role of Mayor's Technical Advisory Task Force in this initiative
3. Identify potential sites for initial deployment
4. Perform site surveys and detailed network engineering
5. Secure potential partners and funding
6. Develop, administer, and manage contractor/proposal selection process
7. Select qualified contractor(s) and proceed with deployment

As this phase is not dependent on other phases to move forward (discussed further in Section 3.3), it is recommended that the community move forward with this Phase 2 in parallel to moving forward with Phase 1.



Section 3.2.3. PHASE 3: Fiber-to-the-Curb (Commercial).

Section 3.2.3.1. Description.

The focus of Phase 3 is to make the commercial sector of Columbus a “world class” fiber optic community. By strategically leveraging public rights-of-way within Columbus area, the Phase 1 build, supplemental conduit builds (as needed), as well as existing conduit and fiber within the community, Columbus can create a “world class” fiber-to-the-curb solution capable of serving the needs of the community into the future. Fiber-to-the-curb, in this instance, refers to constructing a solution that would facilitate the creation of an overall fiber optic backbone that, while residing in close proximity to community constituents (within approximately 1,000 feet), would not physically enter the location. From here fiber optic facilitates could be brought into locations with fiber requirements on an as needed basis and the cost of such would be passed on to the customer according to a detailed business model.

The components of a fiber-to-the-curb solution are the following:

- Conduit facilities to enable efficient and effective delivery of fiber optic facilities to community constituents;
- Telecommunication central office-type facilities for cross-connects and co-location; and
- A third-party (or parties) to own and operate the fiber optic facilities (for constituents that choose not to own and operate their own fiber optic facilities).

The following are community constituents that have been identified as potential fiber-to-the-curb users in the short- to near-term. These entities will ultimately drive the fiber-to-the-curb initiative early on.

- **Arvin Meritor.** There are multiple Arvin Meritor locations across Columbus that could benefit from a private metropolitan fiber optic network.
- **Columbus Regional Hospital.** There are multiple multi-tenant doctor’s office facilities throughout Columbus that could benefit from a private fiber optic network back to Columbus Regional Hospital.
- **Cummins.** There are multiple Cummins locations across Columbus that could benefit from a private metropolitan fiber optic network.
- **InfoTech Park.** The Park will continue to be home to multiple tenants with continuously growing requirements for advanced telecommunication infrastructure and service.



Clearly the most obvious first deployment of Fiber-to-the-Curb in Columbus should be in the InfoTech Park. Figure 3.6 illustrates an example conduit and handholes for such a deployment. More detail on this is available in the InfoComm Systems deliverable "Greater Columbus Conduit System Initiative".

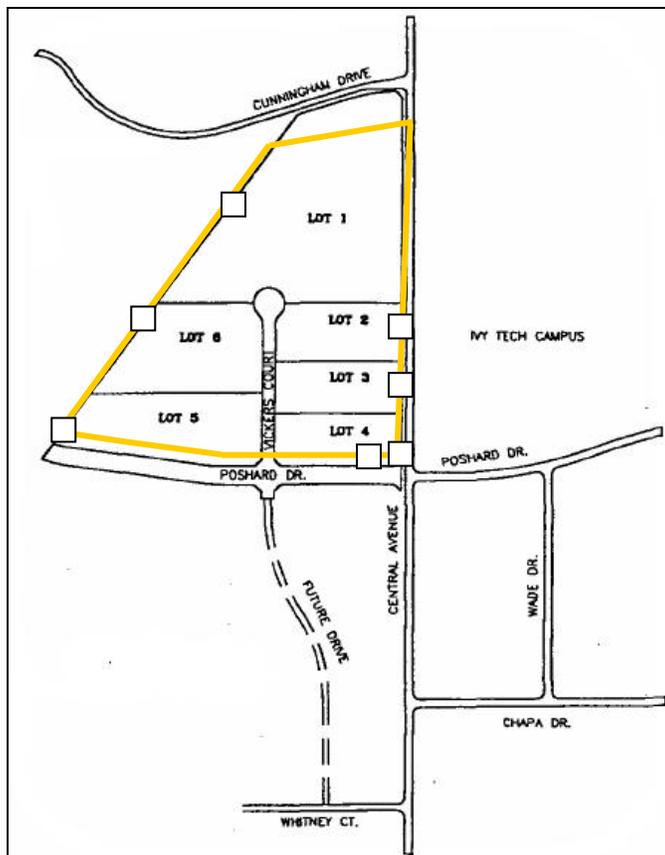


Figure 3.6. InfoTech Park Fiber-to-the-Curb Deployment.

Section 3.2.3.2. Rationale.

Strategically rolling out a fiber-to-the-curb solution will position Columbus to be well-recognized as a "world class" community. Such a solution will afford Columbus opportunities for competitive triple play services to community constituents by leveraging existing community assets, such as the Greater Columbus Conduit System and rights-of-way, to reduce the overall cost for a constituent to connect individually to fiber optic facilities.



Section 3.2.3.3. Budgetary Figures.

The following are high level cost estimates for the initial capital required to deploy Phase 3. The costs for a fiber-to-the-curb solution will be similar to that of the Phase 1 conduit build. Cost categories include:

- Four (4) inch conduit ducts for extending the Greater Columbus Conduit System
 - *Estimated at \$2.75 per foot per conduit duct, \$5.00 per foot labor*
- Three (3) inch conduit ducts for lateral runs to commercial, industrial, retail locations
 - *Estimated at \$3.00 per foot per conduit duct, \$5.00 per foot labor*
- Three (3) feet by five (5) feet by four (4) feet handholes for Greater Columbus Conduit System
 - *Estimated at \$700.00 per handhole, \$400.00 labor*
- Two (2) feet by three (3) feet by three (3) feet handholes for lateral runs
 - *Estimated at \$150.00 per handhole, \$300.00 labor*
- Central office facilities with heating, ventilation, and air-conditioning (HVAC) as well as uninterrupted power supply (UPS)
 - *Estimated at TBD based on size requirements*

Section 3.2.3.4. Revenue Creation.

- **Conduit Lease.** In exchange for access to conduit(s), the community would receive a monthly fee from the Internet service provider; and/or
- **Revenue Capture.** The community captures a portion of the revenue the telecommunication service provider generates by utilizing the conduit system

Section 3.2.3.5. Recommendation for Mayor's Technical Advisory Task Force.

The following detail recommendations for next steps associated with implementing the Phase 3, fiber-to-the-curb initiative.

1. Designate project manager and project team
2. Determine role of Mayor's Technical Advisory Task Force in this initiative
3. Identify potential early adopters to drive deployment
4. Identify second tier adopters that will solidify the deployment
5. Survey potential candidate areas and perform detailed network engineering
6. Secure potential partners and funding
7. Develop, administer, and manage contractor/proposal selection process
8. Select qualified contractor(s) and proceed with deployment



Section 3.2.4. PHASE 4: Fiber-to-the-Home (Residents).

Section 3.2.4.1. Description.

Building on the components and success of the Phase 3 fiber-to-the-curb solution, the Phase 4 fiber-to-the-home solution would offer “world class” triple play services to residents within the Columbus area.

Section 3.2.4.2. Rationale.

Not unlike the Phase 3 fiber-to-the-curb solution, the Phase 4 fiber-to-the-home solution will also continue to position Columbus as a “world class” community. Such a solution will help attract high end homes to the Columbus area and will serve those residents with bandwidth requirements only fiber optics can deliver (e.g. security systems, converged services).

Section 3.2.4.3. Budgetary Figures.

The costs for the Phase 4 fiber-to-the-home initiative will be similar to that of the Phase 3 fiber-to-the-curb initiative, the key difference being that Phase 4 addresses the residential component of the community.

- Four (4) inch conduit ducts for extending the Greater Columbus Conduit System
 - *Estimated at \$2.75 per foot per conduit duct, \$5.00 per foot labor*
- Three (3) inch conduit ducts for lateral runs to multi-family residential locations
 - *Estimated at \$3.00 per foot per conduit duct, \$5.00 per foot labor*
- Three (3) inch conduit ducts for backbone runs within residential locations
 - *Estimated at \$3.00 per foot per conduit duct, \$5.00 per foot labor*
- One and one-half (1½) inch conduit ducts for lateral runs to residential locations
 - *Estimated at \$0.75 per foot per conduit duct, \$5.00 per foot labor*
- Three (3) feet by five (5) feet by four (4) feet handholes for Greater Columbus Conduit System
 - *Estimated at \$700.00 per handhole, \$400.00 labor*
- Two (2) feet by three (3) feet by three (3) feet handholes for lateral runs
 - *Estimated at \$150.00 per handhole, \$300.00 labor*
- Central office facilities with heating, ventilation, and air-conditioning (HVAC) as well as uninterrupted power supply (UPS)
 - *Estimated at TBD based on size requirements*



Section 3.2.4.4. Revenue Creation.

Opportunities for revenue creation for the Phase 4 fiber-to-the-home solution will be similar to that of the conduit lease and revenue capture example in the Phase 3 fiber-to-the-curb solution.

Section 3.2.4.5. Recommendation for Mayor's Technical Advisory Task Force.

The following detail recommendations for next steps associated with implementing the Phase 4, fiber-to-the-home initiative.

1. Designate project manager and project team
2. Determine role of Mayor's Technical Advisory Task Force in this initiative
3. Identify potential sites/neighborhoods for initial deployment
4. Survey potential candidate areas and perform detailed network engineering
5. Secure potential partners and funding
6. Develop, administer, and manage contractor/proposal selection process
7. Select qualified contractor(s) and proceed with deployment

Section 3.2.5. PHASE 5: Inter-Community Fiber.

Section 3.2.5.1. Description.

Establishing a fiber optic connection with an adjacent technologically savvy community such as Indianapolis, Shelbyville, Bloomington, or Louisville could improve information transfer within the region as well as position Columbus to create a hub for telecommunication within south-central Indiana.

Section 3.2.5.2. Rationale.

Currently, through the Indiana Fiber Works network, fiber optic routes exist between these communities even today. As information transfer needs continue to increase over the coming years, Columbus and its neighboring communities will continue to realize the importance of improving telecommunication inroads into their communities. For example: A connection between such communities could be utilized by the community as a whole enabling redundancy for its telecommunication providers; cooperation among governments; and communication between hospital, fire, and safety organizations; to name a few

Section 3.2.5.3. Budgetary Figures.

Existing long haul fiber between two communities would typically be available for lease under an "indefeasible right for use" agreement. This agreement would effectively lease fiber optic strands to the community as well as set up a



maintenance and emergency repair and recover fee schedule for a term of typically 20-25 years. The route would be cost out on a per fiber per mile per month basis in the range of ~\$20.00 per fiber per mile per month.

Section 3.2.5.4. Revenue Creation.

Phase 5 will be driven by a community, state, or federal initiative and will likely be subject to some kind of shared cost for the route in question based on projected revenue or reimbursement from a specific business venture.

Section 3.2.5.5. Recommendation for Mayor’s Technical Advisory Task Force.

The following detail recommendations for next steps associated with implementing the Phase 5, inter-community fiber initiative.

1. Designate project manager and project team
2. Determine role of Mayor’s Technical Advisory Task Force in this initiative
3. Identify potential local initiatives to justify/fund construction
4. Identify potential candidate communities with initiatives to justify/fund construction
5. Work with candidate communities on joint initiatives to justify/fund construction

Section 3.3. Migrating Toward “World Class”.

Section 3.3.1. A High Level Plan for Implementation.

When preparing a high level implementation plan, it is important to first identify dependencies among the tasks to order the list sequentially. Table 3.1 documents dependencies between the aforementioned five phases of the multi-phase network design for creating a “world class” telecommunication environment.

Phase #	Phase Name	Dependent on Phase #
1	Greater Columbus Conduit System	
2	Wireless Columbus	
3	Fiber-to-the-Curb	1
4	Fiber-to-the-Home	1
5	Inter-Community Fiber	1

Table 3.1. Dependencies Among Phases.

Phases 3-5 all have dependences on Phase 1. As Phase 1 has already been identified by the Mayor and the Technical Advisory Task Force as the first phase of the 5 to implement, such a dependency should pose no problem. Moreover,



this does mean that Phase 1 must be complete prior to beginning Phases 3-5 and so on.

Phase 2 does not have dependencies on previous phases. This means that it can be completed in parallel with the completion of other tasks. As mentioned before, Phase 1 is currently underway. Since Phase 2 does not share any dependencies with other phases and because of the community's continued interest in wireless hotspots, it is recommended that the community move forward with this phase in concert with Phase 1.

Figure 3.7 illustrates the dependencies among the eCOLUMBUS initiatives.

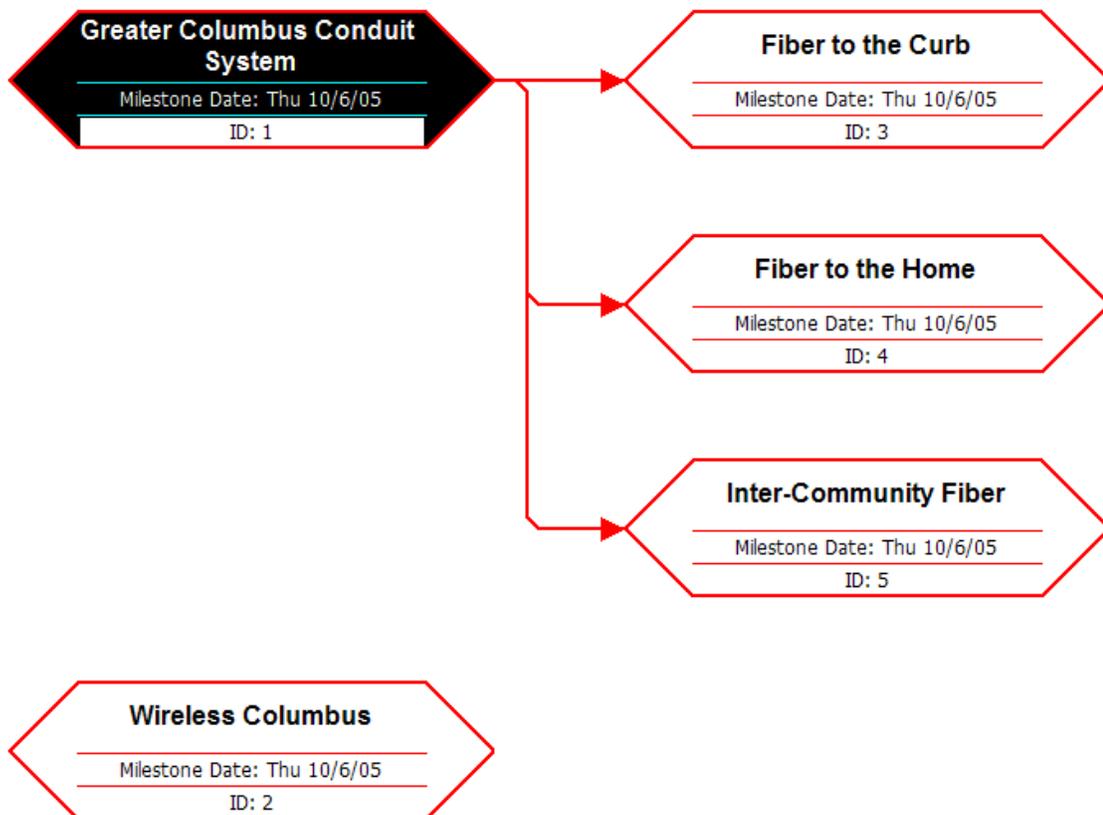


Figure 3.7. eCOLUMBUS Initiatives Gantt Chart.

Table 3.2 identifies a proposed schedule for start of each of the five phases of the multi-phase network design for creating a “world class” telecommunication environment. As stated earlier in this deliverable, it is important to continue with the inertia this effort has already generated up to this point. Keeping this in mind, the following schedule is constructed to be fairly aggressive.



Phase #	Phase Name	Start
1	Greater Columbus Conduit System	0-1 yrs
2	Wireless Columbus	0-1 yrs
3	Fiber-to-the-Curb	1-2 yrs
4	Fiber-to-the-Home	1-2 yrs
5	Inter-Community Fiber	3-5 yrs

Table 3.2. Proposed Phase Launch Schedule.

Section 3.3.1. Phase 1 Implementation.

As the Phase 1 one initiative moves forward toward launch, it will become more and more important to have a detailed plan for execution to ensure that it is implemented efficiently and effectively. Table 3.3 is a sample project plan for managing the Phase 1 implementation.

Task #	Task Description	Dependency	Complete By No Later Than
1	Confirm desired route		10/06/2005
2	Solidify business model	1	10/06/2005
3	Announce Phase 1 plan	2	10/06/2005
4	Prepare RFP for release	3	10/06/2005
5	Release RFP	4	10/10/2005
6	Collect and review RFP responses	5	10/21/2005
7	Recommend most qualified contractor	6	10/28/2005
8	Select contractor	7	11/04/2005
9	Settle contract and schedule for completion	8	12/04/2005
10	Complete construction	9	03/01/2006
11	Publicize completion of Phase 1 conduit	10	03/01/2006
12	Offer conduit services to community	11	04/01/2006

Table 3.3. Phase 1 Implementation Project Plan.



Section 4. Conclusion & Next Steps.

Through a careful reexamination of the Columbus telecommunication environment, the findings of this report yield that while progress has been made in improving the telecommunication infrastructure in the Columbus area, the vision of a “world-class” telecommunication infrastructure remains largely unfulfilled. The only way to move forward toward a “world class” telecommunication environment is to identify realistic goals for achieving “world class” and executing those goals according to a carefully detailed plan.

Through telecommunication service provider partners such as TLS and community constituents represented by the Mayor and the Technical Advisory Task Force, Columbus is poised for forward progress. It is the goal of this deliverable to serve as the vehicle or spring board that will move planning efforts toward execution and implementation. Five initiatives or phases were recommended herein to ensure Columbus will be recognized for “world class” telecommunication. These five phases are:

1. Greater Columbus Conduit System
2. A Wireless Community
3. Fiber-to-the-Curb (Commercial)
4. Fiber-to-the-Home (Residential)
5. Inter-Community Fiber

It will be through further development and careful execution that Columbus will enjoy success with each initiative. It is recommended that each initiative detailed herein be set aside and developed into an inclusive initiative that the community can support and reap the benefits of appropriately. Only then will Columbus achieve the “world class” status for its telecommunication infrastructure commensurate with its other “world class” attributes.

As Columbus continues to move forward with their pursuit of a “world class” telecommunication environment, it will ultimately be the responsibility of the community to brand and market itself according to this “world class” image. The underlying technology and services will provide the foundation for “world class” telecommunication within Columbus, but the public’s perception of this environment as “world class” will ultimately determine whether or not the overall effort will be a successful driver for economic growth. Appendix F details a list of marketing questions and answers to assist in creating the perception of a “world class” telecommunication environment for Columbus.



Appendix A. Columbus Area Towers.

The following section provides a list of available vertical real estate in the Columbus area. These sites could potentially be used to mount wireless radios of other hardware for data and voice networking. These sites consist of cellular towers, buildings, grain silos, and other facilities such as clock towers and air traffic towers.

Cellular Towers.

Docket Number	ID	Name	Prop Location	Representative	Jurisdiction	Approval
C/ZC-3-00-13	1	Cellular One Ind. 8 LLC	CR 550 W and CR 225 S (NW corner), Columbus, IN		City	Yes
C/ZC-12-98-1	2	Ameritech Wireless	2655 Central Ave., Columbus, IN		City	Yes
C/ZC-1-01-02	3	UbiquiTel	Jonesville Road, Columbus, IN		City	Yes
C/ZC-1-01-04	4	UbiquiTel	1621 California St., Columbus, IN		City	Yes
B/ZC-8-97-2	5	Ameritech Wireless	SW corner of 930N & 1075 E		County	Yes
B/ZC-8-97-1	6	Ameritech Wireless	1/4 mile west of CR 200 N & 325W		County	Yes
B/ZC-12-00-02	7	UbiquiTel	3271 W. 650 N., Edinburgh, IN		County	Yes
B/ZC-12-00-01	8	UbiquiTel	15204 S Ferguson Rd., Columbus, IN		County	Yes
B/ZC-9-95-6	9	GTE Mobilnet	N. 330 W., Lot 1, Rapp's Minor		County	Yes
B/ZC-12-98-1	10	Ameritech Wireless	10010 S. 100 W. / Tower Acres, Columbus		County	Yes
B/ZC-7-00-1	11	RSA Telecommunications	2016 S. CR 650 E., Columbus		County	Yes
B/ZC-7-00-3	12	Cellular One Ind. 8 LLC	15793 E. 800 N., Hope, IN		County	Yes
B/ZC-08-01-2	13	RSA Tele. dba Verizon Wireless	3271 W. 650 N., Columbus, IN 46240		County	Yes
C/ZC-2-02-7	14	UbiquiTel / Reising Radio Partnership	3095 Carr Hill Road, Columbus, IN		City	Yes
B/CU-01-03	15	Ronald and Helen Keller	North side of SR 46 just east of Brown County line	Southern Indiana RSA Limited Partnership	County	Yes (conditional)
B/DS-01-01	16	Keller	North side of SR 46 just east of Brown County line	Southern Indiana RSA Limited Partnership	County	Yes (conditional)
C/CU-00-03; C/DS-00-04	17	Arnholt	2016 South CR 650 East	Southern Indiana RSA	City	No



Docket Number	ID	Name	Prop Location	Representative	Jurisdiction	Approval
B/DS-00-05	18	Ronald and Helen Keller	North side of SR 46 just east of Brown County line	Southern Indiana RSA	County	No
B/CU-00-05	19	Keller	North side of SR 46 just east of Brown County line	Southern Indiana RSA	County	No
C/CU-00-03; B/CU-00-03; B/DS-00-02	20	Arnholt		Southern Indiana RSA	County	No
C/DS-00-04; B/CU-00-03; B/DS-00-02	21	Arnholt		Southern Indiana RSA	County	No
B/CU-00-03; B/ZC-08-01-2; C/CU-00-03; C/DS-00-04	22	Arnholt		Southern Indiana RSA	City	No

Other Facilities.

Docket Number	ID	Name	Prop Location	Representative	Jurisdiction	Approval
		Traffic Tower	Airport	Airport		Yes
		Clock Tower	Downtown	City	City	Yes
		Water Tower	Cummins 1			
		Church	First Christian	First Christian		
		Church	North Christian	North Christian		
		Church	St. Peters Luth.	St. Peters Luth.		
		Fire Tower	Mill Race Park			
		County Courthouse	Downtown	County	County	
		Silos	2 nd St.	Farmer's Coop		



Appendix B. Columbus Community Constituents.

The following is a list of community constituents plotted in Figure 4.4 and Figure 4.5. There are a total of 50 locations accounted for herein. This list is in no way all encompassing, but instead acts more as a guide for route location.

1. Arvin Meritor (x2 locations)
2. Bartholomew County Sheriff
3. Bartholomew County REMC
4. Central Middle School
5. City Hall & Police Station
6. Columbus North H.S.
7. Columbus Regional Hospital
8. Comcast
9. County Courthouse
10. County Government Building
11. Cummins (x4 locations)
12. Donner Park
13. Eastside Community Center
14. Economic Development Corporation
15. Fire Station (x4 locations)
16. Francis Smith Elementary School
17. Indiana Business College
18. Insight Communications
19. IUPUC
20. Ivy Tech
21. LHP
22. Library
23. Lillian Schmitt High School
24. Lincoln Park
25. Lincoln School
26. McDowell Adult Education Center
27. Mead Village Park
28. Mill Race Park
29. Northside Middle School
30. Parkside Elementary School
31. Post Office
32. Q.G. Noblitt Park
33. REMC
34. Richards Elementary School
35. Rock Ford Park
36. Sadler Park
37. Sandcrest Family Medicine
38. SBC
39. St. Bartholomew High School
40. The Chamber of Commerce
41. The Commons
42. TLS
43. Visitors Center



Appendix C. Technical Advisory Task Force Membership.

Table C.1 documents the current membership of the Mayor’s Technical Advisory Task Force.

Arvin Meritor	Mark McHolland Bud Phillips
Bartholomew County	Jim Hartsook
Bartholomew County School Corporation (BCSC)	Mike Jamerson
City of Columbus	Oakel Hardy Mayor Armstrong
Columbus Regional Hospital (CRH)	Tim Tarnowski Audry Tyree Steve Baker
Cummins	Mike Gallant Chris Price
Economic Development Board	Brooke Tuttle
IUPUC	William (Bill) Fields Paul Weathersby
IVY Tech	Mark Farr
Irwin Financial	Beth Stroh

Table C.1. Technical Advisory Task Force Membership.



Appendix D. Public Rights-of-Way Resolution Examples.

This section provides an example of public rights-of-way resolution designed to ensure that conduit infrastructure is placed in projects that require use of city easements. Additionally, the following are examples of public rights-of-way ordinances, agreements, and resolutions developed to leverage rights-of-way across the country.

- City of Alma, MI
<http://www.ci.alma.mi.us/ordinances/Ordinance%20No.%20642.htm>
- Randor Township, PA
http://www.radnor.com/government/documents/rights_of_way/Public%20Rights-Of-Way%20Ordinance%201.htm
- Austin, TX
<http://www.ci.austin.tx.us/telecom/stdord1.htm>
- Mobile, AL
<http://www.apwa.net/documents/organization/MobileROWOrdinance.pdf>
- Port Angeles, WA
<http://www.mrsc.org/ords/p54o3083.aspx>

A RESOLUTION OF THE YOUR_TOWN BOARD OF PUBLIC WORKS & SAFETY (“BOARD”) REGARDING ECONOMIC DEVELOPMENT THROUGH TELECOMMUNICATIONS INFRASTRUCTURE MANAGEMENT

WHEREAS, since 1996, the city of YOUR_TOWN has partnered with and supported the efforts of the YOUR_TOWN Economic Development Corporation (YTEDC) for the benefit of YOUR_TOWN, and its residents; and,

WHEREAS, the United States Department of Commerce has affirmed that Economic Development “is fundamentally about enhancing the factors of productive capacity – land, labor, capital and technology – of a national, state, or local economy. By using its resources and powers to reduce the risks and costs which could prohibit investment, the public sector often has been responsible for setting the stage for employment generating investment by the private sector;” and,

WHEREAS, the Center for Economic Policy Research has identified that after evaluating twenty-one countries over a twenty year period there is a “significant positive causal link” between telecommunications infrastructure and growth; and,



WHEREAS, cities have a long-standing history of developing public policies and strategies to address the needs of community constituents in the traditional areas of housing, water, sewer and transportation, with such policies remaining consistent and applicable whether the entity installing, offering or managing the governed service is a public or private entity; and,

WHEREAS, with respect to the public Right of Way in particular, the next logical progression in the efficient management of public resources to promote and promulgate Economic Development would be the development and implementation of public policies and strategies with respect to our newest infrastructure: the telecommunications infrastructure; and,

WHEREAS, the YTEDC has taken a lead role in this area by commissioning and completing a Municipal Telecommunications Strategic Plan which provides insight and opportunities that would ensure community needs in the area of telecommunications are not only expressed effectively, but more importantly, addressed accordingly such that investment in telecommunications infrastructure is sustained at levels that will support continued economic growth; and,

WHEREAS, a strategic initiative of the Municipal Telecommunications Strategic Plan identifies the opportunity to install conduit in City-managed construction projects, such as Bike Trail construction, sewer/water main extensions, and road reconstruction projects, as the beginning efforts of a long range strategy to create fiber optic loops throughout the city and spur advanced telecommunications growth and market development; and,

WHEREAS, the Municipal Telecommunications Strategic Plan also identifies that a Lead Entity must be identified to coordinate activities.

NOW, THEREFORE, be it RESOLVED that,

Section 1: All City Departments and Municipal Utilities of YOUR_TOWN shall, in the planning and bidding stages of a construction project, include provisions through a bid alternate process for the installation of 4" round innerduct conduit as part of the project, complete with appurtenant hand-holds every 1000 feet, and in compliance with the technical specifications as provided by the local telecommunications Lead Entity.

Section 2: The resulting costs submitted for optional work associated with the innerduct installation shall be transmitted to the City Administration and the telecommunications Lead Entity for review and evaluation.

Section 3: The Technology Committee of the YTEDC will act as the temporary "Lead Entity", not necessarily as the implementer but as the facilitator, to coordinate activities and establish itself as the center through which all telecommunications related information flows, information from both public and



private organizations, such as the City YOUR_TOWN, YOUR County, State of Indiana, public safety entities, local service providers, etc., for the purpose of assessing resources, wants and needs in order to facilitate the development of collaborative initiatives involving multiple entities.

Approved by the **YOUR_TOWN Board of Public Works and Safety**, September 27, 2005

Attest:

President

City Clerk

Appendix E. Wireless, Recommended Reading.

The following article provides examples of communities that have community-based initiatives for deploying wireless telecommunication services. This article is relevant to the Columbus area because, like Columbus, these communities are deploying such infrastructure to improve the overall quality of life of their citizens.

Square Off Over Wi-Fi In The Town Square

Hundreds of local governments are building wireless networks-- but the telecom industry has taken issue.

By Elena Malykhina, InformationWeek

Sept. 26, 2005

URL: <http://www.informationweek.com/story/showArticle.jhtml?articleID=171200127>

Alexandria, Va., is steeped in the nation's history, with five museums and annual events that commemorate its prominent role in the French and Indian War. But when it comes to wireless technology, Alexandria is firmly planted in the present. Last month, the city launched the first phase of Wireless Alexandria, a free wireless network that covers several blocks that make up the city's Old Town area of shops, outdoor dining, and a marina. Alexandria's initial investment in the project, intended to serve tourists and others toting laptops and PDAs, was just \$14,000.00.

Another historical city about 150 miles north, Philadelphia, also plans to offer wireless service, but that's where the similarities end. Philadelphia is spending \$10 million on a 135-square-mile wireless network, to go live in about a year, that will provide residents and businesses with high-speed Internet access. Low-income residents will pay about \$10.00 a month for a subscription to the service. Small businesses, which often have difficulty affording wired broadband, likely won't pay more than \$20.00 a month per subscription, says Dianah Neff, the city's CIO. "Right now, they're locked out of that marketplace," Neff says.

And while Alexandria hasn't heard a peep from communications companies about its network, Verizon Communications Inc. last year tried to stop Philadelphia's plan. After negotiations between the city and Verizon in December that drew in Pennsylvania Gov. Edward Rendell's office, the governor signed a telecom-industry-backed bill requiring cities to get approval from their local phone companies to offer wireless services. As part of the deal, Verizon, the state's primary phone-service provider, agreed to let Philadelphia proceed with its plans. But other cities will face a tough test. "It doesn't make sense for [municipal]



governments to jump into the private sector where there are plenty of alternatives, good prices, and widely built-out technology," argues Link Hoewing, VP of Internet and technology policy at Verizon.

Dozens more cities across the United States have become battle zones, often because they want to offer wireless or wired Internet access at low prices, partly to overcome the "digital divide" that keeps poorer residents from getting online, and to encourage business development in rural outposts. Telecom and cable providers, including BellSouth, Comcast, Cox, Qwest, SBC Communications, and Verizon, have been lobbying Congress to stop the practice, claiming that there are plenty of affordable broadband services already available from private providers. Some of them are worried that free or low-cost providers will take away their existing customers. A number of states, including Pennsylvania and Virginia, have passed laws regarding municipalities' abilities to offer communication services--some with heavy restrictions. The issue has reached the federal government: U.S. Rep. Pete Sessions, R-Texas, recently introduced HR 2726, a bill that would prohibit municipal governments from offering telecom, information, or cable services, except in markets where such services aren't available.

While some municipalities have or likely will face telecom-industry opposition, hundreds more will proceed without roadblocks. These are the cities, towns, and villages that are building wireless networks that just cover several square miles and are designed for things such as tourism and public safety. Tropos Networks Inc. is a popular vendor among municipalities because its mesh networking technology extends the reach of a Wi-Fi signal by relaying it from one mesh router to another--an ideal setup for an outdoor network. Two hundred municipalities already have or are planning to build wireless networks using its technologies, Tropos says, and 220 more are expected in the next 12 months.

For the most part, technology vendors outside the telecom industry are encouraging and helping municipalities build wireless networks--even in instances where they might take business away from a telecom or cable provider. Intel has backed Philadelphia's efforts and recently started an initiative with 13 cities, called Digital Communities, to increase adoption of wireless technology. Cisco Systems, Dell, IBM, Microsoft, and SAP are among the vendors planning to provide software and systems for those cities.

Alexandria has managed to steer clear of any legal battles, as its project is tailored for outdoor use and has no impact on commercial Internet service providers. The telecom carriers also have left alone Jamestown, N.Y., which is building a wireless network intended for public safety. "Certain public functions, like connecting libraries, make sense for cities, and we don't oppose that," Verizon's Hoewing says.



Jamestown, a city of 31,000 people surrounded by rolling hills, has been piloting its Wi-Fi network since July. The network will cover Jamestown's downtown, which spans four square miles. Police officers and firefighters are using it with in-vehicle laptops to access critical information such as police and government records, mug-shot photos, and a sex-offender database, says Lt. Barry Swanson, the town's co-coordinator.

But even modest plans for wireless networks can attract the attention of telecom carriers. "Public safety is just the start--the network might prove excellent for commercial applications, too," Swanson says of the Jamestown project. Alexandria will evaluate the success of its wireless initiative with an eye to extending services to residents and businesses. The city hopes it can work cooperatively with telecom carriers on that goal, should it materialize, says Craig Fifer, the city's E-government manager.

In some instances, it makes sense for cities to go it alone. They often have the existing infrastructure to build wireless networks, such as street-light poles and government buildings where they can easily mount wireless equipment (carriers have to lease those facilities). But cities also face costs and challenges, such as creating systems and services for billing, maintaining, and servicing wireless networks.

Outsourcing the work and at least part of the infrastructure is one solution. Addison, Texas, tapped Internet service provider RedMoon Inc. to offer residential users a wireless Internet service for \$17.00 a month. (A state bill proposed last spring to restrict Texas municipalities' ability to offer communication services has since failed.)

Like Philadelphia, many municipalities see free or low-cost wireless access as a boon to businesses, particularly smaller ones. "It's more important to the smaller fish than the bigger fish who can afford it," says Hamid Khaleghipour, Addison's IT director. Addison is one of the Dallas area's most popular tourist destinations, with more than 170 restaurants, 22 hotels, and shopping. Restaurants can benefit from wireless by marketing themselves to tourists as places to have a great meal and check E-mail at the same time, Khaleghipour says.

Rio Rancho, N.M., deployed a Wi-Fi system in October to cover 103 square miles using equipment from Proxim Corp. and services from Azulstar Networks. "We're eager to have businesses come and locate here," says Peggy McCarthy, assistant to the city administrator. Rio Rancho wants to show businesses that "we're high-tech and ready to embrace innovation," McCarthy says. "They'll want to stay."

Even more cities are expected to go wireless if WiMax, the next generation of Wi-Fi, delivers as promised. Today, a wireless LAN can reach data speeds of more



than 50 Mbps over distances of a few hundred feet, while third-generation cellular has a two-mile reach and offers speeds of about 2 Mbps. WiMax promises data speeds of 70 Mbps over distances of more than 30 miles. That means a city could build a larger network with less equipment to deploy and manage. The market for fixed WiMax is expected to reach \$12.4 billion by 2010, according to WinterGreen Research. But there won't be standard WiMax equipment until early next year.

Rio Rancho is using Proxim's pre-WiMax system of several hundred transmitters that have been mounted throughout the city, which even works for cars traveling at speeds of up to 55 mph. For coastal cities, it reaches boats 15 miles offshore. St. Cloud, Fla., is deploying a pre-WiMax system to cover the 15-square-mile city. It plans to have the entire city covered using 300 mesh nodes from Topos this fall.

If WiMax and next-generation cellular become a reality, will the United States be filled with thousands of independent wireless networks? Or will they all interact somehow? Technology that could bring unity to municipal wireless networks--called an IP multimedia subsystem--is in the early stages of development. Carriers will likely use the subsystem in their networks to allow multiple types of networks, including cellular, Wi-Fi, and wireline, to talk to each other. First responders, for example, wouldn't have to restart applications every time they moved between networks, and network interference would decrease. The subsystem, however, won't be widely deployed for five to seven years, Forrester Research analyst Ellen Daley predicts. In the meantime, cities may have worked through their interference problems between neighboring networks as more municipalities deploy wireless.

One thing is for sure: Cities with ambitious wireless-networking plans aren't likely to back down on their vision of the future. "Our wireless initiatives are tied to our social program, designed to improve the lives of our underserved communities," Philadelphia's Neff says. "That's one thing the telecoms and the cable companies will never do for our cities."



Appendix F. Marketing Q & A.

This section provides insight into potential questions and answers regarding the Columbus telecommunication planning efforts.

Questions	Answers
1. What is role for the City of Columbus in the proliferation of telecommunication infrastructure and services throughout the community?	Columbus has pledged to assist in accelerating the creation of a “world class” telecommunication environment for the community, recognizing that it is a requirement for stimulating new economic development and retaining core Columbus businesses.
2. What is the Columbus definition for a “world class” telecommunication environment?	Columbus, through the Mayor’s Technical Advisory Task Force, has chosen to define their vision of “world class” with the following requirements: <ul style="list-style-type: none"> • Reasonably priced voice, video, and data services • Readily available network services • Redundant high bandwidth telecommunication network services • Highly reliable telecommunication infrastructure with no single points of failure • Multiple gateway options for connecting the Columbus area to other communities
3. What is the current state of telecommunication in the Columbus area?	While progress has been made in improving the telecommunication infrastructure in Columbus, the vision of a “world class” telecommunications environment for the community remains unfulfilled.
4. Is Columbus getting into the telecommunication service provider business?	No. The community has made it clear that this is an inclusive effort. The community has pledged to assist in lowering barriers for deployment of “world class” telecommunication infrastructure and services. It will be through partnering with service providers that Columbus will seek or cause to be built a “world class” telecommunication environment.
5. What specific tasks or initiatives has the community identified to accelerate the creation of a “world class” telecommunication environment for the Columbus area?	The eCOLUMBUS initiatives provide a roadmap for accelerating the spread of “world class” telecommunication infrastructure and services throughout the Columbus area. These five initiatives include: <ul style="list-style-type: none"> • PHASE 1: The Greater Columbus Conduit System • PHASE 2: Wireless Columbus • PHASE 3: Fiber-to-the-Curb (Commercial focus) • PHASE 4: Fiber-to-the-Home (Residential focus) • PHASE 5: Inter-Community Fiber
6. What is the timetable for implementing the eCOLUMBUS initiatives?	The following is an estimate for the deployment of the eCOLUMBUS initiatives: <ul style="list-style-type: none"> • PHASE 1: 0-1 yrs • PHASE 2: 0-1 yrs • PHASE 3: 1-2 yrs • PHASE 4: 1-2 yrs • PHASE 5: 3-5 yrs