Telecommunications Study and Municipal Network Business Plan for

City of Kirkland

Kirkland, Washington

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Foreword

City leaders of Bellevue and Kirkland have expressed interest in developing their communities as "smart" cities – both for the health of the community and for economic development reasons. Competition, accessibility to connectivity options and reasonable pricing are factors in evaluating where a community stands relative to long-term competitive position and overall health. They have also consistently expressed a desire to leverage community assets for the benefit of the community.

There is little doubt that each city could use a municipal ring to lower its own ongoing telecommunication costs. The larger question is how the cities could leverage a municipally owned network to benefit the community at large through wholesale service to businesses or actual service to residents. A growing number of cities and counties across the country have found that providing stable, high quality telecommunication service is now viewed as critical infrastructure (e.g., water, sewer) rather than a discretionary service.

As a result, the City of Bellevue and the City of Kirkland have partnered in a joint process to evaluate independent and joint options that can optimize opportunities for mutual long-term gain. This plan is a result of that effort and evaluates options and potential partnerships.

This report, the supplemental report, and other material provided during the plan development—

- Summarizes the economic, political and regulatory environment and their impact on building and running a municipally owned network.
- Identifies opportunities for partnership and leveraging investment between the two cities and potentially other geographically adjacent jurisdictions, entities and private sector partners.
- Reviews different business model options, their viability, and what benefits are required to obtain a reasonable return on investment (ROI).
- Reviews what other public organizations have done and what services they provide.
- Assesses current networking technologies.
- Provides insights on how to manage the network.
- Reviews and recommends financing options.

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Telecommunications Study and Municipal Network Business Plan

Mission and Objectives Statement

We developed the following mission statement to guide development of the plan:

"Enhance quality of life, public safety, economic development, and city services in Kirkland by optimizing the use of communications infrastructure (e.g., conduit, fiber)."

To accomplish this mission and guide plan development, we created the following objectives:

1. Identify gaps between demand and availability of high-speed Internet services (document availability).

2. Identify service gaps that high-speed communications could fill.

3. Understand the role of advanced communications in economic development and community building.

4. Explore partnership opportunities.

5. Explore options to create an environment where affordable and accessible high-speed technology is used to support and enhance citizen and business interactions.

6. Review the appropriate role for each city and highlight what roles other municipalities have played. Identify the differences and commonalities between the two communities.

7. Investigate last mile options and evaluate costs.

8. Identify the benefits of providing basic connectivity throughout the community and developing infrastructure that can be scaled to a regional ubiquitous network.

9. Provide policy decision framework for use by City Councils in making decisions.

10. Provide cities with detailed financial analysis of two or three options for building and/or running a municipal network (data/voice/cable/other).

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Telecommunications Study and Municipal Network Business Plan

1. Executive Summary

This report highlights our findings, outlines potential business models, and offers recommendations for consideration. It includes an evaluation, cost estimates, and benefit analysis of selected models. For readers interested in reviewing the results of the complete evaluation process, a supplemental report is available from the Information Technology Department. The supplemental report includes information on technology trends, competitive assessment, market assessment and regulatory assessment.

1.1 Insights from the Surveys and Interviews

The interviews and surveys were of significant value in framing stakeholder perceptions, highlighting potential opportunities, and identifying connectivity efforts to date. A common theme across the interviews was the desire for and recognition of the benefits of collaboration among schools, governments, hospitals, and other public sector entities and institutions. The interviews and surveys indicated that support was mixed for Kirkland offering connectivity services (retail or wholesale) to businesses or residents. Some respondents felt that adequate connectivity services are available and affordable in the region and questioned the appropriateness of public sector involvement in the provision of these services. Others felt that public sector involvement was appropriate but emphasized that any retail or wholesale offering is best structured as an alliance or partnership between the public sector and private sector.

Specific insights and observations include[1]:

- Support of community-owned connectivity services varies with the expected financing:
  - If the venture was supported only with subscriber revenues.
  - If the venture required additional tax support.

- Other communities may claim to be the most wired; however, we suspect the use of high-speed services is considerably higher in Kirkland.
  - Approximately 92 percent of residents have Internet access, of which 65 percent use a high-speed option. Note: Nationally, approximately 55 percent of residents have Internet access, of which 20 percent use a high-speed option.
  - Approximately 81 percent of businesses have Internet access, of which 95 percent use a high-speed option. Note: Nationally, approximately 80 percent of businesses have Internet access, of which 50 percent use a high-speed option.

- Many of the interviewees were intrigued with the possibility of having wireless “hotspots” or “hot zones” in public areas. The survey respondents also expressed an interest, but it was not as strong:
  - Thirty (30) percent of residences and 48 percent of businesses indicated an interest in a public wireless network.
  - Thirty-four (34) percent of residential respondents indicated they have a laptop computer. These are the users who would likely see the most immediate benefits from public “hotspots” or “hot zones.”

[1] See the supplemental report (Section 4 and Exhibit I) for complete details and analysis of the surveys and interviews.

- Support for online video monitoring in city spaces was mixed. Some respondents expressed concern about a perception of the cities becoming "big brother" and the possibility of providing too much information to the general public. Other respondents however, mentioned benefits such as being able to view schools for security and checking to see whether the parks have activity (i.e., other children to play with).
  - The use of security systems, although high, is not overwhelming.
  - Seventeen (17) percent of residences and 26 percent of businesses subscribe to security monitoring services.
- The University of Washington is actively engaged in encouraging the extension of and actually extending high speed connectivity throughout the area. The University is not in a position to unilaterally implement high speed connectivity to all the points which the University would like to see linked. They strongly believe in partnerships and look for partners able to make real investments in planned projects. The University feels that high speed links can and should be put in place in advance of need. They have seen many cases where the fact that high speed links were in place allowed linked entities to take part in leading edge projects that were not on the planning horizon when the high speed links were implemented. The University is very interested in establishing an ongoing dialog in order to gain a better understanding of the area's needs and to do a better job of communicating the University's plans to the area.
- Each of the three[2] K–12 school districts in the region see benefits in connecting their schools with fiber links and would like to have them. The desire for fiber links is not driven by cost avoidance but by the desire to support new applications. The performance of the T-1 links that currently connect the schools limits the type of applications that can be supported within and between the schools. Lake Washington and North Shore districts are actively pursuing the goal of connecting each of their schools with fiber. All three of the districts also saw potential benefits in fiber interconnection between the K–12 districts and the community colleges. In addition, the high schools (specifically) are very interested in having video monitoring fed to the police stations. A possible constraint is that building a network leveraging existing school fiber links may restrict the future connection of private sector sites to the network due to legal issues.
- The State of Washington's Senate Bill 6598[3] signed by Governor Gary Locke in March may indirectly impact the available alternatives or partnerships that Bellevue or Kirkland can consider. The bill which passed unanimously by the Senate and the House regulates the provision of wholesale telecommunication services by public utility districts. Indirect impacts range from the potential to spur legislation directly regarding municipalities to new interpretation of pole attachments and rights-of-way access.
- The community colleges (CC) have fewer facilities (locations) than the K–12 districts, but still desire fiber connectivity. Both community colleges felt the need to connect to the University of Washington (UW), the Center for Information Services (CIS), selected high schools, and potentially the medical centers. In addition, Lake Washington CC is planning to open a satellite facility in Redmond within the next 12 months, and they would very much like to connect it to their primary site via high-speed links.

[2] Bellevue, Lake Washington, and North Shore.
[3] See Section 5 of the supplemental report for additional detail.

- Overlake and Evergreen Hospitals desire connectivity between their facilities, to the residents of University of Washington, and to the community colleges. In addition, both hospitals see benefits in providing more affordable broadband connections to clinics and doctors' offices. However, since Evergreen and Overlake are public institutions, they cannot financially support a connection to a specific physician's office or the physician's Internet connection.
- Service from commercial wireless carriers (cellular and PCS) is unreliable due to significant coverage area gaps and dropped calls during handoffs between cell sites.
- A common concern is the availability of adequate capacity on a given link, not the basic availability of the connectivity service. The data rates currently offered by existing "high-speed" service providers are not considered adequate to support the desired mix of applications. Lack of adequate capacity currently constrains the types of applications that a given organization can pursue.
- Puget Sound Energy (PSE) has a contract for its electric meters to be read over a radio frequency (RF) network built and operated by an outside provider (CellNet Data Systems[4]). This network uses a licensed 928/952 MHz frequency, generally considered to be effective at penetrating structures, but at this frequency the network has issues sending and receiving data through pine foliage. Experience to date shows that between 80 and 90 percent of all meters can be read via the wireless link. The remaining meters have proven difficult to read via this wireless network despite the relatively low data throughput rate required.
    - A wireless Internet offering running at broadband speeds is likely to have even poorer propagation characteristics than this low data rate implementation. PSE's real-world experience was taken into account in the conceptual design for a broadband wireless offering.
    - The original provider of this service (CellNet Data Systems) was aggressively pursuing the option of offering an expanded mix of monitoring services over their network five years ago. Activities not only included the sale of meter reading services but product development in partnership with Honeywell that was aimed at home security and other sensor monitoring offerings. Contracting water meter readings and other monitoring services with Atos offers a potential opportunity for operational cost savings without a substantial capital investment.
    - PSE is interested in Broadband Power Line (BPL) technologies but is skeptical of whether it would be a viable business model. The question is this: Given the demonstrated difficulties with ubiquitous RF propagation, can BPL be used instead of, or as augmentation to, a wireless approach? We agree with PSE's concerns. At this time, BPL is not ready for deployment (see Section 2 of the supplemental report for additional detail).

[4] A division of Atos Origin, a French-based corporation.

1.2 Business Models

Based on market research, the City of Kirkland can optimize the benefits to citizens by completing the connection of specific public sector sites and facilitating new services by private providers[5] rather than attempting to provide ubiquitous access or retail services. Potential benefits extend beyond the City of Kirkland. The results of our interviews suggest that meaningful additional benefits are attainable by implementing a regional connectivity infrastructure to support education and health applications.

Each model is intended to address the stated mission, take into account potential partnerships and alliances, and meet specific and identified goals. The models are—

1. **Municipal sites.** This fiber optic network would link public facilities within Kirkland that are currently supported by low bandwidth connections or those that have no connection.
2. **Regional "network of networks."** Such a network would make use of existing and additional fiber links to provide high-bandwidth connections between key institutions and organizations (schools, hospitals, other) identified by the city. Because of the unique properties of a high-bandwidth connection, we see exciting opportunities for public sector entities to deliver new and innovative services to the community.
3. **Public use wireless hotspots and hot zones.** At locations defined by the city, wireless connectivity would be made available to members of the community. The identified locations would include public traffic areas, business districts, shopping malls, and public parks. The technology proposed uses readily available software and hardware currently being built into new laptops. Extending existing city connectivity to public spaces would create a community resource that could provide a more enriching experience at these sites.
4. **Wireless Network Model.** The primary purpose of a complete coverage network is to facilitate access to broadband communications for municipal operations[6] and public safety agencies. In addition, a network of this type could allow the city to explore new and more efficient ways of using connectivity to deliver services and potentially reduce the cost of municipal operations.

As we have indicated, we do not recommend the City of Kirkland pursue a retail connectivity business model. The models we recommend are ones that would further develop and enhance the available infrastructure. For each of these models, we present potential benefits; however, please note that the infrastructure itself does not provide direct benefits. The infrastructure facilitates new applications and refinement of existing applications. In other words, the infrastructure enables the applications, and the applications enable the benefits.

[5] By addressing market entry barriers, promoting regulation, and seeking alliances where appropriate.
[6] Mobile access to city networks, inspection records, information systems, e-mail, and other resources.

1.3 Infrastructure Deployment and Operational Costs

The City of Kirkland already has a Cities–Schools Fiber Optic Network Project underway that has been developed by a consortium including the City of Kirkland, the City of Bellevue, Lake Washington School District, and the University of Washington. This project is designed as a sequence of seven segments to be implemented over time. Three of the segments are for the most part in place, and work is actively underway to implement additional segments. We commend consortium members for an excellent approach to helping each other expand access to high-speed connectivity. Our recommended models take into account the availability of fiber-optic links that have resulted from the cities and schools project, and our designs assume that the appropriate segments of the project are in place.

The models can be implemented separately; however, the cost estimate of each assumes that the preceding model has been completed.

Table 1-1 provides an outline of the overall cost estimate to implement and maintain each model.

Table 1-1: Deployment and Operating Costs

Model	Implementation Cost (Includes Engineering and Project Management ($000)	Annual Operating, Maintenance, and Finance Cost (Year 1)	
		If Implemented With General Funds ($000)	If Financed with General Obligation Bonds ($000)
Municipal Sites	57.9	2.3[1]	10.2
Network of Networks	284.3	38.6[2]	74.6
Wireless Hotspots	500.3	119.9	177.8
Wireless Network	2,327.4	482.6	798.8

[1] Cost offset by an estimated $18,240 in cost avoidance of T-1 circuits.
[2] Cost will be reduced by an estimated $4,600 annual payments from partners.

Of the $58,000 implementation cost for the municipal sites model, $60,000 has already been budgeted. Therefore, no budget increase is needed to implement this model. Previously budgeted amounts and potential contributions from partners reduce the net cash needed for the network of networks model to $214,000.

As shown in Table 1-1, there are benefits with a coordinated deployment with the City of Bellevue. The potential coordinated benefits are shown in Table 1-2.

Table 1-2: Benefits of Coordinated Deployment with the City of Bellevue

Model	Benefit
Municipal Sites	• Knowledge sharing
Network of Networks	• Expanded connectivity, which increases the range of applications that can be supported • Sharing of responsibilities for locations and other management (staff reduction/avoidance)
Wireless Hotspots	• Sharing of Internet access point expenses • Joint purchasing, which increases volume with vendor • Reduction of required hot-standby equipment and spaces • Coordinated application development and testing
Wireless Network	• Same benefits as listed in wireless hotspots • Increases in benefits to potential private partners (increased footprint) • Sharing of administrative and support staff • Sharing of Network Operating Center (NOC) functions

1.4 Projected Benefits

We do not recommend pursuit of a retail services model. Therefore, we do not project new revenue streams to offset implementation, operational, and maintenance costs. Benefits of any of the models presented range from cost avoidance, operational improvements, to economic development. The type of benefits for each model is shown in Table 1-3. Additional examples are provided in each model's section of this report.

Table 1-3: Benefit Overview

Model	Example Benefit Type
Municipal Sites	• Completes conduit loop, allowing redundant paths. • Allows fiber extensions while minimizing need for excavation in streets.
Network of Networks	• Addresses need identified by Bellevue School District (increase capacity which allows next application). • Enhances ability of regional public sector entities (schools, hospitals, cities, etc.) to aggregate connectivity services (reduced costs).
Wireless Hotspots	• Enhanced economic development. • Foster improvements in city employee productivity. • Enables the ability of remote video monitoring.
Wireless Network	• Ability to provide remote video monitoring throughout the community. • Expanded economic development benefits. • Cost avoidance of leased services (data terminals) while increasing capacity and performance.

1.5 Opposition and Partnerships

Each model presents varying levels of potential opposition and partnership opportunities to enhance potential community benefits. Table 1-4 presents an overview, and additional detail is provided in each model outline.

Table 1-4: Opposition and Partnerships

Business Model	Opposition	Partnerships
Municipal Sites	• Limited	• Lake Washington School District • City of Bellevue
Network of Networks	• Telecommunication carriers	• Lake Washington School District • City of Bellevue • Hospitals • Schools (K-12 and higher education)
Wireless Hotspots	• Hot spot providers	• Lake Washington School District • City of Bellevue • Existing Internet providers • Businesses near or in zones • Equipment vendors
Wireless Network	• Existing Internet providers • Existing wireless Internet providers • Retail telecommunication providers • Cellular carriers	• Lake Washington School District • City of Bellevue • Potential providers of Internet and connectivity services • Equipment vendors

Partnerships include not only contracts and other legal arrangements for access, but a range of cost savings alternatives as well.

- Access to city connectivity infrastructure may:
  - Reduce market entry barriers for new provider entrants
  - Allow existing providers to expand service area without the need to expand infrastructure
  - Allow new services, such as high-speed Local Area Network (LAN) connectivity, that are currently not available
  - Reduce cost of service to Kirkland citizens and businesses
  - Encourage new application development by area hospitals and educators

- Education efforts regarding available connectivity services may:
  - Facilitate economic development efforts
  - Reduce citizen and business frustration in acquiring connectivity services
  - Allow exiting providers to improve their image and customer service

- Deployment and implementation of new infrastructure technologies may:
  - Encourage equipment vendors to provide discounts in exchange for promotion rights
  - Enable vendors to use deployment as a test site for new product and feature development

1.6 Summary and Recommendations

The decision to pursue any of the outlined models cannot be made on a direct measurable return on investment (ROI) or other financial initiatives. Why? Because proposed infrastructures do not enable benefits directly; rather, infrastructures facilitate applications that drive benefits.

In terms of examination of risks, opposition, and benefits, the first three models (municipal sites, network of networks, and wireless hotspots) clearly fill identified gaps, are likely to see limited opposition, and have a high probability of success. The last model, the wireless network covering the community, offers the greatest benefit potential (public safety) but also presents the greatest technical and financial risk. In addition, discussion of enhancing citizen access will draw out the argument of unfair competition, even if fee-based retail services are not offered.

We recommend that the City of Kirkland pursue the first two models and consider a phased implementation of the wireless hot spots.

1. Municipal Sites: Complete the fiber optic connections to identified locations.
2. Network of Networks: Continued coordination with the schools and medical community provides citizen benefits and creates a platform to encourage private-public partnerships.
3. Wireless Hotspots: Select one to two public locations to deploy free hot spot access. This pilot will test public use and benefit, better understand potential opposition from providers, and facilitate partnership discussions and development. Following a successful pilot, then implement the remaining hot spot locations.

Although deployment of a city-wide wireless network is possible technically, the vendor offerings are early in the development stage. In the next 18 to 24 months, equipment costs are likely to decline and industry standards will more fully evolve.

2. Municipal Sites Model

2.1 Goal

This model consists of installing a fiber-optic network that will link city facilities currently supported by low bandwidth connections or those that have no connection.

2.2 Recommended Direction

Seven facilities are currently served by T-1 lines, and six locations have no high-speed connectivity. Of these facilities, six have a connectivity improvement plan in place or will not be connected. These facilities are—

1. Station 26: Plan in place
2. Station 27: Plan in place
3. Rose Hill Facilities: Plan in place
4. Station 24: Do not connect
5. Station 25: Do not connect
6. Forbes House: Plan in place

The remaining facilities are considered for extending to—

High Priority
1. Station 21
2. Station 22
3. Heritage Hall
4. McAuliffe Park

Low Priority
5. Kirkland Pool
6. Teen Center
7. Kirkland Performance Center

2.3 Conceptual Design

Each of these facilities is near an existing fiber-optic backbone location. Additional fiber-optic infrastructure will be run from the nearby fiber-optic access point to each facility.

2.4 Cost Estimate and Operating Considerations

The cost estimate to complete the links to the identified city facilities is $57,900 (including engineering).

- Annual maintenance (including spares) is estimated at 4 percent of the total installed cost.
- No incremental staff is required to manage the network.

- Internal funds are used to finance the project.
  - Already budgeted: $60,000 (in Information Technology CIP)
  - Additional cash requirement: None (beyond what has already been budgeted)
- Net cost avoidance for T-1 and other connectivity is estimated at $18,240 per year.
- A replacement reserve account is established to build reserves for network replacements. A 50 percent reserve is created.

Given the above assumptions, the City of Kirkland will realize approximately $13,000 in annual savings.

2.5 Possible Other Participants and Partnerships

The City of Bellevue and the Lake Washington School District are active partners in connectivity municipal sites and resource sharing. We were unable to identify any additional agencies near the fiber that could contribute to the cost of network connections.

2.6 Benefits

Fiber-optic infrastructure to these locations can provide enhanced capabilities and reduce operating costs. Some of the capabilities include:

- Better use of centralized servers and support for desktop devices through faster connections.
- Reduced cost through the use of Voice Over Internet Protocol (VoIP).
- Video surveillance of parks and facilities.
- On-demand training for Public Safety employees.
- Increased redundancy with less dependency on utility-provided infrastructure.

The avoided costs for the 6 T-1s is approximately $18,240, which is $13,000 per year greater than the estimated incremental operational and maintenance cost.

2.7 Barriers to Implementation

The only barrier we identified is the cost and effort of installing the fiber-optic infrastructure.

Existing telecommunications, Internet, or other connectivity providers are unlikely to oppose a municipal fiber effort supporting internal city needs.

2.8 Financing

Use of city reserves is recommended.

3. Regional "Network of Networks" Model

3.1 Goal

This model makes use of existing fiber and implements additional fiber links to create a "network of networks," linking specific public sector organizations. These high-speed fiber links would support the concept of a "smart city" by linking key institutions and organizations while leveraging community intellectual resources and technical skill sets.

The "network of networks" would provide a mechanism by which each of these municipal networks could be interconnected using a high-capacity link.

3.2 Recommended Direction

Our conceptual design is based on identified connectivity "gaps" where connections do not exist or where existing connections have limited capacity. The existing networks of the identified organizations support their internal needs. An interconnecting network for the following organizations are proposed for the "network of networks" links:

1. City of Bellevue
2. City of Kirkland
3. Evergreen Hospital
4. Lake Washington School District
5. Lake Washington Technical College

Please note that the proposed location for the City of Bellevue's network of network models is complementary. To maximize the potential benefits, it is important that both the City of Kirkland and the City of Bellevue implement their portion of the network of networks.

3.3 Conceptual Design

Fiber-optic cable would be extended from existing locations to each of the identified facilities.

Through a link between the Kirkland and Bellevue City Halls, the Lake Washington School District and Bellevue School District would be linked with each other and the University of Washington.

The Lake Washington Technical College can be connected using two possible routes. The north route would link the college to the fiber-optic network at Evergreen Hospital. The south route would take the fiber to a junction point in the existing fiber-optic backbone.

The fiber-optic network would be constructed in a logical star topology. The Kirkland City Hall would form the center of the network, and each facility would have at least two fibers. The network would use a combination of existing and new underground duct and fiber. Approximately 27,000 feet of fiber would be required to link these facilities, with all of the fiber placed in existing or new duct.

3.4 Cost Estimate

The cost of implementing the network of networks model is $284,300. In addition to the implementation costs, we project that annual internal revenue is required to maintain the cash flow of the connectivity enterprise. The internal revenue requirement is $34,000 in year 1, increasing to $42,800 in year 5.

- Annual maintenance (including spares) is estimated at 4 percent of the total installed cost.
- A 1/4 Full-time Equivalent (FTE) staff is required to handle the network coordination, increased locates, and other network administration.
- Internal city funds are used to finance the project.
  - Partner contributions: $20,000
  - Previously budgeted: $50,000
  - Additional cash requirement: $214,000
- Each non-city participant will annually contribute 2 percent of the total implementation cost of the site.
- A replacement account is established to build reserves for network upgrades. A 25 percent reserve is created ($7,100 per year).

3.5 Possible Other Participants and Partners

This network will have the capability to be expanded to additional participants using several approaches. Subject to security considerations, the network can be expanded to cover the campus surrounding each facility with a number of wireless approaches. See Section 2 of the supplemental report for further details on wireless systems.

As indicated in the Lake Washington School District, City of Bellevue, Evergreen Hospital, and education centers are key partners. In addition, partnership opportunities with non-profits, chambers, and other organizations with a need to connect to facilities within the region may surface over time.

3.6 Benefits

The benefits of this type of network structure include:

- Ability to share information between local organizations. In particular, the city, schools, colleges, hospitals and the UW could achieve cost savings by reducing transportation costs of people and information between locations.
- Connection of facilities may reduce inventories and staff by connecting users and sharing resources.

- Provision of a platform to pursue enhanced future services such as IP telephony, video conferencing and distance learning.
- Ability to serve as the backbone of a consortium to gain high-speed access to the Internet beyond that which would be affordable to each organization on an independent basis.

The real benefits of this type of network would come from the applications that the network would enable. The network itself does not provide the benefit to the end user. The specific applications are unknown today but can only become useful when a network is in place given the number of participants and the long-term benefit.

3.7 Barriers to Implementation

The key barrier to implementing this network is the effort and expense of installing the fiber-optic infrastructure. Additional duct space and fiber must be installed to link the facilities with the existing fiber cable backbone network.

Deployment of the network of networks model is likely to draw opposition from Qwest, Verizon, and other telecommunication carriers. Although the City of Kirkland is not offering retail services, the access provided would reduce the number of T-1 and other services acquired from telecommunications providers. In this case, their opposition would not be based on competitive concerns but lost business to public sector sites. To date, opposition based on lost revenue from public sector sites has had little success. The telecommunication carriers such as Qwest have actually lobbied state legislations to offer restrictions on how municipalities can use their infrastructure. We expect that initiating the Network of Networks model will spur this political debate.

We believe the City of Kirkland would not be required to obtain a Competitive Local Exchange Carrier (CLEC) license for this or other models presented in this report.

3.8 Financing

Internal funding from the city is the likely first option for funding the network.

Grants are also a possibility; however, many grants are more directed toward application development rather than infrastructure.

4. Public Use Wireless Hotspots/Hot Zones Model

4.1 Goal

This model proposes that the cities extend existing city connectivity by means of wireless technology to unserved public spaces. Public access to wireless connectivity would significantly enrich a visitor's experience to these sites. An increased sense of community may be an unexpected byproduct of wireless connectivity in public spaces.

This model also recommends the cities develop wireless hotspots and hot zones in the areas identified by the City. The identified locations include: public traffic areas such as the downtown business district, shopping malls, public parks, and other areas where wireless access can be provided to support public Internet access. The candidate hot zones identified include:

1. Juanita Beach Park
2. Juanita Bay Park
3. Crestwoods Park
4. McAuliffe Park
5. Peter Kirk Park
6. Marina Park
7. Houghton Beach Park
8. Woodlands Park
9. Downtown Business District
10. Rose Hill Business District
11. Totem Lake Center District
12. Houghton Business District
13. Juanita Business District
14. North Kirkland Community Center

4.2 Recommended Direction

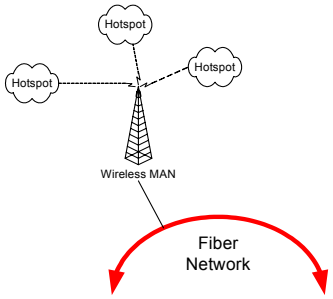
To deploy the wireless hot spots, having fiber near the access is required. Augmenting the existing fiber-optic infrastructure allows expansion of the wireless hot spots.

The starting point for this model is to deploy wireless access in one or two public areas. This will allow monitoring of use and judging citizens' acceptance of the offering prior to making a substantial investment.

4.3 Conceptual Design

The proposed design uses a three-step architecture (see Figure 4.1).

1. A fiber-optic backbone would distribute large amounts of bandwidth to key locations throughout the city. The existing fiber-optic infrastructure would be augmented with new fiber in selected locations.
2. The Level 1 wireless system would provide high bandwidth connectivity (about 20 megabits) through a series of point-to-point wireless links to the Level 2 hotspots and hot zones. The Motorola Canopy equipment has been selected for the analysis because it appears to offer the best support for connectivity in the Kirkland environment.
3. A local 802.11-based wireless system would provide the actual hot zones. This standards-based approach would provide wireless connectivity to the public using common software and wireless components such as those built into the new laptops. These links would form the second layer wireless network. Tropos equipment has been selected to provide a versatile link between the Level 1 wireless network and the end user community. The Tropos mesh architecture would provide links tolerant of interference with the capability of easy placement of additional nodes where coverage needs to be improved because of physical obstacles or foliage. Use of this industry standard 802.11 architecture would provide easy access to the end user community because many of the newer laptops and portable devices already have the necessary hardware.



New towers are not required: antennas will mount to existing lamp posts and other structures.

Figure 4.1: Wireless Hot Spot Architecture

This leveled approach to the overall network would allow bandwidth to be distributed to areas of the city in a cost-effective manner.

The selected components allow for the future extension of this network to support either public or private access. For the public, any user with a laptop and a wireless adapter would be able to access the Internet. For private access, Virtual Private Network (VPN) software could be added to encrypt the transmission of private data. This private access could be expanded to members of the business community through a subscription process if desired to promote the goals of the city.

Section 2 of the supplemental report provides an evaluation of wireless components proposed to extend the coverage of the network.

4.4 Cost Estimate

The cost of implementing the wireless hot spot is $500,300 (includes engineering and project management). In addition to the implementation costs, we project annual internal revenue is required to maintain cash flow of the connectivity enterprise. The internal revenue requirement is $119,900 in year 1 increasing to $142,400 in year 5.

- Annual maintenance (including spares) is estimated at 6 percent of the total installed cost.
- A 3/4 Full-time Equivalent (FTE) is required to administer and maintain the wireless hot spot network.
- Internal funds are used to finance the implementation.
- A T-1 interconnection to the Internet is required. The annual cost is $7,500.
- A replacement account is established to build reserves for network replacements. A 50 percent reserve is created.

4.5 Possible Other Participants and Partnerships

Creation of public-private partnerships is possible with this model. The key potential partners in this model are the existing Internet providers and businesses in or near the hotspots. The benefit to the Internet providers would be the potential to increase demand and use of the Internet and related services. The benefit to businesses in or near the hot zones would be the potential to increase traffic and thereby increase sales.

- Existing providers offer “back office” support and the connection to the Internet. In exchange, the providers are allowed to “advertise” on the hotspot access page.

- Area businesses are allowed to provide services and information on the hotspot access page. In return, advertising services are collected to help offset operational expenses.

Another potential partnership type is with the equipment vendors. Vendors are interested in offering equipment discounts, free training, and ongoing development support for high profile, early adopter communities in exchange for promotional rights.

4.6 Benefits

Hot spots would allow city employees to update records, while working in the community, leading to improvements in employee productivity. In other communities where hotspots have been deployed in high-traffic areas, connectivity has assisted law enforcement in its ability to access information previously available only at the police station. The benefit has been that officers can maintain their visible presence in the community for longer periods of time.

Economic development efforts will be enhanced. The deployment of hotspot technology would provide potential benefits for Bellevue businesses. By accessing the Internet from numerous locations, employees can have the freedom and flexibility to carry their office with them as they move from location to location. As companies incorporate a wireless strategy to improve productivity, a substantial number of citywide hotspots could provide opportunities for businesses and the city to test new ways of working and new ways of delivering services to the community. For employees who desire ”always on” connections, hotspots may improve the ability to attract such workers.

Tourists as well as business travelers will benefit from enhanced wireless connectivity. Having ubiquitous access, without high “roaming” charges, is becoming more critical.

On the one hand, a potential benefit of wireless hotspots is that they enable remote video monitoring of an area. A common concern with using cameras is a perception that the city may become “big brother” and other privacy issues. On the other hand, benefits such as monitoring school security and checking parks for activity (i.e., parents checking for the presence of other children for their children to play with, etc.) may reduce privacy concerns.

Hotspot technology would move the city closer to ubiquitous Internet access. This technology would further reinforce the city’s position as one of the most connected cities in the country. Hotspot technology gives a public face to that claim. Hotspot technology can reinforce and promote the image that the city is prepared for future economic development. Having such capability will allow the community to take advantage of new connectivity technologies such as Wi-Fi telephones as they are introduced to the market. Many of the additional benefits will come to light through applications that are developed after the enabling technology is in place.

4.7 Barriers to Implementation

Barriers exist to implementation of this network. Barriers include:

- The hilly terrain and dense foliage that block wireless network signals. Typical interference that must be accommodated includes structures, hills, foliage and other access points that may be operating in the area.

- In the downtown area buildings can create a concrete canyon effect that interferes with transmission of the wireless network.

- The park areas and downtown zones will need wireless systems that have the capability to provide links on a user by user basis.

Private providers of wireless connectivity may not be a barrier since the presence of hotspots may, in fact, encourage some users to try the technology, resulting in increased demand. This is not to say, however, there will not be opposition. Existing hotspot providers are likely to view this model as public competition.

4.8 Financing

Use of operating funds is recommended for this model.

Although this model does offer the potential to obtain revenues or participant fees from area providers and businesses, use of revenue bonds is unlikely.

- The potential revenues are not likely to be sufficient to cover maintenance and operational expenses.

- The financial community has avoided the use of revenue bonds for municipal telecommunication ventures unless the bank is secured by another revenue source (water, electric, other).

Grants are a possibility to advance the video monitoring or other application. When pursuing a potential grant source, it is critical to identify a new use or application that has the potential to be reproducible in other municipalities across the county, bridges the digital divide gap, or meets a homeland security or other law enforcement need. In the supplemental report, we have included a list of potential grant sources.

5. Wireless Network Model

5.1 Goal

Extend fiber and wireless systems installed to this point and implement a wireless network for municipal use completely covering the community. The primary use of this network is for public safety agencies and other field workers (fire and building inspectors, other). A secondary purpose is to improve efficiency and reduce cost of municipal operations and offer alternatives for citizen access. The network can also support wireless Internet access to area businesses or residences.

The goal of this network is to develop a network design that builds upon existing resources expanded to include wireless access to the Internet throughout the entire community, avoid provider costs, and increase security. This design must support the needs of municipal government, with modalities supporting both fixed and mobile access.

5.2 Recommended Direction

The existing fiber optic infrastructure can be augmented in key areas and serve as a high bandwidth backbone network to support a wireless network that will extend connectivity to the user community.

A wireless network will provide a variety of configurations and areas of broadband access across the city. The approach used to cover the entire city builds upon the approach used to serve the hotspots and hot zones by increasing the number of wireless points supporting the additional coverage areas. The expanded coverage area will enable ubiquitous access and allow a wider range of applications to be pursued.

5.3 Conceptual Design

The proposed design, as shown in Figure 5.1, uses a three-level architecture:

1. A fiber optic backbone serves to distribute large amounts of bandwidth to key locations throughout the city. The existing fiber optic infrastructure will be augmented with new fiber in selected locations. The starting point will be the network of networks model. Additional fiber optic links will be added where the distances are short.
2. A wireless system suitable for distribution of service over a four-mile diameter area will distribute bandwidth to each targeted area. This layer one system will provide eighteen access point locations that will provide higher bandwidth links to the wireless network supporting the end user community. This network uses a series of point-to-point wireless links.

3. A local 802.11-based wireless system will provide access with industry standard software and wireless components. The Tropos system is suited to support the link to the end user community. This system supports a mesh architecture.

The design of the network provides adequate capacity for use by municipal staff. While the chosen technology would allow extension of service to the general public, the installed hardware and connectivity links will need active management to ensure network capacity is sufficient as public use increases.

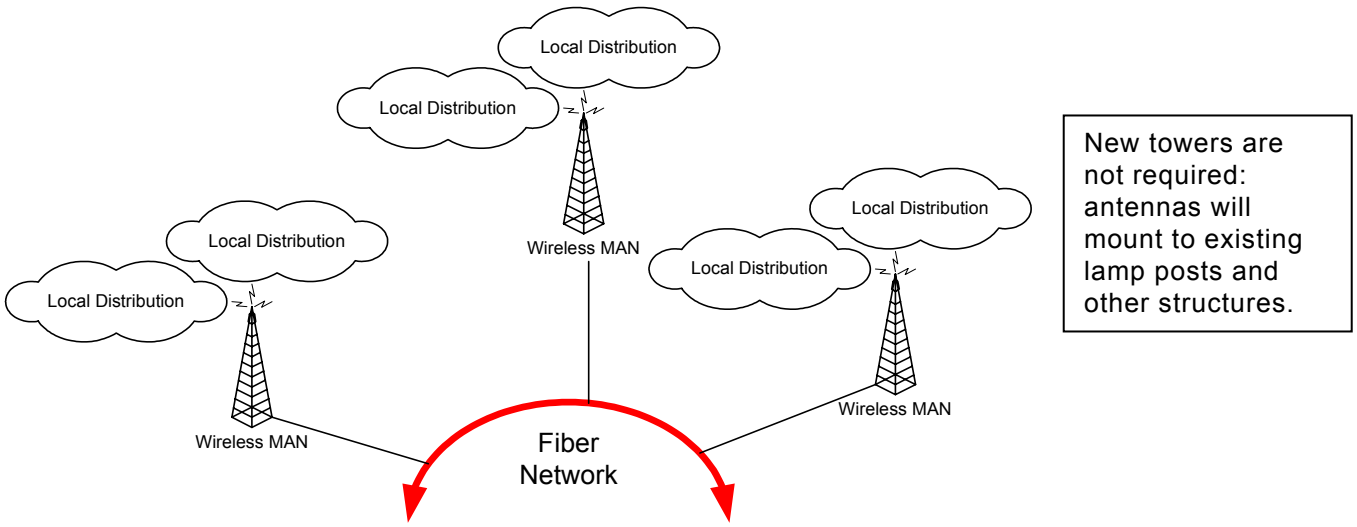


Figure 5.1: Proposed Wireless Architecture

The selected components allow this network to be operated to support a closed network allowing only private access. Secured access is provided in several ways:

- The wireless systems provide 128-bit encryption to secure the radio transmission.
- VPN software should be used to provide end-to-end security.
- 802.11 access points can be configured to hide their characteristics.
- As an option, support of intrusion detection and user monitoring is worthy of consideration.

This network will not support cell-to-cell handoffs as seen with cellular networks. However, the bandwidth offered is much greater, thus allowing easier migration of desktop applications to the field.

Adding client software from NetMotion[7] or Padcom provides additional security and improves ease of use for the mobile user as they move from location to location on the network. This software automatically connects to each access point as it is acquired and resumes any application that was running when a connection was lost.

See the supplemental report for a further discussion of approaches to mobility with this network.

5.4 Cost Estimate

The cost of implementing the wireless network model is $2,327,400 (including engineering and project management). In addition to the implementation costs, we estimate the annual operating, maintenance, and debt services expenses at $682,100 for year 1 and $734,200 for year 5 ($316,200 is for debt service for years 1 through 10).

The key assumptions in include:

- Annual maintenance (including spares) is estimated at 6 percent of the total installed cost.
- Two Full-time Equivalent (FTE) staff are required to administer, balance, and maintain the network.
- 6 percent general obligation bonds are issued, with a 10 percent reserve requirement. Internal funds are used to cover the reserve requirements.
  - Bond requirement $2,327,000
  - Cash requirement $232,700
- A T-3 interconnection to the Internet is required. The annual cost is $63,000.
- A replacement account is established to build a reserve for network upgrades. A 50 percent reserve is created.
- Net cost avoidance for mobile data termination, blackberry, and other devices is $57,600 per year.
- A help desk fee is allocated at $12,000 per year.
- Equipment leasing (spectrum and network analyzers, other) is estimated at $18,000 per year.

5.5 Possible Other Participants and Partnerships

A potential issue with a wireless network, that covers the entire city, is that it may provide a disincentive for private firms to make future investments in wireless technology if the private firms fear the city will begin to compete for residential and business customers. This can lead to decreased competition and higher prices for consumers. To promote private investment and encourage customers to try wireless connectivity, the city could pursue several models that private sector firms would likely encourage.

[7] The City of Kirkland uses NetMotion products today.

- Allow private retail connectivity (ISP, alternative voice, other) providers to use the wireless network. In other words, the City of Bellevue leases the infrastructure, which allows new providers to offer the retail services to area residents and businesses. The city and the private providers could come to an agreement that allows the private providers to avoid infrastructure development costs and provide service at a lower cost to consumers. While this would provide benefits to the retail providers, citizens and the city, the incumbent providers may object. Also, while this approach would lower the start-up cost for new retail providers, it may also reduce the market exit barriers leading to a less stable market in the short-term.

Equipment vendors are also potential partners. The concept of a municipal offering ubiquitous wireless access has gained popularity over the past 6 to 12 months, yet the vendor offerings are early in their life-cycle. The proximity of Bellevue to Microsoft, combined with the different coverage area offers a unique opportunity. The wireless vendors and application development community would have a platform to show new applications to a sophisticated user community, while demonstrating their ability to perform in harsh conditions.

5.6 Benefits

Benefits of the proposed approach expand beyond those enjoyed through the limited use of hotspots and hot zones.

- There will be some cost savings from reduced reliance on connectivity services for equipment such as Blackberries. The city currently uses 60 remote wireless devices such as police MDTs and Blackberries. Moving to a wireless system would eliminate this expense. While small compared to the cost of implementing and maintaining a wireless network, there are other “soft” benefits that the city should consider.

- A fiber optic network can be used to provide video surveillance of key areas. Other cities have received grants for these types of systems.

- Public safety officials are increasingly using this technology to provide paperless reporting and integrated messaging for mobile officers.

- For city employees the wireless network will allow them to update records or receive communication while working virtually anywhere in the community. This may foster improvements in employee productivity.

- In other communities where wireless connectivity has been deployed, law enforcement has gained access to information previously available only at the police station. Now officers can maintain their visibility in the community for longer periods of time, thereby reducing crime.

- The city’s police and fire departments use Automatic Vehicle Location (AVL) technology. This network will allow the city to eliminate leasing costs associated with some or all of this equipment.

- Enable remote video monitoring and security systems of city buildings. This may reduce security staffing expense.

Many of the benefits of a wireless network will come from future applications of the technology. The network itself does not provide the benefit to the end user, but provides the enabling technology to support evolving applications. Future applications are unknown today, but we are confident they will continue to develop after the wireless network is in place.

Having the city completely covered by a wireless umbrella network may enhance economic development by allowing the city to become a "real world test area" for emerging broadband applications and improving the city's ability to attract technology companies and employees. The citizens can benefit by being part of a connected city with movement toward ubiquitous Internet access. A wireless network can also support alternative services such as Wi-Fi telephones.

5.7 Barriers to Implementation

The initial use of this network is for city use. For city use, we do not see barriers beyond the technical and financial issues. These barriers include:

- Cost is a barrier. Are there sufficient benefits to justify the implementation and operational costs?
- The same technical barriers (such as interference) listed in the previous section.
- The ability of the LAN-based hardware switches and wireless equipment to support full mobility of the users. See the supplemental report for a further discussion of this issue.

Upon supporting public use, we do see additional barriers.

The incumbent providers may object to the implementation on the grounds of unfair competition. Although we are not recommending the City of Bellevue to offer retail services, it does offer the potential to increase competition by reducing the market entry barriers for new ISP's. The existing providers are likely to claim unfair competition with the new entrants since they did not have to make an infrastructure investment. The opposition will claim unfair competition and claim that the city is subsidizing the network access. To counter these claims, reasonable access fees for provider access are required, and network access be offered to not only the new entrants, but to the existing providers as well.

To date, state or federal legislative restrictions related to municipal Internet offerings and infrastructure access (data) have had limited successes. However, the existing providers have had success in influencing local elected officials. Please note that the anticipated opposition is based on opening the wireless network up to private use, not for internal city use.

5.8 Financing

We recommend the use of general obligation bonds supplemented with potential grants to enhance application development.

6. Industry Trends

6.1 Economic Development

Traditionally, the criteria for stimulating local economic growth include good highways, adequate water and sewer lines, reliable gas and electric utilities, railroads, ports, affordable real estate and labor, and a favorable tax system, and these criteria continue to be important factors in business attraction and community development more generally. Because of changes in the global economy, however, local policymakers—in wealthy and depressed communities alike—are facing new challenges.

The Cities of Bellevue and Kirkland have partnered to evaluate opportunities, individual and joint, for leveraging communications infrastructure for economic development and the overall health and benefit of these communities. The mission of this partnership is to "enhance quality of life, public safety, economic development, and city services in Bellevue and Kirkland by optimizing the use of communications infrastructure (conduit, fiber, etc.)." This mission recognizes that the communities' long-term economic growth and success will depend on its ability to compete effectively in the global economy. The partnership mission also recognizes that the key to success in the global economy is innovative capacity, demonstrated by placing a high value on both human capital in the 21st century workforce and the role of science and technology in the economy. Those who have convened in and support this partnership know that advanced connectivity capabilities are increasingly important for local economic development and a high quality of life for current and future residents.

For businesses willing to embrace Internet business solutions, Broadband[8] is an enabling technology that can transform processes and realize significant returns on investment. Broadband offers the opportunity to work or learn more productively, publish multimedia, and increase communication possibilities. These transformations are not shrink-wrapped solutions, however. They require work and effort.

While broadband infrastructure is rapidly becoming essential for accessing education, safety, work, entertainment, government and other applications, **creating a broadband infrastructure should not be recognized as the sole means for achieving broadband accessibility.** Several other factors, such as access to necessary computer hardware and requisite technical skills, are also critical to broadband accessibility. As distinguished from broadband infrastructure alone, broadband accessibility is an enabling technology that can contribute to the economic development of communities but is not the sole means for achieving economic development. **To create a successful framework for local economic development policy that includes broadband infrastructure and broadband accessibility, policymakers must consider the context in which broadband will be deployed.** Specifically, policymakers must consider two primary development strategies that must accompany deployment of broadband infrastructure:

1. Encourage economic clusters of industry within communities and more broadly across the region.

[8] Broadband is defined as a connectivity technology with sufficient speed or throughput that does not limit your application. Under this definition, cable modem or DSL services are not broadband.

2. Aggressively align human capital (i.e., academics and workforce development efforts) with the needs of these clusters.

Secondary strategies include:

- Targeting Industries: Embrace specialization and promote the region's comparative advantages.
- Training: Competencies for job activities in today's knowledgeable economy are in a state of perpetual change. Proactive development of training programs is imperative to fund on-going economic development growth.
- Applications: Connectivity is only one half of the entire solution; applications are the other half. Possible application areas include:
  - Public Safety
  - E-Commerce
  - E-Government
  - Television
  - Tourism
  - Distance learning
  - Telemedicine
  - Entertainment
  - Video conferencing

Both Bellevue and Kirkland have developed and promoted applications that leverage the available connectivity. Continued development and enhancements in conjunction with connectivity deployment is required. The availability of broadband connectivity will allow migration of desktop tools and applications to the mobile environment.

Further background on the above strategies are provided in the supplemental report.

Both Bellevue and Kirkland are well underway with many of the strategies.

- Regional education centers recognize the need for ongoing training to support economic development. Implementation of the "Network of Networks" model will provide the region's schools the required connectivity capability to advance education applications and to share resources.
- Permits, records, and other city informational and transactional functions are on-line today in Bellevue and Kirkland. Ongoing efforts to expand and encourage on-line use are underway.
- Evergreen and Overlake Hospitals are excited about the opportunities that the "network of networks" model will enable. Broadband connectivity between the facilities will enhance the shared services, improve patient care, and other telemedicine applications.
- Telework, tourism, and public safety efforts will benefit from the wireless models. The wireless models add the feature of mobility, which allows portable devices to connect without the encumbrance of wires.

6.2 America's Most Wired Cities

What makes a city "wired"? For the most part, the distinguishing criteria are subjective and vary greatly from one claim to another. We have developed several factors to measure whether the cities of Bellevue and Kirkland are wired cities and to define the parameters of a most-wired-city campaign.

- *Availability:* Is broadband available? Is high-speed available?

  In Bellevue and Kirkland, high-speed connectivity alternatives are available for residents and businesses.

- *Affordability*: How do the prices charged for high-speed connectivity in Bellevue and Kirkland compare with other regions? Affordability can be defined three ways.

  1. Prices are similar to other geographic regions of the country.
  2. Prices are comparable in rural and urban areas.
  3. Any household, regardless of disposable income, is able to purchase high-speed connectivity service.

  Under the Definition 1, high-speed is affordable in Bellevue and Kirkland. Under the Definitions 2 and 3, it is not.

- *Demand*: If high-speed connectivity services are available, are residents and businesses aware of the benefits? Some of the gaps in availability of high-speed connectivity services may be perceived rather than real.

  The use (through demand) for high-speed services in Bellevue and Kirkland is 3 to 4 times the national average.

- *Digital Divide:* Is there a gap between applicability and use of broadband connectivity services? While a digital divide most certainly exists, the severity of the divide varies by city and region. Beyond issues of access, the digital divide is affected by the availability of hardware, training on how to use the services, and education on the benefits, as well as the availability and affordability of services. Although a digital divide does exist in Bellevue and Kirkland, it appears to be significantly lower than other regions of the country.

These criteria focus largely on infrastructure, what it will allow, and customers' awareness of the benefits of high-speed connectivity. Other claims to being a wired city may be based on the competitiveness of service and usage.

It is our observation that Bellevue and Kirkland communities are among the most wired. Each community has advanced applications that encourage e-government, improve public safety, and tie-in economic development efforts. Both communities have implemented targeted infrastructure that fills gaps in the public sector, while developing a platform that can encourage public-private partnerships. Pursuit of the identified models will continue and will further enhance and advance Bellevue and Kirkland as being the most wired cities.

6.3 Municipal Case Studies

Municipal involvement in providing connectivity service is growing. Some communities lease services from a private provider. For example, three U.S. municipalities are turning to BelAir Networks[9] to deliver essential communication services to their respective city personnel via WiFi technology.

BelAir has inked deals with the cities of Des Moines, Iowa; Show Low, Arizona; and Lincoln, Nebraska to deploy its BelAir200 cellular LAN platform.

- In Iowa, the Department of Transportation will use this technology to link the West Des Moines Traffic Department and the Iowa Department of Transportation. The platform will also monitor traffic at busy city intersections.

- In Arizona, the BelAir200 will be used to enable police and fire departments to maintain communications between mobile units and databases at city hall.

- In Nebraska, the network will connect scattered city offices and provide a redundant link for existing wired networks.

BelAir Networks did not disclose the value of its contracts but indicated that its platform can also be used to create networks that provide public Internet access, private enterprise networks, and secure municipal networks.

So what are the potential roles for communities to consider? Saying that the cities are considering getting involved in advancing broadband service is not the same as saying they will provide retail services. Here we present a variety of potential roles.

- **Catalyst.** One possible role is that of catalyst. Without undertaking a direct role, city government could prod existing private sector entities to increase demand and awareness of services and provide better broadband access. One advantage of this approach is that if local government can motivate private sector entities to provide services at a competitive cost, it would give the city "one less thing to do" and eliminate a potential risk area.

  Communities that have built business parks or incubators that use private providers to provide high-speed broadband access can play a modified catalyst role and stay out of the "business" yet benefit from the availability of broadband for a focused concentration of businesses. Local government may find itself playing a limited provider role, however, when it acts as a landlord in a business incubator that includes broadband as one of its services.

- **Enabler.** A slightly more ambitious role is that of enabler. The city would be able to avoid getting "in the business" but would still be able to use government resources to help private sector entities provide more and better service. A common example would be for the government to allow wireless providers to place antennas on the city's water towers and radio masts.

[9] See www.belairnetworks.com for additional information.

- **Infrastructure Provider.** A more ambitious role is for the government to act as an infrastructure provider. Often, the city initially gets into the infrastructure business by installing a base infrastructure to serve only government and school sites. But the government can then rent out capacity on the infrastructure to allow retail providers to connect to customers or possibly to allow customers to connect between multiple sites within the community. In some cases, cities are extending their infrastructure to individual homes, especially for new, larger developments.

- **Retail Service Provider.** The most extensive form of involvement is for the city to act as a retail service provider. The city may be able to use existing infrastructure to directly provide competitive services such as Internet, cable television, and telephone.

The market research conducted in Bellevue and Kirkland indicate that residences and businesses feel it may be appropriate to consider an enabler or infrastructure provider role. The research clearly indicated that residences and businesses feel the cities should not pursue a retail service role.

In Table 6-1, we present a number of municipal case studies. Following the table, we briefly describe each example. Inclusion of a given case study is not an endorsement, but rather, an example of what other communities have done.

Table 6-1: Case Studies

Entity	Infrastructure	Services	Involvement
Beaver Dam, WI	Fixed Wireless	Internet	Enabler
Bellingham, WA	Fiber and DSL	Internet	Catalyst
Cerritos, CA	Wireless (WiFi)	Internet	Enabler
Chicago, IL	Fiber	Internet, telephone	Infrastructure provider
Grant County PUD, WA	Fiber-to-the-Premises	Transport (voice, video, and data)	Infrastructure provider
Idaho Falls, ID	Fiber (Dark)	Internet and public MAN	Infrastructure provider
LinkMichigan	Planning initiative	Internet	Catalyst
Los Angeles, CA	Fiber	Internet and transport	Infrastructure provider and catalyst
New Smyrna Beach, FL	Fiber-to-the-Premises and Wireless	Internet, telephone, and cable television	Retail provider
Newnan, GA	HFC	Internet, telephone, and cable television	Retail provider
Reedsburg, WI	Fiber-to-the Premises	Internet, telephone, and cable television	Retail provider
Sullivan, IL	Wireless	Internet	Infrastructure and retail provider
Sun Prairie, WI	Fiber and Wireless	Internet	Infrastructure and retail provider

Table 6-1: Case Studies (cont.)

Entity	Infrastructure	Services	Involvement
Tacoma, WA	Fiber and HFC	Internet, telephone, and cable television	Infrastructure and retail provider
Tukwila, WA	Fiber-to-the-Premises	Internet, telephone, and cable television	Infrastructure provider
UTOPIA (Utah)	Fiber-to-the-Premises	Transport (voice, video, and data)	Infrastructure provider

Entity: City of Beaver Dam, Wisconsin
Population[10]: 15,169
Infrastructure: Fixed wireless
Services: Internet
Involvement: Enabler

The City of Beaver Dam is in central Wisconsin. In 2002 cable modem service was available in the city, but DSL service was not, and the cable modem access did not extend outside the city. A local ISP approached the city, hoping to offer fixed wireless broadband service using antennas on the water utility tower. The city agreed to this and leased use of the water tower to the ISP, with lease terms similar to those of existing cellular telephone antennas on the water tower. By special arrangement, however, the ISP "worked off" the first 18 months of the lease by developing a Web site for the city government.

Entity: City of Bellingham, Washington—Economic Development Council
Population: City of Bellingham, 67,171; Whatcom County, 166,814
Infrastructure: Fiber optic and DSL
Services: Internet
Involvement: Catalyst

Two incumbent telephone providers serve Bellingham and the surrounding region. In the mid-1990s neither carrier offered DSL service. The Bellingham and Whatcom County Economic Development Council encouraged community leaders to pressure telephone providers to offer broadband service. In response, the telephone providers began to implement DSL access ahead of previous schedules. Several competing vendors have also entered the market to provide DSL.[11]

The Economic Development Council and other entities have continued to push for better broadband access, especially through development of fiber optic infrastructure. Also, the City of Bellingham has been encouraging telecommunications providers to take advantage of the opportunity to install their own fiber optic cable as part of other construction projects, through what is called the "open ditch policy."[12]

[10] This and all following city population figures are from the 2000 U.S. Census.

[11] Sommers, Paul, and Heg, Deena, "Spreading the Wealth: Building a Tech Economy in Small and Medium-Sized Regions," Center on Urban and Metropolitan Policy, The Brookings Institution, October, 2003, p. 9.

[12] Bellingham and Whatcom County Economic Development Council Website at www.bwedc.org.

CITY OF KIRKLAND

Telecommunications Study and Municipal Network Business Plan

Entity: City of Cerritos, California
Population: 51,488
Infrastructure: Wireless (WiFi)
Services: Internet
Involvement: Enabler

The City of Cerritos is a residential community in suburban Los Angeles that covers an area of about nine square miles. Although it is in a large urban area, the city has no cable modem service and only DSL service in some areas. Playing an enabling role, the city has allowed a provider to attach wireless antennas on public buildings and city traffic signals in an effort to provide citywide wireless Internet access. The city collects no fee for this access.

This project is especially interesting because it is one of the few efforts nationwide to blanket such a large area for Internet access using WiFi wireless access rather than fixed wireless. The provider uses antennas mounted on city facilities such as streetlights, traffic signals, and public buildings as well as the homes of subscribers. Initial service began in early 2004.

Entity: City of Chicago, Illinois (CivicNet)
Population: 2,896,016
Infrastructure: Fiber optic
Services: Internet, Telephone
Involvement: Infrastructure provider and catalyst

For several years the City of Chicago has been advancing a CivicNet project to build a citywide fiber optic backbone. The city would leverage the telecommunications needs of its 1,600 various government sites (including public schools) to justify their investment in the network, which would then be made available for commercial users.

The CivicNet initiative expects that changes in the demands for communications services and technologies will require changes in business models for the provision of services and in the cost structures for those models. Consequently, the city expects to cooperate with those selected to work with the city to define new forms of business and financial models that will allow all parties to benefit from the fundamental rapid changes occurring within the communications industry. This team model assumes that the city will work in close cooperation with service providers to address these issues.

CITY OF KIRKLAND

Telecommunications Study and Municipal Network Business Plan

Entity: Grant County Public Utility District (PUD)
Population: 74,698
Infrastructure: Fiber-to-the-premises (FTTP)
Services: Internet, telephone, and cable television
Involvement: Infrastructure provider

Grant County Public Utility District opened its FTTP network to any service provider and offers market-driven competition and choices to benefit end users. With Gigabit Ethernet access to every customer in the county, the network sets a new standard for delivering high-value, high-bandwidth services.

Grant County PUD is a not-for-profit, government-owned organization in eastern Washington state that owns and operates four hydroelectric projects. It generates and distributes electric power to its constituents and sells excess capacity through the national power grid. Its core assets include its rights of way to deliver energy to every constituent in the county and its relationships with those constituents. These assets took on new significance when the citizens of Grant County asked the PUD to help them address the lack of a high-speed communications infrastructure within the county.

Grant County PUD had already installed extensive fiber facilities and therefore decided to install FTTP to all its constituents throughout the county via their existing rights-of-way, conduits, and equipment facilities. Fiber offered much higher capacity, greater longevity, and easier maintenance compared to the copper lines, and the Grant County staff already knew how to operate it.

The utility decided to limit its role to wholesale transport providers and open its network to any service provider who wanted to offer data, voice, and video services, creating a kind of “Internet Utopia” for its constituents. This business model has opened Grant County to market competition to offer both choice and sensible pricing to constituents, with the PUD focused on its core competencies – utility services. To serve as a catalyst for competition, the network must support “equal and open access,” provide symmetric transport, and adapt to changing service options and requirements.

Entity: Idaho Falls, Idaho—Idaho Falls Power
Population: 51,096
Infrastructure: Fiber optic—dark fiber
Services: Internet access and public metropolitan area network (MAN)
Involvement: Infrastructure provider

Idaho Falls is a city in southeast Idaho. In recent years the city began exploring ways to use improved Internet access to foster business development. The city considered a number of alternatives and decided to develop a fiber optic backbone that could be leased by various providers. The city will not retail information services; instead, customers must contract with service providers who lease the rights to use the infrastructure.

The backbone covers major parts of the community and was designed to serve areas where customers are likely to be. In addition to businesses, potential customers include federal Department of Energy sites in the area. This option is attractive because it does not require a complete build-out of the city. Instead, the city will wait to develop last-mile connections when requested by customers.

CITY OF KIRKLAND

Telecommunications Study and Municipal Network Business Plan

Entity: State of Michigan—LinkMichigan
Population: 9,938,444
Infrastructure: Planning initiatives
Services: Internet
Involvement: Catalyst

LinkMichigan is a statewide telecommunications planning effort led by the Michigan Economic Development Corporation (MEDC) in conjunction with the Michigan Broadband Development Authority (MBDA). Its primary objective is to help communities develop strategies for improving Michigan's access to high-speed Internet access (i.e., broadband) and other advanced telecommunications services for the benefit of all communities throughout the State, including business, government, education, health care, families and individuals. To achieve this objective, MEDC provided grants to counties for the development of telecommunication infrastructure plans. MEDC also encouraged the creation of regions consisting of counties to carry out projects so plans attain a broader perspective. An example of a region is an alliance created among Allegan, Kalamazoo and St. Joseph Counties.

A significant benefit of broadband communications is economic development and job creation. The MEDC commissioned the Gartner Group to study the impact of broadband services on economic development. The study identified the potential for 500,000 new jobs and an increase of $440 Billion in Gross State Product (GSP) in the next ten years due to telecommunication infrastructure advances in the state. According to the MEDC, another goal of the project is for 51 percent of all jobs created by increased access to high-speed telecommunications to be made available to people of low and moderate incomes.

Entity: City of Los Angeles, California (LA On)
Population: 3,694,820
Infrastructure: Fiber optic
Services: Internet and transport
Involvement: Infrastructure provider and catalyst

Los Angeles formed LA On to encourage competition among private providers, optimize Rights of Way (ROW), and provide services to city departments and agencies. LA On provides bandwidth, dark fiber, and fiber backhaul and leases wireless tower sites. The system consists of over 300 miles of fiber (40,000 fiber miles) and connects 175 government buildings.

In addition, LA On partnered with a community development agency to create the Watts-wide area network. As part of this project, they received grants to build out to key service areas such as schools, libraries and hospitals.

CITY OF KIRKLAND

Telecommunications Study and Municipal Network Business Plan

Entity: City of New Smyrna Beach, Florida
Population: 20,048
Infrastructure: Fiber optic and wireless
Services: Internet, telephone, and cable television
Involvement: Retail provider

The City of New Smyrna Beach, Florida, is a suburban area of Daytona Beach, Florida. Over the years, New Smyrna Beach (utility) has provided a wide variety of services including dial-up Internet access, telephone, and wireless broadband. The utility is now installing wireless infrastructure in several new developments, and this infrastructure will be used to provide a full range of data services. In addition, the utility is currently in the construction phase of an FTTP infrastructure system in three new developments, with a projected customer count of about 2,500 homes. The utility will offer telephone service, high-speed Internet, cable television programming, home security, and automated meter reading for water and electric in these developments.

Entity: Newnan, Georgia—Newnan Utilities
Population: City of Newnan, 16,242; Coweta County, 89,215
Infrastructure: Hybrid fiber-coaxial (HFC)
Services: Internet, telephone, and cable television
Involvement: Retail provider

The City of Newnan is a largely residential town about an hour's drive southwest of Atlanta. Newnan Utilities' first entry into providing Internet access was in 1995, with the implementation of a fiber optic backbone to provide high-speed access to local schools as well as businesses.

Shortly after this, Newnan Utilities partnered with a telephone provider to obtain a telephone switch at the Newnan site and gained the ability to provide telephone service. After attempts to partner with local cable television providers were not successful, Newnan Utilities decided to implement a hybrid fiber coax (HFC) infrastructure and begin retailing cable service.

The system now provides access to all of the City of Newnan, and Newnan Utilities continues to expand this infrastructure into unincorporated areas of Coweta County. Today about 15,000 homes are connected to the system. The Newnan area is growing rapidly, and about 4,000 of the homes were cabled as new development was added.

CITY OF KIRKLAND

Telecommunications Study and Municipal Network Business Plan

Entity: Reedsburg, Wisconsin—Reedsburg Utility Commission
Population: 7,827
Infrastructure: Fiber-to-the-premises (FTTP)
Services: Internet, telephone, and cable television
Involvement: Retail provider

Reedsburg is a small but somewhat fast-growing town about 60 miles north of Madison. The Reedsburg Utility Commission is implementing the most comprehensive possible solution for local government information infrastructure and services: building out a fiber optic network to all businesses and homes and acting as the direct service retailer for Internet access, telephone, and cable television.

The Utility Commission began developing its network in 1998 by implementing a fiber optic network to its own facilities, running the fiber on its utility poles. The Commission then partnered with the local school district to provide Internet service to the schools using a fiber loop.

The Utility Commission partners with a neighboring telephone company to offer telephone service and runs telephone traffic through the telephone partner's switching system. The Commission has installed satellite antennas to allow it to download cable television programming, and the fiber infrastructure allows the Commission to provide digital video in addition to basic programming. The Commission is investigating use of the network to read utility meters, and future services may include home security.

Entity: City of Sullivan, Illinois
Population: 4,326
Infrastructure: Wireless
Services: Internet
Involvement: Infrastructure provider and retail provider

The City of Sullivan is a small community of 4,000 people in central Illinois. The city suspected, and market research confirmed, that competition was inadequate for high-speed connectivity services. Primary concerns with entering the market were the price of FTTP, early obsolescence of an HFC system, depletion of electric utility reserves and burdening non-users with electricity rate increases. Given these concerns, they sought an alternative for high-speed connectivity with lower startup costs and are preparing to become a provider of wireless Internet service.

CITY OF KIRKLAND

Telecommunications Study and Municipal Network Business Plan

Entity: Sun Prairie, Wisconsin—Sun Prairie Water and Light Commission
Population: 20,369
Infrastructure: Fiber optic and wireless
Services: Internet
Involvement: Infrastructure provider and retail provider

Sun Prairie is a historic Wisconsin town that has become a suburb of Madison. In 1998, neither the local telephone provider nor cable provider could provide Internet connectivity to the district at a reasonable price. In response to a request by the local school district, the Water and Light Commission developed a fiber optic loop using mostly overhead wiring to provide high-speed Internet connectivity to all school districts, the City of Sun Prairie and Water and Light Commission facilities. This fiber loop provided the basis for extending high-speed Internet service (including both ISP and dark fiber) to several businesses. A fiber loop has also been extended through the city business park.

The Water and Light Commission also provides fixed wireless services. The city had cable modem coverage and some limited DSL coverage but felt that businesses and homes would benefit from wireless Internet. The Water and Light Commission installed wireless antennas on its three water towers to provide access through the city and acts as the direct provider of wireless Internet access. One of the city's problems, however, is the hilly terrain and heavy forestation in the city.

Entity: City of Tacoma, Washington—Tacoma Power's Click! Network
Population: 193,556
Infrastructure: Hybrid fiber coaxial (HFC)
Services: Internet access, telephone, and cable television
Involvement: Infrastructure provider and retail provider

Tacoma Power's Click! Network is the most ambitious effort by a local government to provide a single information infrastructure for the community while both leasing the infrastructure to independent providers and directly retailing some services. As a result of these efforts, Tacoma bills itself as "America's Number One Wired City."

In the mid-1990s, Tacoma began to consider providing Internet access and cable television service. The city selected a model in which Tacoma Power, the city-owned electrical utility, would provide infrastructure connections to most city homes and businesses. The city selected "Click! Network" as a brand name for these services, which began in 1998. The network is an HFC system with a fiber optic backbone, coaxial cable connections to homes, and fiber connections to some businesses.

Services provided over the network include both Internet access and cable television. Whereas Click! Network provides its own cable television service, Internet access is provided by several competing vendors who lease the right to use the network. Internet access includes both cable modem and higher speed access to businesses using fiber connections, and some providers leasing the network have used it to provide telephone services to their customers. Infrastructure construction was completed in the City of Tacoma in 2000 but the network is now expanding into neighboring communities. The system also leveraged the needs of local governments and supports the CityNet network that serves school and government buildings. The network also serves the internal needs of Tacoma Power such as utility monitoring.

CITY OF KIRKLAND

Telecommunications Study and Municipal Network Business Plan

Entity: City of Tukwila, Washington
Population: 17,181
Infrastructure: Fiber-to-the-premises (FTTP)
Services: Internet, telephone, and cable television
Involvement: Infrastructure provider

The city's Strategic Economic Development Plan contains a number of specific goals for improving Tukwila and positioning the city to meet the needs of those who will eventually live and work in the community. One of the development plan goals calls for an initiative to provide fiber optic network connectivity throughout the city. The projected result is that every business and resident of Tukwila will have access to high-speed broadband capabilities for telecommunications services within Tukwila. Telecommunications services are those provided over telephone, television (all video), and computers (data and the Internet). The objective of this goal is to create high technology opportunities and advantages for Tukwila businesses and residences.

Under the plan, fees paid by service providers will make up the majority of the revenue that will pay for the networks. The city will not be in the telecommunication business; rather, it will provide a way for those services to reach everyone in Tukwila and, therefore, enrich the lives of those who live and do business in the community.

Entity: Salt Lake City Region – UTOPIA
Population: 723,933 for 18 member cities
Infrastructure: Fiber-to-the-premises (FTTP)
Services: Voice, video, and data transport
Involvement: Infrastructure provider

In what has become the nation's most ambitious municipal telecommunications project, a consortium of 18 local governments in the Salt Lake City region (including Salt Lake City) have been working to develop a fiber optic network that could potentially serve all businesses and homes in the area. The area includes 725,000 residents and 280,000 households and businesses. The effort is being carried out by the Utah Telecommunications Open Infrastructure Agency, or UTOPIA. Construction of the network is scheduled to start in 2004 and is estimated to cost $470 million.

The infrastructure for the project will consist of a fiber backbone throughout the community with fiber connections to all businesses and homes subscribing to at least one service. UTOPIA will serve only as an infrastructure provider, and private sector companies will provide all services available over the network. In December 2003, AT&T was named the first major service provider. AT&T plans to offer services including Internet access, local and long distance telephone, cable television and video-on-demand. The two major telephone and cable television providers in the area have so far declined to participate in the network.[13]

[13] Richtel, Matt, "In Utah, Public Works Projects in Digital," *New York Times*, November 17, 2003.