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March 28, 2008

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To: Supervisor Yvonne B. Burke, Chair
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           Supervisor Michael D. Antonovich

From: William T Fujioka
           Chief Executive Officer

FEASIBILITY STUDY ON WIRELESS FIDELITY (WIFI)

On April 10, 2007, on the motion of Supervisor Burke, your Board instructed the Chief Executive Officer to work with the Chief Information Officer, Directors of Public Works, Community and Senior Services, Parks and Recreation, Consumer Affairs, and Internal Services to conduct a feasibility study in order to assess the viability and benefits of expanding WiFi Internet access throughout Los Angeles County. Your Board also requested that we consult with other jurisdictions within the County to determine whether the expanded service could be coordinated in collaboration or partnership with interested municipalities, assess the operational benefits of WiFi access for County Departments, and report back to your Board with findings and recommendations within 180 days.

On October 3, 2007 and December 21, 2007, our office submitted a status report to your Board and requested an extension of time in order to provide you with a more comprehensive final report on this issue. This was particularly helpful since the issues related to WiFi have undergone dramatic transformation related to technology advances, financial models, and project failures.

"To Enrich Lives Through Effective And Caring Service"

WiFi Advisory Group

In order to achieve your directives, our office formed and chaired a WiFi Advisory Group that included members of the aforementioned departments, as well as the Public Library, and Beaches and Harbors. In addition, we garnered research assistance from the Center for Telecom Management at USC, who authored the attached report entitled, "LA County WiFi Feasibility Report."

RECOMMENDATIONS

The WiFi Advisory Group unanimously concluded that the most effective way to expand WiFi is to provide multiple users access on a flexible basis to grow as needs develop. This will serve many of the County's goals for governmental efficiency and will enrich services to the public. To this end, under the CIO, a Wireless Task Force will be created to continue to work in the following areas:

- Expand existing projects and create dual-use scenarios;
- Identify "best practices";
- Identify funding streams; and
- Engage in needs-driven projects of manageable size for greatest success.

Each of these recommendations is discussed in more detail below:

EXPAND EXISTING PROJECTS AND CREATE DUAL-USE SCENARIOS

Investigate possibilities for the extension of existing WiFi projects, as well as for dual-use scenarios, in which public use of WiFi technology is offered as a value-added service, piggybacking on official County services that have been implemented based on identifiable needs. This can be achieved by following the Los Angeles County Public Library WiFi model whenever possible. The Public Library currently provides WiFi service to both County employees and residents. Other existing projects are potentially well positioned for dual-use including the Department of Public Works traffic signalization project, where poles could be equipped with WiFi technology and be well positioned for other County users.

CREATE COUNTY WIRELESS TASK FORCE AND BEST PRACTICES

Coordinate County wireless initiatives, identify needs, and streamline wireless activities for maximum efficiency and benefit through the creation of a Wireless Task Force under the leadership of the CIO. This central coordination will provide a better opportunity for successful, economically efficient, project implementation and oversight. The Task Force will serve as a clearinghouse to coordinate future strategies for the use of wireless technologies, and to facilitate communication among County departments for a more efficient use of resources.

The Task Force will use a framework of best practices and lessons learned from County and other municipal wireless projects to inform Task Force strategies. The CEO may lead and coordinate the effort to identify and track best practices for the Task Force.

IDENTIFY FUNDING STREAMS

Create a funding stream that may include grants, corporate, and internal funding to support the provision of wireless services. CEO and CIO should work in partnership to locate diverse sources of funding from both public and private sectors. Additionally, the new Wireless Task Force should collaborate with the State of California who has funding for its goal to achieve ubiquitous access and increased use of broadband in California. This effort is particularly relevant in remote or geographically challenging areas in the County of Los Angeles where access to broadband is currently limited or unavailable.

START SMALL – BUILD INCREMENTALLY

Start with small or more manageable sized pilot projects that have a high probability of success and may be scaled up. If successful, these projects can be promoted as "proof of concept" in order to gain support for further initiatives. The Public Library began their project by initially offering WiFi in some of their branches, then expanded to include all of their libraries, and is now continuing to expand wireless access through its two North County bookmobiles in order to provide broadband benefits to employees and residents in distant areas. Additionally, there are a few proposed relatively small wireless projects in the County that should provide useful lessons and successes to build upon.

BACKGROUND

These unanimous recommendations of the WiFi Advisory Group are founded upon the work of the Group and the research and analysis provided by the USC Center for Telecom Management. Specific efforts undertaken by the group included regular meetings of the Advisory Group to discuss issues, trends, and the significant changes that occurred technologically and with the business models related to WiFi. In addition, the group undertook a series of examinations of the driving forces and factors within the County internally, externally, among localities in the region, and within the industry. Below is a synopsis of those activities and findings.

County WiFi
The County needs to look no further than its own public libraries for an excellent example of municipal WiFi in action. In 2007, the Public Library launched two-tiered WiFi access at all 84 County libraries. One tier of access is available free to the public;

all that's needed is a County library card. The second tier of access is available to County employees who possess a SecurID card. This makes it possible for any authorized County employee to gain WiFi access to County designated network locations.

The Public Library is seeing significant WiFi usage at their libraries. Since WiFi can be accessed anywhere within the general area of the WiFi "hotspot" (access zone) 24 hours a day, the library has seen considerable usage in some locations even at times when the library building is closed to the public. The Library's project was accomplished using a model of a "Government Owned and Operated Network." As a result, the $2 million project was funded 50 percent by an Information Technology Fund grant, and 50 percent by a Quality and Productivity Commission grant. The Public Library is funding the associated ongoing costs.

Additionally, we are aware of three other proposed County WiFi projects that may significantly benefit governmental uses as well as public uses of WiFi. One project proposes WiFi as an Internet access element, along with wired access, to provide the use of mobile technology and remote access for the Public Defender, Alternate Public Defender, and District Attorney. Another project proposed by Parks and Recreation would provide mobile access to key locations (e.g., camp grounds, golf courses, high volume local and regional parks, Arboretum operations, etc.) for public use as well as government uses. Additionally, Community and Senior Services have proposed a project for WiFi connectivity to its Service Centers. Its proposal presents opportunities for Senior Citizens, disabled individuals, and other community members to gain access to the Internet access.

CIO Internal and External Surveys of WiFi
Instrumental to the assessment of the County's WiFi interests, needs and assets was an Internal Survey, conducted by the CIO. According to that Survey, 57 percent of County departments responding have plans to develop or acquire wireless applications within the next two years. Although several cities indicated they have no plans for providing any WiFi services to their citizens, those cities with County libraries within their boundaries have the benefit of free WiFi hotspots as a result. Equally useful to the WiFi Advisory Group was an External Survey conducted by the CIO. Of 84 cities responding, 27 were already offering WiFi services. This data helps illustrate that there is additional WiFi reasonably accessible to the public within the County. Improving and providing public and governmental access to municipal services was the priority objective of those surveyed. This confirms that the County's goals and strategy recommended in this report are complementary to regional goals.

Municipal Collaboration
The WiFi Advisory Group was successful in bringing together County departments to share information and discuss wireless practices and projects. Neighboring municipalities were invited to provide the group with information on their activities with respect to wireless projects. This was useful in identifying the benefits, and significant challenges, when considering municipal WiFi projects. The possibility of collaboration on future projects was also discussed.

Several cities located within Los Angeles County are currently using WiFi, while others are considering WiFi and are in different stages of planning and development. Some cities that are interested in utilizing the technology have not identified the necessary funding.

Cautionary tales have been told by some cities that were already in the implementation phase of their WiFi project when the provider pulled out. An example of this is the cities of Santa Monica and Culver City who were working on a project with a company called "Azulstar." These two cities were well into the design and testing of their project when, in October of 2007, Azulstar went out of business. Some other cities who have tried to work collaboratively, such as those in the Silicon Valley, have run into difficulties reaching consensus, resulting in stalled projects. While municipal collaboration should not be ruled out, it most often involves complications that should be carefully considered prior to engagement.

Industry Perspective
A cross-section of wireless communications providers were invited to share their experience and respond to the WiFi group's questions, "What can you offer the County and its residents with respect to wireless communications?" and, "What recommendations would you make to the County with respect to implementing a WiFi or other wireless communications project?" The dominant reply from these industry representatives was that whatever projects the County chooses to engage in, it should be need-driven, and not technology-driven. They affirmed the belief that the WiFi Advisory Group collectively shared, that need will drive the best technology choice. There was general agreement among the industry representatives that while the use of WiFi technology fulfills some needs quite well, it is not a satisfactory solution to all Internet access issues. Most successful municipal WiFi implementations have been based on the use of the wireless infrastructure by the municipality for business applications with public access as a secondary benefit. To that end, both AT&T and Verizon discussed their Internet access solutions offered on a cellular technology platform.

It also became evident that some providers were showing little interest in many of the business models that have been associated with WiFi technology to date. Their concerns have recently been evidenced by Earthlink's decision in August of 2007 to no longer engage in municipal WiFi because that business model has lacked financial viability for them. Rolla P. Huff, Earthlink's President and CEO, was quoted as saying, "We will not devote any new capital to the old municipal WiFi model that has us taking all of the risk by fronting all the capital, then paying to buy our customers one by one." This will require cities like Pasadena, Chicago, Houston and San Francisco to either shift to another, more viable, business model or abandon their plans.

In February 2008, AT&T announced its partnership with Starbucks to start offering a mix of free and paid WiFi Internet service at 7,000 of the coffee retailer's shops by the end of the year. This deal positions WiFi as a value-added service, since it's free to nearly all of AT&T's broadband Internet customers and free for two hours to those who use a Starbucks card. It also could significantly change the landscape of reasonably accessible WiFi in the County and may even spur other commercial businesses to follow suit.

Feasibility Report
The WiFi Advisory Group worked in concert with the Center for Telecom Management of USC as it completed its feasibility report. Information for the feasibility report was gathered from various sources including: periodicals; surveys; meetings with County representatives, city representatives, industry representatives; and attendance at Municipal WiFi conferences. The information gathered was then analyzed to determine its relevance and applicability to the County and its unique assets, geography and related factors that are relevant to deployment of WiFi. The group determined that WiFi is *feasible*, however, the true *viability* of County WiFi is contingent upon factors such as the County's geography and topography, financial resources and commitment, and the all-important infrastructure assets of the County upon which most successful WiFi projects are predicated. Therefore, the provision of ubiquitous WiFi is not feasible at this time. At best, areas or hotspots of wireless services are the most practical and cost-efficient. The WiFi group also felt that policy recommendations that demonstrated a broader wireless perspective -- not just limited to WiFi as one technological solution -- would best serve the County's needs.

CONCLUSION

WiFi is one technology solution among several existing and expanding wireless technologies, and new technologies are fast-evolving. We believe that the unanimous recommendations of the WiFi Advisory Group will minimize investment, maximize dual-uses, and focus commitment on fulfilling needs, rather than chasing evolving

technologies.   We believe this course will serve many of the County's goals for governmental efficiency and will enrich services to the public.

If you have any questions, please contact Susan Herman, WiFi Advisory Group chairperson, at sherman@ceo.lacounty.gov or 213-974-6807.

WTF:GK
SH:FT:lm

Attachment

c: Chief Executive Officer, Board of Supervisors
    County Counsel
    Chief Information Office
    Public Works Department
    Community and Senior Services Department
    Parks and Recreation Department
    Consumer Affairs
    Internal Services Department
    Public Library
    Beaches and Harbors Department

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LA County WiFi Feasibility Report

December 12, 2007

By
The Center for Telecom Management (CTM)

Principal Researchers: Elizabeth Fife & Laura Hosman

Additional Contributors: Jinna Choi, Leon Kaye

Executive Summary

As hundreds of municipalities nationwide have either explored or launched WiFi initiatives, Los Angeles County is considering whether and how it should proceed with a similar endeavor in light of the lessons learned from those initiatives, both the successes and failures. While there is much that can be learned from the experiences of other municipalities in terms of business and logistical arrangements, the scope of network coverage, and the kinds of services that a government-run WiFi network can offer, it is important to also understand from the outset the unique characteristics of Los Angeles County that affect the provision of any services.[1]

WiFi technologies vary in capability depending on the terrain, making LA County's urban, rural, coastal, and mountainous topography a particular challenge for designing any uniform, county-wide service offering. Los Angeles County contains more cities than most counties, each with their own policies for providing WiFi services, requiring the County to consider a collaborative approach as plans are developed. Although the County is rich in

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[1] WiFi stands for Wireless Fidelity and refers to any wireless network that uses the 802.11 standard. In a WiFi network, computers with WiFi network cards can connect wirelessly to a wireless router. The router is connected to the Internet by means of a modem, typically a cable or DSL modem. Any user within 200 feet or so of the access point can then connect to the Internet, though for good transfer rates, distances of 100 feet or less are more common. WiFi has historically been used as a low cost networking option for homes, university campuses and offices, and now is also used in municipal-wide settings. WiFi is also available at "hotspots" which are either free of charge or available to subscribers of service providers.

resources, its government owns few infrastructure assets typically used for WiFi purposes (such as street lights, fiber networks, and utility poles) and has to compete with the agendas of city, state, and federal entities in this area. Unlike most municipalities who have undertaken such efforts, Los Angeles County does not own sufficient or pervasive infrastructure that might be used to deploy a WiFi network; therefore, the County would have to rely on regional collaboration and promoting a shared agenda for distributed resources if it wanted to achieve a ubiquitous WiFi network throughout the County. All of these factors create complications for the County in providing WiFi services within the environs of Los Angeles County.

Despite these obstacles, the County has already made significant progress in providing access to the Internet for all of its residents. As documented in this report, and through surveys undertaken by the Chief Information Office (CIO) in response to the Board's motion on WiFi services, almost all Los Angeles County residents now have access to free wired and wireless services at County and city libraries within reasonable distance from their home or business. Furthermore, the Los Angeles County Public Library is providing dual-use WiFi at all of its 84 libraries. It provides the public with Internet access and serves internal County needs by providing County staff with the enhancement of secure access to designated County Intranet locations increasing governmental efficiency. The remarkable popularity of these services demonstrates the level of public interest in the County providing broadband access, but the question remains whether WiFi technologies provide the best way to take the next step in addressing this interest on the part of County residents.

In this report, we have attempted to provide the County with enough information to begin to address the essential questions that must be answered before proceeding with a WiFi initiative:

- What level of service would be provided? To which constituents?
- How will the County's employees benefit, and who will have access?
- How can a wireless network improve public safety and disaster preparedness?
- What are the local business and economic considerations?
- How will such a network improve services for citizens?
- What is the business model or funding structure the County would use to deploy such a service? Will the network be entirely county-owned, owned and operated by a third party, or utilize a public-private partnership of some type?

The report provides data and case studies designed to help policy makers answer these questions, but it is important to recognize that the overall outlook for municipal wireless networks is still unclear. Two years ago cities and counties all over the United States were enthusiastic about the potential of wireless networks. Many of these projects, however, have stalled or terminated for numerous reasons, and we believe the County should study the mistakes and success of other locales before making its own decision to proceed.

While it is certainly technically feasible for the County to provide WiFi services, the financial challenges of doing so suggest the need to focus any first steps on clearly defined needs

with well documented potential to provide the County a return on its investment. Residents in unincorporated areas are likely to be more interested in the County becoming involved in providing WiFi services than those living in cities or parts of the County that already have access to such services from alternative sources. Most successful government initiatives in this area have financed the deployment of WiFi technologies from the savings that have flowed from the improvements in government operations the technology offers, rather than new revenue streams from the public. But even here, alternative sources of wireless broadband services already in use by Los Angeles County, such as EDGE or EVDO, have been shown to be equally, if not more, effective in many cases. For all of these reasons, it is important that the County be clear about what goal any WiFi initiative is designed to accomplish and tailor its expenditures on the technology accordingly.[2]

Therefore, we recommend that the County begin with incremental steps that can each stand on its own in terms of costs, benefits and needs addressed. In the long run government-financed WiFi will be driven by applications that make business sense and only a few of these applications are available today. The County should start by expanding governmental services via broadband access and experiment with wireless pilot programs that provide public access as an adjunct or offshoot of that expansion. At the same time the County should explore various funding streams that can build a foundation for continued success in accomplishing the County's strategy for greater broadband access for its employees and residents.

Recommendations:

The Los Angeles County WiFi Taskforce has spent nine months listening to experts in this field, discussing what is already working in the County in this arena, and working with researchers from the Center for Telecom Management at USC's Marshall School of Business, to formulate a plan of action for the Board's consideration. To guide readers of this report, the Taskforce's six specific recommendations are presented here. The recommendations are supported by the data in this report, including results from both internal and external surveys undertaken by the CIO's office, and the experiences of many other governmental entities, which are also summarized in the report. The recommendations are detailed in the conclusion of the document as well. Following is a summary list of the recommendations:

1. Adopt a strategy for LA County's use of wireless technologies and place its WiFi implementation plan within the framework of that strategy. The strategy should be in line with public employees' needs, in order to enable them to effectively provide

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[2] EVDO is a standard for high-speed wireless broadband. The acronym is short for "Evolution, Data Only" or "Evolution, Data Optimized," but it is also known as one of the 3G forms of CDMA2000, and is one of two major 3G standards for high speed wireless transmission. EVDO is theoretically as fast as residential DSL or cable broadband connection. EDGE is also a digital mobile phone technology for transmitting data, but has a slower speed than the 3G technologies, and is classified generally as "2.75 G."

constituent-centric services. Here is one possible version of such a strategy statement:

> "LA County will use the benefits of wireless technologies to enhance the performance and effectiveness of its services, and where feasible, expand the ability of its residents to use the same technology to enrich their lives."

2. Investigate possibilities for the extension of existing WiFi projects, as well as for dual-use scenarios, in which public use of WiFi technology is offered as a value-added service, piggybacking on official County-services implementations based on identifiable needs.

3. Coordinate initiatives among relevant offices, to determine needs, and ascertain how to streamline activities. Central coordination also provides better opportunity for management of project implementation and oversight.

4. Use a framework of best practices and lessons learned from other municipal wireless projects being implemented across the country. The components of such a framework are elaborated upon in this report.

5. Create a funding stream that may include grants and corporate funding as well as internal funding to assist with financial aspects of wireless provision, especially, though not exclusively, if and where projects provide wireless technology to the public.

6. Start with smaller, pilot projects with a high probability of success, that may be scaled and may also be promoted as proof of concept, in order to gain and increase support for such initiatives.

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Chapter 2 - Introduction

Los Angeles County is one of the most unique municipalities in the world. Containing 88 cities and more than 130 unincorporated areas, it has a larger population than any other county in the nation. It contains more people than many states in the USA, and an economy that would satisfy the metrics to qualify as a G-10 state if it were an independent nation. Los Angeles County is full of potential, anomalies, and contradictions. The County is rich in resources, but its government owns few assets in the public rights-of-way such as utility poles, unlike some cities within its boundaries. Each of the five members of the Board of Supervisors represents a swath of population equal to that of three U.S. congressional districts. The County is urban, rural, coastal, and mountainous. Diversity not only describes its population, but its economy, affluence, and political beliefs. And all of these factors contribute to the complications involved in implementing a municipal WiFi network within its environs.

This report will provide background information, research and analysis, as well as preliminary recommendations regarding the various options available for the development and deployment of wireless Internet capabilities at the municipal and/or county-level. It is prepared in response to the Los Angeles County Board of Supervisors' directive to:

- Conduct a feasibility study on the expanded development and implementation of Wireless Fidelity (WiFi) services to be made available throughout the County;
- Assess the operational benefits of WiFi access for County departments; and
- Consult with other jurisdictions to determine whether collaboration or partnership may be possible with other interested municipalities.

The report presents options and issues to consider as the County faces important decisions regarding the deployment of this technology and its ramifications for the working conditions and quality of life of both public employees and constituents alike. As such, a central objective motivating the project team was to think broadly about the role of information and communications technology (ICT) in meeting both government and constituent needs—and in particular, to determine how meeting these needs could be improved through the provision of wireless technologies.

With this objective in mind, the report builds a foundation upon which to base preliminary recommendations for the County to move forward with its technological decisions—specifically those addressing the questions of *why, for whom*, and *how*, as these relate to the provision of WiFi technology. The report also represents an initial step towards building a strategy for the County. Following this introduction, the report's chapters discuss the promise, reality, and challenges relevant to WiFi technology, and presents six preliminary recommendations.

1. Executive Summary
2. Introduction and Methodology

3. Overview of Key Trends
4. A Clear Strategy for WiFi Technology in Los Angeles
5. Engagement for an Effective Strategy
6. Business Models
7. Locally Relevant Case Studies
8. From Vision to Reality: Preliminary Recommendations for LA County Municipal WiFi

At the end of the report, Appendix A describes the issues and challenges affecting the deployment of a WiFi network in the County from a cost, timing, technical, security and environmental perspective. The reader will also find definitions and descriptions of WiFi technology in the opening section of the appendix.

Methodology

The research team for this report comprises expertise in the areas of information technology and telecommunications, business and engineering, public policy, and public management. The team drew members from both academia and the public sector, and conducted background research as well as in-person, primary gathering of information. Research activities included:

- Using the LA County WiFi Taskforce of departmental stakeholders and leaders in WiFi, coordinated by the Chief Executive Office (CEO), as a sounding board;
- Attending each Taskforce meeting whose agendas included:
  o presentation of the WiFi plans and projects from some of the surrounding cities in the County;
  o presentation by the telephone and cable industry on their perspectives on WiFi and recommended role for the County;
  o a review of recent trends and articles on WiFi; review of the County Public Library's WiFi project; and
  o results of the CIO's internal and external surveys.
- Drawing from both internal and external (84 cities) surveys commissioned by the County CIO's office, to determine the wants, needs, beliefs, and strategies for WiFi, at department-level CIOs' offices, and for County departments and their employees in general;
- Utilizing relevant academic literature;
- Compiling background research on best practices, challenges, and pitfalls for WiFi strategies among other municipalities;
- Conducting primary research on security strategies for WiFi services;
- Internal drafting and peer reviews of the research findings and report document.

Chapter 3 - Overview of Key Trends facing Governmental Provision of Wireless Services

The future of municipal WiFi networks and the benefits for users are still unclear as many high-profile projects across the nation have run into cost issues, logistical problems in implementation as well as lower than anticipated usage rates. Telecom service providers are currently pulling back on their WiFi commitments as networks have frequently exceeded their initial cost estimates; and the business model remains elusive. Nevertheless, municipal wireless networks can offer benefits: providing broadband access in some underserved areas, and giving an economic boost to some communities.

There is evidence that governmental services have been able to be more efficiently and effectively delivered, particularly when publicly-owned assets (e.g., utility poles and street lights) can be dual-purposed for WiFi applications. Given this mix of experiences, how and where Los Angeles County should implement municipal wireless networks requires a careful examination of just what benefits can be achieved by such an initiative and how much money it would cost to achieve them.[3] (See Appendix B, map of LA County's unincorporated areas).

Despite the grand promises that advocates of municipal wireless networks initially brought to the table, results across the country and globally have been mixed. Academic journals, the popular press, and industry experts indicate that those who stand to benefit the most—particularly in urban settings—are not necessarily local residents who were plagued by lacking or substandard service, but municipal employees who saw gains resulting from increased mobile technologies. In South Sioux City, Nebraska, for example, police officers using their laptops to communicate with their stations or processing complaints could work throughout the city and were no longer relegated to local WiFi hotspots. In Granbury, Texas, municipal employees reported higher productivity, while the city's police officers also benefited from having access to data at higher speeds.

The city of Anaheim also has plans for their police force to make use of their wireless capabilities—notably, to make the city's squad cars into their own hotspots when they travel outside of the city's wireless network. Communities are also reporting increased efficiency from using WiFi to monitor their automotive fleets, from buses to public works equipment to garbage

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[3] For a discussion of trends in municipal wireless networks, see Gene J. Koprowski, "Municipal Wireless Networks Generating Controversy," *TechNewsWorld*, April 16, 2005; Steven Titch, "Cities Scrap Municipal Wireless Plans," *The Heartland News*, September 1, 2007; Richard Martin, "Muni WiFi Forecast: Cloudy," *Information Week*, July 11, 2007; Martin, "Muni WiFi: Next Big Thing—Or Next Tech Boondoggle?" *Information Week*, May 19, 2007; for a legal discussion, see Sharon E. Gillett, "Municipal Wireless Broadband: Hype or Harbinger?" *Southern California Law Review*, vol. 79, 2006; Eric Griffith, "Cost of Muni WiFi is High," *WiFi Planet*, July 6, 2005; William Lehr, Marvin Sirbu, and Sharon Gillett, "Municipal Wireless Broadband: Policy and Business Implications of Emerging Access Technologies," Massachusetts Institute of Technology Conference, 2004; "Our Fi: Municipal Wireless Searches for its Connection," *ComputePowerUser.com*, June 2007; Gwen Shaffer, "Frame Up: An Analysis of Arguments For and Against Municipal Wireless Initiatives," Sage Publications, 2007.

trucks. Other communities report that local governments are becoming closer to their constituents by raising awareness of local services.

A recent and somewhat unique WiFi initiative is Burbank's Water and Power planned network that will offer metering as well as residential service. Metering will be the first step to assess how power is used, and that information will be used to develop a plan for efficient use of power. The utility will be able to use its field workers, mapping data (including trees in the rights of way and building outlines), utility poles and other rights of way ownership. This rollout is planned in four stages: Phase 1 assessment which is complete, Phase 2 involved a pilot test on the utility company's 20 acre campus. Phase three costing $1 million will involve serving a portion of their larger power customers. Finally, stage 4 costing about $5 million will cover most of the 18 sq mi. town. Burbank already has a fiber –optic network spread throughout the town.[4]

Officials in Greene County, North Carolina, claim that the county's investment in a wireless network, coupled with grants that provided laptops to its students, has actually led to higher test scores and business growth.[5] Communities such as Chaska, Minnesota, where residents resented the high broadband residential rates offered by privately-run Internet service providers, now see measurable savings due to their towns' decisions to simply create their own local wireless networks. Nevertheless, the benefits do not appear to be the broad macroeconomic benefits that are often hoped for, but more often, positive results occur at a very finite micro level. Rather than luring new businesses, there are some suggestions that fledgling businesses are sustained locally, and existing ones may be more likely to remain.

Additionally, the mere presence of a wireless network does not necessarily generate usage. Initial assessment needs to be carried out so that access, services, and applications are matched to demand. If an initiative is responding to needs, then goals and benefits can be articulated and promotion of the network is better achieved. If the goal is providing access to members of the public who have limited access, other considerations should include the need for computer equipment, training and education programs.

Finally, the promise of "free wireless" is one that can be too costly to keep and arouses less interest than government leaders may have initially thought. *The Economist* reports that most of the networks deployed in the US between 2004 and 2006 underestimated costs, and that completed networks have attracted fewer users than expected.[6]

Further complicating the argument that voters want more affordable access is the fact that most residents of Los Angeles County already have wireless broadband options through schools, the public library system, and local businesses such as coffee shops, or they are able and willing to pay for broadband access to their homes. In addition, WiFi access cannot compete with more

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[4] Glenn Fleishman, "Burbank Pursues Unique Wi-Fi Network: As Many Nodes as Needed," http://wifinetnews.com/archives/008003.html
[5] Report is available at http://www.ndn.org/advocacy/globalization/laptoppaper.html
[6] http://www.economist.com/business/displaystory.cfm?story_id=9726651, August 2007.

attractive options, such as higher speed and service bundling that telecom and Internet service providers already do offer.[7]

In sum, Los Angeles County must first address the important issues of what goals it hopes to achieve if it proceeds with further deployment of wireless technology. To do so, the County must address the questions: what, for whom, and why, regarding wireless technology, in order to formulate a clear strategy and efficient plan of action.

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[7] http://www.internetadsales.com/modules/news/article.php?storyid=987;

Chapter 4 - Creating a Clear Strategy for Wireless Technology in Los Angeles County

Prioritizing Objectives: what, for whom, & why

The first step in developing a strategy is identifying and ranking goals that the County wants to achieve with the deployment of wireless technology. A clear prioritization will bring both focus and direction to the development of a strategic WiFi plan. It will also provide motivation and justification for the County's eventual deployment decisions, and will shed light on the appropriate business model to suit the County's needs.

The County's objectives in providing wireless capabilities may be numerous and quite varied in nature, in terms of intended beneficiaries, financial requirements, degree of controversy, and so forth. Some of the goals that have been enumerated by those undertaking municipal WiFi projects across the country include:

- Providing support for emergency response teams
- Increasing the efficiency of the County's workforce by enabling public service workers to take advantage of mobile technology applications, and perform tasks in the field that would otherwise require them to return to the office
- Providing broadband service to communities currently without such service
- Offering residents and businesses with an affordable broadband data service an alternative to cable modem or DSL services—reducing costs and increasing competition
- Facilitating commerce, expansion, and economic growth within their area of jurisdiction
- Creating opportunities for local wireless companies to develop new products and services
- Reinforcing their municipality's reputation as (or transforming their municipality's reputation to become) an economic hub/center of technological innovation/pioneer in providing effective services, etc.
- Increasing the attractiveness, or "stickiness," of certain areas, such as historic downtowns, by drawing and retaining citizens and consumers with the offer of wireless hotspots
- Addressing the "digital divide," and fostering an environment where disadvantaged citizens can access the Internet, and inform and avail themselves of governmental services
- Expanding educational opportunities
- Enhancing the visitor's experience to the locality

Although all of these goals appear worthwhile, it is necessary to prioritize the County's purposes in pursuing this initiative. Governments that have embraced too many disparate goals

have often been left achieving none. Identifying the application(s) and needs is the first step –
the appropriate wireless technology choice follows from identifying the specific use.

The County therefore will need to consider carefully which of the above objectives are
most relevant for it to pursue and possible for it to achieve, given its fiscal constraints,
geographical considerations, division of responsibilities vis-à-vis other governmental entities,
technological capabilities already in place, and constituents' and employees' demands.

The most important goals enumerated for municipalities across the nation are represented
graphically below in Figure 1. Improving public safety and encouraging economic development
are the two most important objectives noted.

Figure 1

Most Important Goals of Wireless Network Initiatives
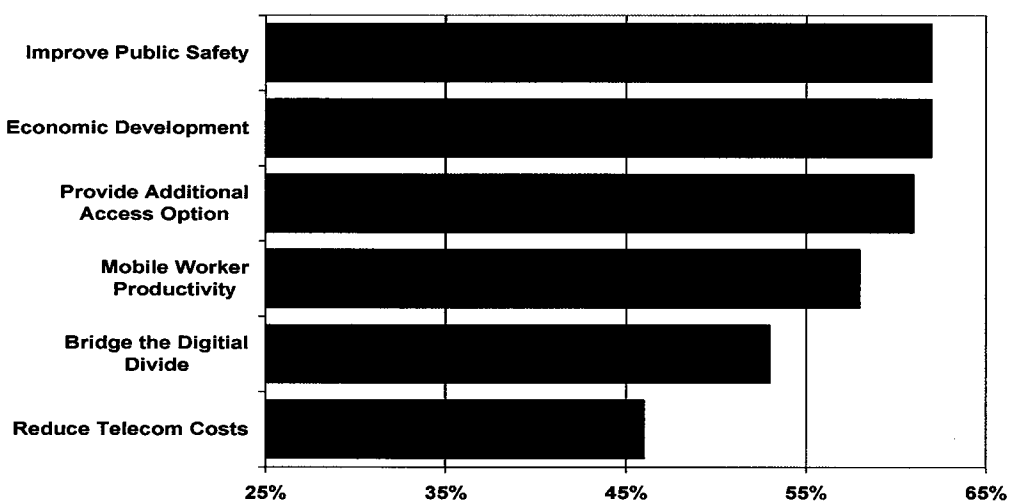
Source: Muniwireless.com, *State of the Market Report*, 2006

A recent CIO survey of 84 cities in LA County shows that these cities do see benefit in
providing free or minimal cost WiFi services. Most, however, have no immediate plans for WiFi
deployment. For those that do have plans (17 cities) the time frame is one to two years. As
shown below in Figure 2, among the 27 cities that already offer WiFi services, the objectives
were: first, to generally provide public access to the Internet and second to improve public access
to city information and services.[8]

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[8] Jon Fullinwider, Los Angeles County, Chief Information Office, "External Survey," 2007.

Figure 2

City's Objectives in Providing WiFi
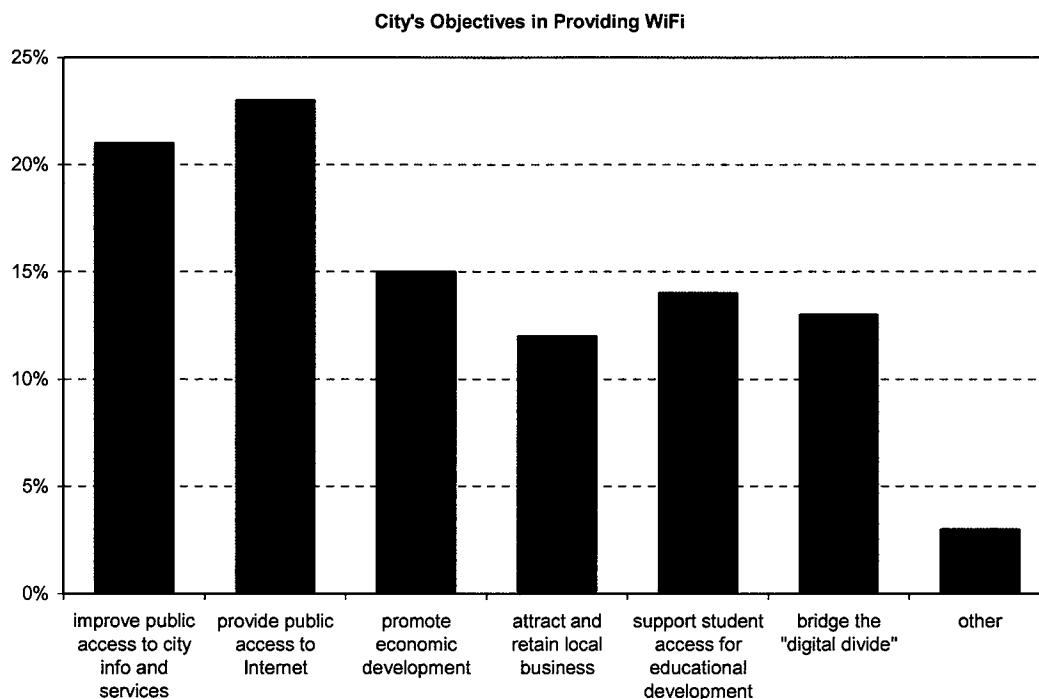
Source: External Survey, CIO's Office, July 2007

Overall, these results, representing eighty-four out of eighty-eight cities that responded to the CIO's External Survey, are roughly in line with the MuniWireless.com survey shown in Figure 1 that represents cities across the U.S. Bridging the digital divide is not seen as a top priority in either survey, rather providing the public with access to city services and info is a prominent objective.

Public Services and Public Employees

Information and communications technologies (ICT) are already extensively used to meet the needs of Los Angeles County's employees, citizens, workforce, economy, and communities. Wireless is an enabling technology that could be used to make public services more readily available and allow public employees to be more efficient in their abilities to serve the County's citizens. An efficiently connected County government will serve Los Angeles County constituents by:

- Providing reliable communication and information sharing for emergency services, in terms of:
  - public safety,

- law enforcement, and
- emergency/disaster preparedness and services;
- Enabling public employees to perform at a more efficient level, particularly when they provide services in the field, or on-site, in such departments as DPW, DCFS, CSS and ISD.
- Promoting the use of wirelessly-enabled remote monitoring and controlling of service applications where applicable, to save taxpayer funds. A few examples of such applications include:
  - Meter reading
  - Traffic and parking, monitoring and control
  - Asset tracking

> **New York City's Public Safety Solution:**
>
> New York City is in the process of building a wireless network specifically designed for public safety that is the first and largest such network of its kind. It is run out of the Mayor's office and the Department of Information Technology and Telecommunications for the City. This is a mission critical network that is being built to put tools in the hands of first responders; it is not WiFi-based, but rather is a cellular network so that a high level of security and reliability could be provided. This network is not meant for public use, however it could be prioritized for this capability. In addition to safety applications, other government uses are possible, such as meter reading, traffic controllers, and applications for mobile workers like inspectors and social workers. Northrup Grumman built the network, and owns and maintains it. They work with the city's Dept. of IT which is the single agency out of the mayor's office that manages this initiative. This kind of network is beyond the current scope of LA County – but is an example of a comprehensive approach that at a future point could be considered. *Source:* http://www.nyc.gov/portal/site/nycgov Sept. 12, 2006, "Mayor Bloomberg Announces Selection of Northrop Grumman to Build High Speed Wireless Data Network for Police Officers, Firefighters and Other City Workers," PR- 326-06

The CIO's recent survey of County departments found that 93% of respondents agreed that they had job functions that would be better performed if staff had access to data and information in the field – suggesting a need for wireless access. About half the departmental staff from the departments who answered this survey currently use wireless applications (not confined to WiFi) in their jobs, and over half (58%) of respondents state that their department has plans for developing or acquiring wireless applications in the next 24 months that would allow staff to access data and information remotely in the field. Furthermore, 37% of respondents state that their departmental locations have wireless 802.11 (WiFi) connections to the Internet.

These findings indicate departmental use of wireless applications, in some cases through WiFi technology. Nonetheless, the majority of departments do not provide the public free access to the Internet from any of their office/facility locations or public areas operated by the County. Among the few departments that do provide free public access, the majority (83.3%) are willing to expand the number of wired PC devices for public access. This indicates that a degree of readiness and willingness to meet constituent demand for wireless broadband – however, most departments do not have plans to expand public access at this time.

One best practice that has been identified in implementing successful initiatives is to start with smaller, pilot projects that can demonstrate success, and can be scaled or utilized as exemplars for moving forward. The County has already recognized the importance of taking such measures—

of utilizing both pilot projects and infrastructural improvements—by moving ahead with individual, targeted wireless projects, such as its recent decision to enable remote (wireless) traffic management at signal intersections in the unincorporated areas of the County and within numerous cities. Going forward, as these applications prove successful, dual-purpose use may be possible to achieve economies of scale and efficient use of public assets. For example, use of the wireless Internet capabilities at the County's library system is heavy both during hours of operation and after hours as people use their laptops outside the library structure. It is possible to envision a dual use scenario in this case where the public network is also accessed by field workers in the Public Works Department – who could stop by a library to get work orders.

Beyond continuing these efforts, it appears that the time may be right for the County to adopt a larger vision that includes examining departmental services to see how various public-sector projects might also be more widely utilized by constituents. Efforts to identify dual purpose of use with a single deployment may be possible. If both public and private utilization can be built into a given project, there may be cost-savings and increased "value added."

Public Safety and Disaster Preparedness

Public safety is one of the most often-cited application used in justifying deployment of wireless networks around the country. From small to large cities, 75 percent of all municipalities and counties report that they are using or plan to use their municipal networks for public safety applications.[9] Like Pleasanton, California, most cities have proceeded with wireless plans based on the public safety benefits it will bring to police and fire workers, but are allowing the public to piggyback on the service as a value-added benefit.[10]

In Tempe, Arizona, where the public safety officers already have access to the city's wireless network, police officers carry a laptop in their vehicles, and can access mug shots, maps, warrants on people and vehicles, and send and receive information on missing children, all via national databases, instantly, from the front seat of their patrol cars. Specialists in hazardous materials are alerted when there is a chemical leak or a suspicious substance. Through the wireless network, useful information, such as floor plans and chemical inventories of local industries can be accessed online, while lab reports can be emailed instantly to on-scene officers, to facilitate safe clean-up.[11]

In the wake of the Katrina hurricane in 2006, both the cellular and wired phone service went down. Municipalities and volunteers rushed to set up WiFi networks to get communications up and running. In preparation for future emergencies, numerous public safety agencies have begun setting up wide-area wireless broadband networks (running on 2.4 and 4.9 Ghz) because the phone networks may take a long time to restore and are unreliable in inclement situations. In

[9] MuniWireless.com, State of the Market Report, October, 2006, p.11
[10] Fitzhugh, M. "Pleasanton preps for downtown Wi-Fi," East Bay Business Times, May 16, 2007. Accessed at http://www.bizjournals.com/eastbay/stories/2007/05/14/daily34.html?from_rss=1
[11] Termen, A. "Tempe Wi-Fi: Firefighters, police are fans," CNet News, June 29, 2006. Accessed at http://www.news.com/Tempe-Wi-Fi-Firefighters,-police-are-fans/2100-7351_3-6089236.html

the recent fires around Southern California, the Malibu Library provided WiFi IDs for the firemen battling the blazes to send their reports back from the field.

The LA Fire and Sheriff representatives who participated in the CIO's recent survey believe that although WiFi services can provide some of the wireless data services they need on an operational basis, this will be a supplement rather than their primary access method. The Sheriff may be using WiFi in specialized functions, such as in high crime areas for TV cameras and license plate recognition systems. The Fire and Sheriff departments plan on placing WiFi hotspots at Fire Stations and Sheriff Stations for vehicles to drive in and upload and download documents. However, they believe that large-scale WiFi is very costly and difficult to obtain good coverage and manage. They are looking at WiMax and other forms of cellular broadband as possible interim solutions.[12] In the future they are anticipating the use of the 700MHz spectrum which will provide some broadband data service capability in conjunction with, and with the same coverage as, their mobile radio systems.[13] Neither department has investigated to a great degree the use of the 4.9GHz spectrum due to the build-out cost.[14]

The Sheriff may utilize some of the independent cities' (such as Cerritos) WiFi services if arrangements can be worked out. For WiFi services to be viable for public safety, near ubiquitous coverage is necessary, similar to what now exists with mobile radio systems. That means that ALL the cities and unincorporated areas within the County (this is due to contracted services and mutual aid needs) would need to participate in a unified municipal WiFi system. This would be a mammoth political and financial undertaking.

WiFi has been used effectively in emergency preparedness planning as witnessed by the recent experience of the I35W Bridge disaster in Minneapolis in August, 2007. A new WiFi network deployed in that city—only partially completed and just two months old—nonetheless gave the city critical help in responding to the bridge collapse. Upon learning of the disaster, the city's IT department immediately went to work to provide basic support and desk-side services for the city's emergency operations command center, while the GIS (Geographic Information Services) staff also worked to provide maps, both for public use and internally, to assist with traffic and recovery efforts. In the minutes following the report of the bridge collapse, the cellular network jammed due to the volume of calls being placed. As a result, USI Wireless (the

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[12] See Appendix A for discussion of WiMax and the major varieties of wireless data technologies.

[13] The 700 MHz spectrum is currently owned by broadcasters and has been used for analog television. It will be turned over to the government in 2009. Due to its broadcast-attractive physics (like its ability to penetrate walls), this spectrum is desirable for both broadband communications in general and public-safety uses in particular. Om Malik, http://gigaom.com/2007/03/14/700mhz-explained/, March 14, 2007.

[14] See: http://www.safecomprogram.gov/SAFECOM/library/spectrum/1088_publicsafetys.htm. The Federal Communications Commission (FCC) has allocated 50 megahertz (MHz) of spectrum in the 4.9 gigahertz band for pubic safety agencies to implement on-scene wireless networks for streaming video, rapid Internet and database access, and transfers of large files.

subsidiary providing wireless service in Minneapolis) opened the WiFi network to anyone, thus allowing people with WiFi-enabled phones to make calls free of charge on that network.[15]

Broader Use of WiFi

Deploying a municipal wireless network to address business and digital divide considerations becomes a subject of great debate when these efforts are undertaken independently of government efficiency or public works endeavors, or when they are not seen as dual-use projects. The lack of a proven business model to address either business or digital divide considerations is noted repeatedly in the press, at industry forums, and among the major WiFi service providers. Numerous municipal wireless initiatives, including those in Philadelphia, Miami, Houston, Chicago, and San Francisco, have met with difficulties, setbacks, and even failure in their ambitious attempts to close the digital divide by providing public access to WiFi, despite their numerous and varied approaches, business agreements, goals, and levels of available funds. In general terms, identifying the proper terrain for a WiFi network has been problematic. Rural areas tend to lack sufficient population density, while urban areas with a sufficient user base may have structures and buildings that impede WiFi signal penetration. Suburban areas often have broadband access already through the local cable provider or phone company.[16]

These challenges notwithstanding, most of the above-mentioned cities, and many more, are pressing ahead with municipal WiFi projects.[17] However, the stumbling blocks each locality faces are real, and highlight the need not just for a clear strategy, but also for a need-driven, well-designed, appropriate business plan, and for an effective implementation strategy, consisting of training, education, and benchmarking.

With these considerations in mind, we turn next to the areas of business and economic development considerations.

Business and Economic Considerations

In calling for a County-level investigation of wireless services implementation, Supervisor Burke made the following introductory statement about the importance of information and communications technology (ICT) enabled economic activity in the region:

> "The County of Los Angeles is an international leader in numerous industries including entertainment, technology, and trade. As the 8th largest economy in the Nation and the 17th largest in the world, it is essential that the County government continue to

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[15] Thibodeau, P. "New Wi-Fi network proves critical in Minneapolis bridge disaster. August 3, 2007. Accessed October 2, 2007 at
http://www.computerworld.com/action/article.do?command=viewArticleBasic&articleId=9028978
[16] Interview: Paul Sosa, Karen Miller, Rupert Young, Carl Nerup, (AT&T) 9/5/07. Interview conducted by CIO's office, LA County.
[17] MuniWireless.com, State of the Market Report, October, 2006, p.5.

support the infrastructure which historically has been an integral component in the economic growth of our region. Whereas in previous economic cycles, innovations in heavy industrial manufacturing served as the catalyst for economic growth, today it is clear that continued economic prosperity relies on communications technology. Specifically, the Internet stands as the driving force behind any jurisdiction's ability to compete in an increasingly global market.

While the County has shown initiative in making Internet access available, it is time to pursue a broader initiative that will not only allow the County to remain at the forefront of high tech globalization, but would be an essential upgrade to our constituents' quality of life."[18]

One method by which municipalities have promoted local business development has been by increasing competition among WiFi providers. With normal goods and services, competition drives down prices and improves quality of service provision. It also promotes economic activity and development as new competitors enter the market. Such competition may be promoted either through legislation encouraging or mandating it, by offering WiFi services where there is no service available (or promoting private provision of service where none is extant), or by offering WiFi service in direct competition with private providers. Such wireless services may be provided to businesses as well as to the public.

This goal must be considered carefully, because the decision of whether the County will provide business and public WiFi service provision will play a large role in determining the business model that the County should pursue. It will also greatly affect the financial responsibilities of such an undertaking. Once again, the County must determine whether it represents the best level of government to provide such a service, and to what extent, or according to which model, it will provide all or any such services. Discussion of business models is further developed in chapter six.

Social Justice Issues: bridging the digital divide

Los Angeles County is the largest county in the nation, and it comprises an extremely diverse population in terms of social and economic levels. The wealthy are 20 times more likely to have Internet access than the poor, according to a recent Commerce Department study, which also referred to the digital divide one of America's leading economic and civil rights issues.

Using email and navigating the Internet to locate information have been identified as necessary for obtaining employment in today's workforce. Technology experts say inner cities— and their residents—are losing out on job training and opportunity, economic development, and civic participation as the high-tech train roars by, given that businesses may avoid locating in areas where workers are not technologically trained and networks are not available.[19] In LA

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[18] Minutes of the Board of Supervisors, County of Los Angeles, State of California. April 10, 2007. p.1.
[19] Koch, K. (2000, January 28). The digital divide. CQ Researcher, 10, 41-64. Retrieved September 21, 2007, from CQ Researcher Online, http://library.cqpress.com/cqresearcher/cqresrre2000012800.

County it is possible for any individual to have access to the Internet via the public libraries. If "reasonable access" is defined according to the provisioning at these venues, (free of charge, available to all regardless of whether they have their own device), then this public good can be considered as a service currently available to residents.

The County recognizes the importance of Internet access, and has demonstrated its commitment by providing free public access in all libraries under its provenance. Further, all County libraries offer *wireless* Internet, free of charge to all patrons. This effectively provides access to anyone already in possession of a laptop and other WiFi-enabled devices, as well as those unable to afford such equipment. Demand for these capabilities is high. Fred Hungerford, Assistant Director for the County of Los Angeles Public Library, reported to the County's WiFi Advisory Group that the library computers with Internet access are occupied—with waiting lists filled and time limits for use enforced—from open to close of the libraries' hours of operation – and beyond.[20] Interestingly, the County of Los Angeles Public Library Wireless Usage Report shows substantial wireless hourly usage during evening hours when the library is closed. Patrons use their laptops outside the library, either driving by in their cars or sitting outside of the library structure.

Keeping in mind budgetary constraints, assets, and most importantly the demand for access and services, the County will need to decide whether addressing the "digital divide" should be a primary goal for WiFi provision, and if so, whether the library-provided Internet sufficiently meets this goal.

If library-provided Internet access does not meet a threshold definition of "meaningful access," the County will need to look into alternative methods for enabling access to economically disadvantaged constituents. The County will have to determine whether a threshold will be achieved through the provision of free wireless services to an underserved area, the offering of education and training programs, or with the provision of hardware—or through some combination of the above. It will also need to decide how to fund such endeavors.

One further way in which municipal projects have delivered value to constituents is by providing WiFi capabilities to schools, and partnering with them to offer education and training in technological capabilities to students. However, the County does not have jurisdiction over the public schools. It could seek to influence the availability of such services, however, through the County's Department of Education. Meanwhile, community service and senior citizen centers and parks facilities may provide comparable, convenient venues. From the CIO's Internal Survey, six departments reported that they offered the public free access to the Internet (the Public Library at eighty-four locations, and Parks and Recreation at forty-five venues). When asked if they would be willing to expand the number of wired PC devices for public access, 5 departments, including Community and Senior Services, Mental Health, Parks and Recreation, and the Public Library, reported that yes, they would. Thus, these departments can be considered as possible candidates for partnering to provide WiFi services and applications.

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[20] Report made at LA County WiFi Advisory Group meeting, July 26, 2007 and October 25, 2007.

The majority of departments, both those who offer public access to the Internet and those who do not, report that they do not in fact receive requests from the public to provide Internet access.[21]

Improving County Operations

Business applications that utilize machine-to-machine communications, including water monitoring, asset management, transportation management and gunshot monitoring are now available to improve the delivery of government services.[22] Public safety and building inspection are among the most popular WiFi applications at the moment. Below, Figure 3 shows the most commonly utilized WiFi technology applications across the United States:

Figure 3:

Top Municipal Applications
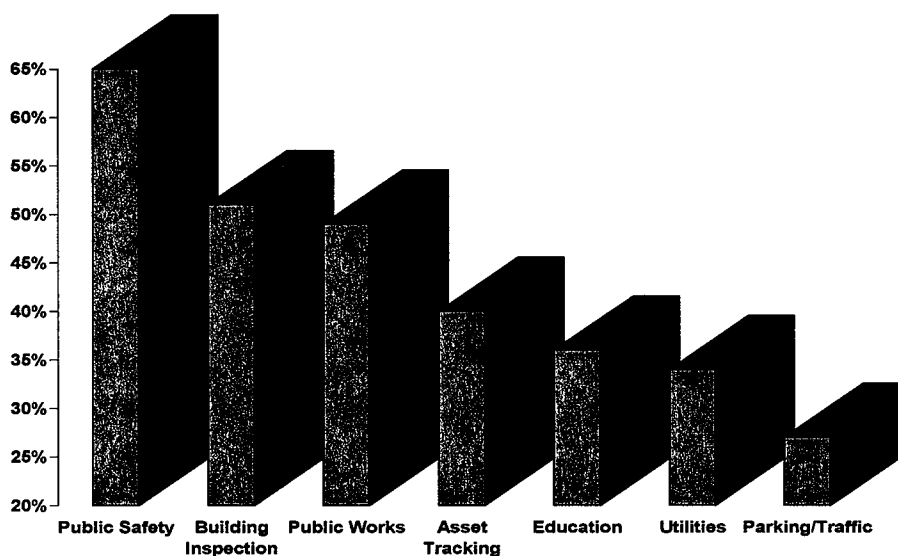
Source: Muniwireless.com State of the Market Report, 2006

Increasingly, the business proposition for WiFi is focused on improving the capabilities for government to more effectively serve the public. The CIOs' Office for the County of Los Angeles, survey of internal departments finds that 57% of the departments surveyed have plans to develop or acquire wireless applications in the next two years that would allow staff to access data and information remotely in the field. Presently, only 36% of departmental locations have 802.11 connections to the Internet. In fact, when asked if they receive requests from the public

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[21] CIO's Office, LA County *Internal Survey*, 2007.
[22] Interview with Peter Wells, SP Advanced Technologies and Business Development, Cisco Systems, and James Hersey, 9/10/07 (conducted by CIO's office).

to provide Internet access at facility locations or other public areas, operated by the County, the majority—81 percent—of the survey respondents said "no."[23]

In fact, in many recent government deployments of WiFi technology, improving the efficiency of government operations has been the primary goal, with all other goals discussed in this report undertaken only as an adjunct to that primary purpose.

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[23] CIO's Office, LA County, "*Internal Survey*" 2007 (Respondents include 42 departments of LA County)

Chapter 5 - Engagement for an Effective Strategy

Developing an effective strategy to implement the County's WiFi objectives will require the engagement of public employees, businesses, and citizens, in order to determine the wants and needs of all of these participants, and to identify which elements of a wireless plan will be necessary for the County to move forward in its goals of efficiently providing "constituent-centric" services and capabilities. Based upon this understanding, the County can devise a strategic plan that clearly identifies the steps necessary to achieve the plan's desired outcomes.

The "People" Issue: communication for involvement and inclusion

Municipalities that have engaged in successful strategic planning for wireless projects have implemented practices to achieve clear communication, accurately assess current architecture, determine workforce needs and areas for capacity building, promote stakeholder consensus and input, and develop strong cases to demonstrate the need for change, as well as the value-added that wireless technology will provide.

Communication is essential to building a successful strategy for wireless technology. The County must actively communicate the benefits of a wireless networks to key stakeholders including management and employees. The County must take an active role in soliciting the opinions of its employees regarding the benefits they perceive will arise from their ability to utilize wireless networks on-the-job. The CIO's office for LA County has made initial efforts in this direction having conducted an internal survey to identify current capabilities and usage, intentions, and actual needs.

Next, a clear road map that articulates implementations and goals—near-term and long-term—is necessary despite the inevitability of changes due to unforeseen obstacles and evolving technology. Tackling an initial pilot project that has a high probability of success, for example, has been suggested as a successful way to gain support, and visibility. The County can then communicate the success of this project to stakeholders. In this case, the concept of stakeholders includes public employees, businesses, and the public because the support of these groups for wireless initiatives can prove vitally important to the success or failure of such projects.

Recognizing that good communication includes promoting stakeholder awareness, involvement, and "ownership" of the project, as well as forging consensus on its aims, the County can take numerous steps to increase its efforts at communicating about its wireless initiatives. Gains for the County's employees, residents, and businesses will not occur independently among each of these three groups of stakeholders. With the proper planning, the County could benefit from a synergy among the three groups.

Some examples of two-way communication initiatives involving the public would include holding informational, town hall-type meetings on the County's strategic wireless plans and its key initiatives. Another example would be to hold meetings with targeted local business

leaders. In addition to educating the public, participants' input and suggestions could be solicited.

For example, various departments within the County, from Parks and Recreation to Community and Senior Services, could create community programs and events that would not only be possible because of increased access to technology, but could be promoted via this network. Finally, businesses that promote their services in a medium that is only possible from broadband access could spur economic activity among local residents who are also their potential customers. These scenarios would be realized if the County strives for more than installing a wireless network, but also aggressively promotes new services before, during, and after implementation.

Communication and Involvement for Digital Divide and Business Promotion Initiatives

Los Angeles County should not assume that establishing an end-to-end WiFi network is the best solution for bridging any "digital divide" that may exist.[24] If maximizing inclusion and utility for citizens is a top objective for the County, it should consider the following options:

1. Undertake extensive research of unincorporated areas of the County and determine reasons for any lack of service. Have service providers decided that these are not cost-effective areas for investment or are there plans to provide such service, where missing, in the near future?
2. Survey local residents and determine whether there is a need for services, and furthermore, assess residents' cost sensitivity to paying for access.
3. Research the availability of state, federal, and private-sector grants that would provide computers to students. Other communities' experiences show that combining free wireless with increased computer access to students is one key to spurring usage.

For every success story such as Greene County, North Carolina, which saw new businesses open and improvements in students' test scores, there are other case studies that exhibit the risks in implementing municipal wireless networks. One example is the implementation of Philadelphia's wireless network, where local residents and leaders are questioning the wisdom of offering free wireless access in neighborhoods where residents cannot afford computers.

If the County decides to provide residential access, several strategies could be envisioned:

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[24] Kolko, "Broadband for All?" p. 3; Brian Carlson, "Wireless Broadband in the Mainstream," *WiFi Planet*, July 19, 2007.

1. The County could provide cost-competitive WiFi Internet to residents who are without high speed Internet access. However, building a ubiquitous network covering all of Los Angeles County would not be advisable, given the experiences of large cities around the nation. Smaller communities with more concentrated populations appear to have greater success in terms of cost management, deployment and targeting of customers.
2. In low-income neighborhoods wireless access could be deployed, granting the service at either a considerably low cost or for free. Such an initiative would only succeed, however, if the County can partner with local school districts and private companies in providing computers to students, increasing the likelihood that the investment in a WiFi network would translate into actual use.
3. The County could provide business incentives to spur service in targeted areas with incentives such as expediting permits, reduced taxes, etc.

If the County decides to focus on providing access, it needs to pinpoint where a digital divide exists and how to go about supporting use scenarios for a given WiFi initiative.[25]

The first option, creating a low-cost alternative to current (or lacking) broadband offerings, would be the most realistic for the County to pursue. If there is a need for broadband access, coupled with a lack of service from privately run vendors, this may represent an opportunity for a government offering. Free access however, is problematic. No cost access is recommended only for special areas like malls, airports, and government

> **Success story: Greene County, North Carolina**
>
> Prior to launching its WiFi network in 2003, Greene County (estimated population 23,000 in 2006; 18,974 in 2000 U.S. census) was an area in economic decline. Dependent on tobacco farming, Greene County had watched jobs and its young people leave. By 2006, with WiFi installed in its three largest towns, Greene County reportedly experienced a complete socio-economic turnaround: broadband access increased to 90% from 10%; twelve new businesses opened—reversing years of negative business growth; high school proficiency and SAT scores soared, and 80% of its high school seniors applied to college, a sharp rise from 28% only two years earlier.
>
> Installing WiFi, however, was not in itself the reason for Greene County's renaissance. The service, marketed to households for $34.95 a month, revolved around a local portal, beehivegreene.com, that served as a career center, small business development, online marketplace, and information on agricultural opportunities other than tobacco. Furthermore, the County initiated an aggressive PC acquisition program for students in grades 6-12, ensuring that the new wireless technology would have users. Residents became involved in a volunteer computer training program that saw them train their neighbors of all ages at "hotspots" in churches, community centers, and fire stations.

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[25] Rob Preston, "Down to Business: The Sky Isn't Falling When It Comes to U.S. Broadband," *Information Week*, August 4, 2007; Jonathan Lipman, "Chicago Pushes WiFi Despite Other Cities' Struggles," *Chicago Daily Southtown*, July 31, 2007; Lesley Stahl, "What if Every Child Had a Laptop?" *CBS News*, August 26, 2007; www.digitaldivide.org; www.digitaldivide.net; "Technology and Development," *The Economist*, March 10, 2005.

buildings. (The City of LA does in fact charge for access is some public places like LAX and the Convention Center through its third party service vendor). Finally, dial-up users may not be interested in paying for higher speed access.[26]

Further study is also needed to determine whether residents require access encompassing all neighborhoods, or if local "hot-spots" at community centers, parks, and around County-owned buildings are sufficient. Since Los Angeles County Libraries installed wireless access, they have seen a spike in interest; further research of usage patterns of library patrons and identifying their interest in expanded wireless access could give the County valuable insight.

In gaining acceptance from small businesses in Los Angeles County, the County must be able to provide an attractive, cost-effective alternative to privately-run broadband networks. General benefits include:

- Lower cost of broadband access
- Availability of broadband where it was previously lacking
- Greater efficiency for businesses and their clients
- New possibilities resulting from a new medium by which to offer products and services

But first, the County should carefully assess the needs of businesses in areas that may already have a broadband option. Small businesses, coffee shops for example, often offer free wireless access as a differentiating feature to their customers, and thus could consider a County WiFi initiative as a hindrance to their own business operations rather than an opportunity. If the County seeks to maximize utility of a wireless network to business owners, they would need to identify need and gauge initiatives accordingly.

If the focus is enhancing access for those who can't afford access in their home, the County may want to consider spearheading an education and training program, one akin to the Greene County, NC project that brought success to the one-time declining tobacco growing region and went beyond simply providing access services. The lesson from Greene County is that a cohesive effort is necessary in ensuring that a local WiFi installation will bring tangible results. A comprehensive strategy to support usage was initiated in conjunction with the network implementation. This was much easier to do in Greene County, a small-sized community with unified interests and needs that were easily identifiable then it would be in Los Angeles County. While providing affordable, not necessarily free, broadband service is a strategy that may not attract new business from elsewhere, in this case, it stimulated local development and turned a stagnant community into a dynamic one, benefiting not just a few targeted users, but many across the socioeconomic spectrum. Some of the underlying factors that were beneficial to Greene County's s success, however, are not present in Los Angeles County, which is diverse in population, spread out geographically and has a heterogeneous mix of suburban and more rural terrain.

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[26] Interview with Strix Systems, Martin Levetin, VP Carrier and Municipal Networks, Sept. 4, 2007, (interview conducted by CIO's office)

Continuing communication about the possibilities of wireless technologies will be necessary in any case. It is possible that unexpected benefits not discussed elsewhere in this report could materialize in the near future. For example, Internet broadcasts could serve as a community action portal serving as a source of local weather and events, and could eventually provide a lower-cost alternative than cable television. Government employees might reap the greatest rewards with better intergovernmental communication, more effective assignment and use of city fleets and equipment and improved interaction among governmental agencies.[27]

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[27] Robert Randall, "Mainly Mobile: A Walk in the World of Wireless," *InterGovWorld.com*, May 5, 2005; Christopher Swope, "Working Without Wires," *Governing.com*, May 2007; "Turning Municipal Video Surveillance Cameras Into Municipal Webcams," National Research Council of Canada, June 2006.

Chapter 6 - Business Models

Ownership and Operation

One of the most important decisions a municipality will make regarding a wireless deployment is the type of business model it wishes to follow. Generally speaking, there have been three types of network management strategies that have emerged among the multiplicity of potential organizational structures existing. In order to best understand and distinguish the differences between these models, it is useful to keep in mind the following questions: *who would own the network, and who would operate it?*

The three most widely employed models include:

1. Government entity both owns and operates the network
2. Government entity owns, but does not operate the network (this most often results in a public-private partnership)
3. Governmental entity contracts out both ownership and operation to a third party

Each of these models is described below, with a discussion of the costs and benefits, particularly as these apply to Los Angeles County.

Government Owned and Operated Network

The first model is the government owned and operated network, commonly called a wholesale model. This model, which was common earlier this decade as municipal WiFi networks began to emerge, requires the local government to take complete responsibility for the ownership and management of the wireless network. The County would be free to use the majority of the new bandwidth for internal operations; excess bandwidth would be available to local constituents on terms that the County would set. The additional bandwidth could also be resold to privately-run Internet service providers that in turn would sell to local citizens. In this model, business and residential customers may have choice among various service providers—in the case where service already exists, competition may be increased. Sometimes this model is followed in locations where private companies are not offering service and thus the municipal government provides the only wireless Internet service to fill a hole in the market. The majority of WiFi offerings provided by cities in LA County, which number twenty-four according to the CIO's External Survey, assume some or all of the financial responsibility for providing and sustaining WiFi services.[28]

Whatever its advantages, the wholesale model is a costly proposition for governments to implement. Its adoption could cause the County to incur large upfront costs, continuous operating expenditures that could fluctuate over time, and require a large, competent IT staff to manage all of the network's operations. Furthermore, after such a costly initial investment, the

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[28] ibid, CIO's *External Survey*, 2007.

County would have no guarantee that when future upgrades are needed, its stakeholders would advocate additional spending to keep the network updated and functional. With the rapid pace in which technology is evolving, nothing would protect the County from an investment in a technology that could become outdated before it ever reaches its potential. This would render an expensive upfront outlay worthless and thwarting whatever public goals the initiative was designed to accomplish. The lack of County-owned infrastructure assets, which has been the common denominator in other muni-owned networks, makes this model particularly problematic for Los Angeles County.

Public-Private Partnerships

Next are Public-Private Partnerships (PPPs), which have become an increasingly common business model for all types of infrastructural development at all levels of government. Accordingly, more municipalities have been turning to a PPP model for WiFi services, an arrangement alternatively known as a managed-services model. Within this model, the local government enters into a partnership with a private vendor such as a telecommunications company or Internet service provider. Ultimately, the government owns the network, but it contracts with the vendor to construct and then operate the network on a day-to-day basis. In addition, the vendor would decide how it will generate revenue from its customers, with the options including Internet advertising, tiered subscription rates, or charging fees for access on a use-by-use basis. The corporation may use a hybrid of all of these approaches. Meanwhile, the County would likely face no upfront or "fixed" costs.[29] The cities in LA County that plan to provide WiFi access within one year favor public private partnerships for the planning, development, and sustainability of the project, according to the CIO's External Survey.[30]

The PPP is attractive to governments for the following reasons:

- There is no expensive IT staff to maintain the countless network nodes that are scattered across the municipality, whether it is a city or county.
- Governments believe they benefit from having a new technology to provide services for its residents and greater technological reach for its employees—without any additional investment.
- Most importantly, without enormous upfront investment governments can budget for predictable operational expenses, and not have the concerns of a fiscal shock that would result from a massive network failure.

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[29] For a discussion of various municipal wireless network models, see François Bar and Hernan Galperin, "Building the Wireless Infrastructure: Alternative Models," Annenberg Research Network on International Communication, University of Southern California, October 2004; Christopher Elliott, Your City is Going Wireless: 7 Rules for Safe Computing," *Microsoft.com*, August 14, 2007; "Choosing the Right Business Model for Municipal Wireless Networks," Datamonitor, July 9, 2007; Sascha Meinrath, "Municipal WiFi Series: Boston's Forward-Looking Innovations," *Govtech.com*, September 25, 2006; "Wireless Silicon Valley Task Force Initiative," Intel Solution Services, April 5, 2006.

[30] ibid, CIO's *External Survey*, 2007.

The private-public partnership model has become quite attractive to numerous municipalities, but the fact that Los Angeles County owns few fixed assets also complicates this approach. The County could make it incumbent upon the vendor to make arrangements with the Los Angeles Department of Water and Power or Southern California Edison to negotiate installing wireless equipment on assets including utility poles (or could investigate the use of assets it owns, such as traffic signals). It could even look into more creative solutions, such as solar powered WiFi network, such as St. Louis Park, MN, is utilizing. The County may also consider waiting until WiMax, a next-generation wireless technology that has a broader signal range requiring fewer towers, is established. The vendor would be free to install such equipment on County buildings such as hospitals or recreation centers, simplifying the installation process.

Even with these possible options, the private-public partnership remains a complicated approach for Los Angeles County to take in initiating a WiFi network. In order for the County to expand Internet access to the population, it might have to grant such access on the terms of a future vendor. If negotiations over access to city- and corporate-owned assets became too problematic, the County might have to work with private corporations to have networking equipment installed on County-owned assets.

In return for installing wireless equipment, however, vendors may insist that the County agree to an "anchor tenant" agreement, often a central feature of private-public partnership arrangements. Under such agreements, municipalities guarantee a predetermined stream of revenue. Many vendors, in turn, agree to provide free and/or subscription access to residents, but only after they have received a guaranteed contract or revenues from the municipality. Many vendors have turned to anchor tenant agreements because of financial losses they had suffered in the past. Mountain View, California-based MetroFi, for example, stopped building networks at no cost to municipalities because the Internet advertising model often failed. Now, the company only builds networks for municipalities that pledge to use the network for conducting their daily business. Following this trend, wireless access for residents and local businesses is becoming not the primary goal of these new wireless networks, but a value-added benefit from this technology's implementation.[31]

In sum, taxpayers would be spared costs of building the network, as well as the additional costs of maintaining it, in the public/private model. The vendor administering the network, meanwhile, would ensure that the network operates effectively. If it fails to do so, however, competitors could threaten to offer a better alternative. The potential or reality of the termination of a large wireless network contract could create both an operational and a public relations nightmare. For these reasons the underlying contract for any such partnership must clearly spell out performance goals and levels of service with sufficient incentives and penalties to ensure compliance.

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[31] Glenn Fleishman, "Anchorage, Alas., Cancels Over Anchor Tenancy," *WiFi Net News*, July 13, 2007; http://www.muniwireless.com/article/tag/anchor_tenancy; Wayne Hanson, "Earthlink Shifts Municipal WiFi Strategy," *GovTech.com*, July 30, 2007; John Letzing, "Google-Earthlink San Francisco WiFi On Hold," *MarketWatch.com*, August 2, 2007; Andrew F. Hamm, "It's Time to See If Bidders Share Valley's Free Wireless Vision," *San Jose Business Journal*, April 21, 2006.

Contract Model

Finally, the third major type of model utilized in municipal wireless projects is the contract model. In this model, the County would neither own nor operate the network. Instead, it would outsource all of these functions to a contractor and, in return, guarantee a certain level of usage of that network as its "anchor tenant." The contractor, in turn, agrees to provide certain levels of service and coverage to the general public in return for the government's support. Some providers are now deciding that local governments must be anchor tenants for the service so that risks and costs can be mitigated. This is the case for the Silicon Valley Network, a project that includes forty towns.

However, several governments across the United States have had unsatisfactory experiences with the contract model. Local governments and vendors have had disagreements over the quality of network maintenance. Vendors have also found that maintaining these networks became more costly and unprofitable than the monetary terms of the contracts to which they and local governments had initially agreed. Here again, governments with smaller territories to cover and smaller populations to serve have found the contract model more viable than those that are larger. This, combined with the increasing costs for implementation and maintenance involved in serving large areas, suggests the contract model may not be viable for Los Angeles County.[32] Minneapolis is possibly an exception to the otherwise troubling landscape of WiFi projects that are on hold or abandoned. The city is moving slowly, installing its network in phases and is charging the public $20/month for service.[33]

Analyzing LA County's Needs and Identifying the Optimum Model

Considering all the current networking models that are in operation across the United States, Los Angeles County's options are limited by its lack of fixed assets and vendors' reluctance to install a WiFi network across a swath of land that includes vast rural areas, mountains, 88 cities, and over 130 unincorporated areas. The halcyon days when governments were being presented with the opportunity to benefit from a wireless network installed at little cost, with the promise of increased Internet access did not last long. Vendors including MetroFi and Earthlink have lost millions of dollars on municipal wireless networks, or retracted their partnership offerings, while other companies have learned from their example and will only install such equipment on a wide-scale with a substantial *quid pro quo*. The LA County WiFi Taskforce talked to vendors/service providers and confirmed this view. Vendors were especially not interested at this time in participating in new initiatives that required upfront costs on their part.

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[32] www.tropos.com; www.muniwireless.com; www.savemuniwireless.org; Ericka Morphy, "Ground Shakes Under San Francisco's Municipal WiFi Project," *TechNewsWorld*, August 8, 2007; Chris Selly, "Goodbye to WiFi," *McLeans*, September 24, 2007; Michael Liedke, "Municipal WiFi Faces Financial Hurdles, *The Associated Press*, August 31, 2007.

[33] Judy Keen, "Cities turning off plans for Wi-Fi," *USA Today*, 9/19/07.

Therefore, the County must analyze the departments that have the greatest need and reap the most benefits from installing a WiFi network. Next, it must determine whether such services can be adequately provided with equipment installed on the County's limited properties, or if negotiations over access to property owned by third parties or neighboring cities are necessary in meeting the County's goals. Finally, the County would have to decide whether it can deliver a guaranteed amount of revenue to a vendor sufficient to cause that contractor to install the necessary equipment to provide such service. [34] If these possibilities do not prove to be viable, the only option remaining for the County would be to adopt the government owned and operated model.
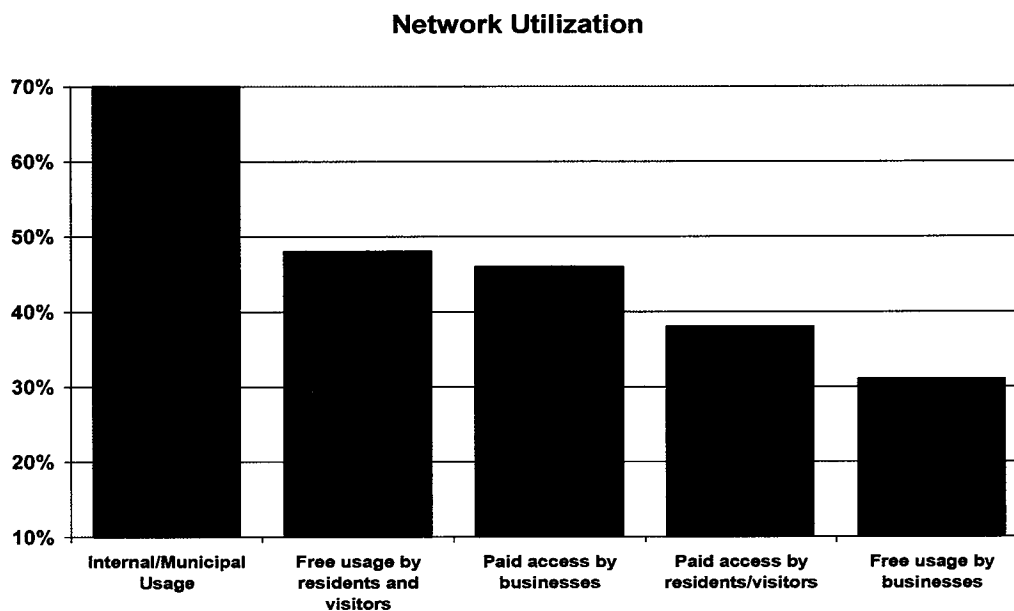
An additional strategy, the collaborative approach, or consortium model could be considered, although thus far it has proven somewhat problematic. In this model, the County would act as facilitator for neighboring municipalities within its borders that express interest in joining up and negotiating as a group with vendors. The consortium model has been pursued across the nation, as the number of neighboring municipalities making agreements with vendors has been on the increase, witnessed in Silicon Valley, the Sacramento area, and the Westside of Los Angeles.

Effective governance models for such efforts, however, are still being worked out and some of these projects have faced stumbling blocks as it has proved difficult to agree on priorities and money, and manage the consortium's overall efforts. The External Survey conducted by the CIO's office does identify an interest among local governments in collaborative WiFi ventures, but the cautionary lessons from other attempts bear closer examination. A more regionalized approach could make sense if goals are aligned and the governance structure is designed carefully. The first step however, is assuring that there are common goals, agreement on costs, and most important, that needs and objectives have been clearly identified by the participants.

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[34] Richard Martin, "Boulder Joins Wireless Gold Rush," *Mountain Press*, June 18, 2007; Rick Smith, "Where's the Gold? Earthlink CEO Calls Timeout on Metro WiFi Projects," *LocalTechWire.com*, July 30, 2007; Sarah Jane Tribble, "Municipal WiFi: A Not-So-Free Lunch," *San Jose Mercury News*, August 6, 2007; Angela Singhal Whiteford, "Municipal Wireless Takes Shape," *SecurityInfoWatch.com*, April 2007; Becca Vargo Daggett, "Municipal Wireless: Evaluating 'Public-Private Partnerships' and Other Private Business Models," www.govtech.com, January 22, 2007.

Figure 4 below shows usage in municipalities across the country, which partially reflects the type of services offered in these localities.

Figure 4:

Network Utilization

Labels: Internal/Municipal Usage, Free usage by residents and visitors, Paid access by businesses, Paid access by residents/visitors, Free usage by businesses

Source: Muniwireless.com, *State of the Market Report*, 2006

Chapter 7 - Locally Relevant California Case Studies: Anaheim, Corona, Santa Monica, Lompoc, Riverside

The following provides a brief overview of a few select municipal WiFi initiatives.

Anaheim: showing promise

Anaheim, California (population 342,410) has completed 90% of its ubiquitous WiFi network that will cover 29 square miles, providing access to constituents through a monthly subscription ($21.95). Anaheim is the municipality that other cities and counties are watching the closest because of its early adoption and its business model of using an independent contractor who owns and operates the network.

Strategic partners in this venture include EarthLink, Tropos and Motorola. Earthlink is the owner of the network, its devices and components. It has spent around $5 million on the network. The City of Anaheim provides streetlight poles, traffic signal poles and dark fiber from its City-owned fiber network to EarthLink.

Anaheim has a history of deploying cutting-edge technology to improve its citizens' lot. It was one of the first cities in America to build its own electricity grid -- to illuminate its streets and lure late-night shoppers from nearby towns. Before Internet use had become widespread, Anaheim had networked the City with "fat" communications piping, so residents could have a variety of cable TV providers and telephone companies to choose from, while local utilities could automate their meter reading and businesses could provide a variety of online services.

EarthLink and the City have agreed to form a steering committee to establish and manage service levels for the Network. The steering committee is comprised of the City manager, or his designee, a representative of Anaheim appointed by the City manager, and an equal number of representatives named by EarthLink. EarthLink is responsible for marketing and administering the operations of the Network. However, the City works jointly in cooperation with EarthLink to make the public aware of services enabled by the network to the extent possible under local ordinances, laws and regulations.

Corona: calling off WiFi plans

On July, 2007, the City of Corona (population 150,253) called off its plans to install a citywide wireless broadband Internet system. The move came after Corona's chosen provider for the service, Mountain View-based MetroFi Inc., altered its business model and requested an amendment to its agreement that would have required the City to pay $450,000 over five years.

The Corona City Council had unanimously approved an agreement with Metro-Fi Inc. to install a citywide wireless broadband Internet system in 2006. At that time Corona was the first inland city reach such an agreement.

Under the Corona agreement, Metro-Fi would have installed about 10 to 20 radio devices per square mile, or about 500 citywide, on streetlight poles. The City would have received about $18,000 a year from Metro-Fi for allowing the light poles to be used. The free access version of the WiFi service would have required users to allow banner ads publicizing local businesses across the top of their screens. Subscribers not wanting the ads could have paid Metro-Fi $19.95 a month.

However, the company recently asked that the City pay $90,000 a year for five years and to become Metro-Fi's anchor tenant, instead of functioning solely as the location where the provider could set up its equipment. According to Metro-Fi, the company's business model and the industry as a whole have evolved. Metro-Fi gradually has moved away from offering 100 percent ad- and subscription-supported wireless access. The annual payments Corona would have made to Metro-Fi would have covered a variety of applications the company offers, including wireless meter reading, video traffic monitoring and a subscription service for mobile devices.

Currently, the City of Corona is looking at possibly purchasing equipment to bring its own wireless network to City facilities, specifically to public parks. While the City is looking at a WiFi network, it is also considering a more advanced form of that technology, such as Wi-Max. The City's experience illustrates the importance of understanding a potential partner's financial viability and business goals before the local government agrees to embark upon such an initiative with them.

Santa Monica: satisfied customers

Although Azulstar, Santa Monica's selected provider has gone out of business just at the time proof of performance tests were being undertaken, the City currently has numerous operational WiFi hot spots owned and operated by the City, and plans to add more in the near future. The City has 14 operational WiFi hot spots in public areas such as parks, the court house, the Pier, the Civic Auditorium, the 3rd Street Promenade shopping area, City Hall, and at all 4 public libraries. They have approximately 300 users at any given time throughout the city. So far, residents and businesses have been very supportive, and there have been few complaints. It's a free service, no registration is required, and there's no filtering in place. The network is owned by the City. Santa Monica has worked with many companies including Cisco, Tropos and P.C.C. to provide the equipment and build out the projects. The cost of the first WiFi deployment, which was installed by P.C.C. (reseller of Tropos) was approx. $18,000. That project included 4 access points.

The lesson learned in Santa Monica is that even with a business partnership with Azulstar that proved unreliable, the City-owned assets -- streetlight poles and a fiber network -- helped to decrease the overall cost and allowed the City to proceed on its own. The current cost for installing a wireless router is approx. $1,300 ~$1,500, depending on the physical location. So far, the hot spots (free WiFi) have been mostly used by residents and visitors. But, the City has concrete future plans for public safety and governmental applications that are now being tested.

Those plans are part of the phased approach Santa Monica took after a developing a comprehensive Master Plan that included input from the public, businesses, communications providers and other key stakeholders in the City.   Currently, they are working with Cisco to install video surveillance cameras using the 4.9 GHz for public safety. This project will be covering an area of one and half miles from the Santa Monica Pier to 20th street. They are also testing the technology for other projects like traffic signal management, utility applications, online permitting system for building inspectors, and meter parking, in addition to others.[35]

Lompoc: enthusiasm, then frustration

Nestled in Northern Santa Barbara County, about 20 miles from the nearest major highway, Lompoc would appear to be an ideal candidate for a municipal wireless network. However, broadband service providers were not interested in initiating service in Lompoc, which had been hit hard by the cutbacks at nearby Vandenberg Air Force Base. The City invested $3 million dollars in wireless "mesh" technology that would blanket the town. Almost immediately, however, chinks appeared in the armor of Lompoc's strategy. In 2005, as the mesh network went live, new competition arrived as Comcast and Verizon suddenly rolled into town, laying cable and offering service. And with a glitch that has plagued wireless networks as far as Portland, Oregon and St. Cloud, Florida, walls supporting the stucco houses' throughout the town blocked signals from reaching users' computers, frustrating the City's efforts. As a result, the residents turned to the privately-run services that offered more expensive, but dependable, wired broadband services. Customers who had initially bought into the City's offering, believing that they were gaining free or low-cost broadband, became incensed at having to buy a wireless signal amplifier, which often cost between $100 and $150.

The lesson learned from Lompoc and other cities who employed a similar strategy is that they enthusiastically embraced a solution and forged ahead, failing to adequately survey users' needs and price sensitivities, as well as not paying sufficient attention to technical logistics in their environment. Lompoc learned that customers wanted to use their computers at a desk in an office or at home at any moment—and demand for occasional outside use at a picnic table in a neighborhood park was not sufficient to sustain the network.[36]

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[35] Interview: Mr. Metspakyan, City of Santa Monica, with Jinna Choi, date: November 1, 2007.

[36] Martin, "In Lompoc, The Network Works But Users Are Scarce," *Information Week,* April 25, 2007; Glenn Fleishman, "Metro Round-Up," *WiFi Net News,* August 15, 2007; Chris Nuttal, "Costly Errors in the Free Internet Experiment," *Financial Times,* August 8, 2007; Jack Schofield, "Potholes on the Road to City-Wide WiFi," *The Guardian,* August 15, 2007; Anick Jesdanun, "Municipal WiFi Services: Big Promises, Small Deliveries," *TechNewsWorld,* May 27, 2007.

Riverside: a smart city

In July 2007, the City of Riverside, located in the Inland Empire region approximately 60 miles east of Los Angeles with a population of 290,000 residents and 40,000 students, announced officially the launch of its citywide WiFi initiative called SmartRiverside Wireless Network Service, a public and private partnership between the City and AT&T/MetroFi. This initiative is on track for completion at the end of first quarter 2008 with nearly ninety percent of the city's 86 miles covered by the end of January. Feedback from users has been universally positive thus far.[37]

According to the project's plan, AT&T is required to provide 95% coverage for the developed areas of the City's 86 square miles which equates to approximately 54 square miles. Access points are being placed at the rate of 30-35 per square mile with each having a range of approximately 1,000 feet depending on topography. Access points are installed on street lights, traffic signals, and City facilities.

As part of the five-year contract with AT&T that the Riverside City Council approved in October 2006, the City agreed to spend up to $4 million over the five years for a variety of services – new phone and cell-phone service, high-speed, non-wireless Internet access and wireless Internet access for everything from remote meter-reading equipment to ball field lighting controls to computers in police cars.

The City of Riverside has offered access to City facilities and power at no charge to the selected vendor who is contractually obligated to deliver on agreed upon service level agreements, including a basic level (average speeds of 512kbps) of free service to all residents. The City expects to be a major user of the WiFi network. In addition to other municipal applications, Riverside is testing the service to run video to and from police department patrol cars. Officers also will use the public safety network for computer-aided dispatch, automated vehicle location and high-speed communications for queries to integrated justice databases to provide detailed information previously unavailable in the field. Additional applications available with AT&T Metro WiFi include traffic monitoring and coordination, video surveillance to minimize graffiti and illegal dumping and facility security.

The wireless broadband Internet access network in Riverside includes both a consumer and business solution and a municipal network for use by City agencies. AT&T and its partner, MetroFi, own and operate the Riverside network. MetroFi is supplying the free service, which is supported by advertising. There are several service plans available – a free service, called MetroFi-Free, with advertising intended for general usage, a paid service, called AT&T Metro WiFi, targeted at business and other users who want higher performance and less advertising, and municipal and public safety services available only for municipal use. Paid service plans have less advertising and vary in price depending on the service plan. A 1-day pass provides access for 24 consecutive hours at $7.99 and a weekly pass allowing connection for 7 consecutive days at $15.99.

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[37] Interview with Steve Reneker, CIO Riverside, with Jinna Choi, LA County, Dec. 11, 2007.

Besides providing access to its residents, the City has implemented a computer giveaway called the Digital Inclusion Program through SmartRiverside. This nonprofit was set up to encourage high technology innovation and use. Also, the program provides free refurbished computers to low-income households after one household member completes an eight-hour computer-training course at one of the City's community centers. The City has a grand goal to offer computers and Internet access to every home.

An overall lesson from this case is Riverside's ability to attract private business partners such as AT&T and MetroFi to build out and provide free basic services to all its residents. This was accomplished by providing access to its facilities for easy installation and committing to be the anchor tenant for various public safety and municipal uses.

From the locally relevant cases included above, Riverside appears to be a standout; it includes almost all elements of a municipal wireless such as use for public safety, free basic service, a reasonable financial commitment from the City, and digital inclusion programs with free PCs and training.

Chapter 8 - From Vision to Reality: Preliminary Recommendations for LA County Municipal WiFi

Developing a wireless technology strategy that allows for the selection of best practices from a portfolio of successful examples recognizes that every county or municipality has unique technology needs, priorities, infrastructure assets, and geographic/topology factors. Avoiding a "one size fits all" approach will allow the County to retain the flexibility needed to successfully implement a wireless plan that can effectively overcome its unique structural constraints. The plan for Los Angeles County must take into account the unique challenges the County faces in undertaking such an initiative or it will ultimately not meet the expectations that will inevitably accompany such an effort. The recommendations for the Board of Supervisor's consideration from the WiFi Advisory Taskforce, which conclude this report, have carefully taken the following challenges into account in their development:

Challenges

1. The lack of fixed assets, including power poles, on which the installation of network signaling equipment is critical, complicating any County effort in expanding broadband access to its cities.

2. The political dynamics of Los Angeles County, with its 88 cities, over 130 unincorporated areas, and separate political entities including the Los Angeles Unified School District, make any consensus towards increased broadband access difficult to achieve in a timely fashion. Leadership throughout the county is fragmented, and many towns within the county's limits have already installed their own wireless networks. Consortiums can help in terms of negotiations with vendors and increasing the speed of permitting and access, however, so far they seem to be difficult to manage.

3. The sheer physical size of Los Angeles County, combined with its diverse geographic, urban, and suburban landscape, offer a huge challenge in expanding wireless access. Breaking it up into smaller pieces also creates an issue, however, since this could eliminate the ability to have WiFi access seamlessly throughout the region.[38]

4. Private vendors, many of whom have lost money in installing wireless networks throughout the United States, are now reluctant to invest in municipal wireless networks without large financial commitments from local governments.

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[38] Industry Interview with Earthlink, August 21, 2007, Cole Reinwand, VP Product Strategy and Marketing, Stephen Salinger, Dir. Market Development, (interviewed by CIO's office)

Recommendations

Based on the findings of this report, the WiFi Advisory Taskforce proposes the following recommendations on how Los Angeles County should move forward in implementing a WiFi technology initiative within the County.

1. **Adopt a strategy for LA County's use of wireless technologies and place the WiFi implementation plan within the framework of that strategy.**

   The strategy should be in line with public employees' needs, in order to enable them to effectively provide constituent-centric services. Here is one possible version of such a strategy statement:

   "LA County will use the benefits of wireless technologies to enhance the performance and effectiveness of its services, and where feasible, expand the ability of its residents to use the same technology to enrich their lives."

2. **Investigate possibilities for the extension of existing WiFi projects, as well as for dual-use scenarios, in which public use of WiFi technology is offered as a value-added service, piggybacking on official County-services implementations based on identifiable needs.**

   Given that the strategy of government providing broadband for citizens has proven problematic in the majority of current municipal WiFi endeavors, we recommend that the County of LA consider projects that target specific service needs and offer service to the public as a subsidiary goal.

   Learning from the technical, political and economic issues that many municipal WiFi projects have encountered, we conclude that a productive approach for the County is to think in terms of dual access, and of creating a value-added scenario. For example, when a county department deploys a WiFi network with a public safety application, excess capacity could perhaps be used for public access and/or other governmental applications, such as in-field data entry or fleet status reports. Such a path could ensure evolutionary deployment which can save cost, and ensure that projects are carefully defined so that decisions about network operators, business models, technology choices and other relevant decisions are appropriate to reach desired outcomes.

3. **Coordinate initiatives among relevant offices to promote collaboration, knowledge-sharing and best use of resources.**

   The appropriate offices for this purpose may be the CEO's office, with the CIO's office coordinating initiatives on the operations side. Central coordination will help streamline activities and will provide more opportunity for "dual use" to emerge.

Central coordination also provides better opportunity for management of project implementation and oversight. In addition to managing project proposals and oversight of implementation, a body that can provide assessment of proposals should be encouraged. Use of a framework for best practices will help identify important factors involved in moving from feasibility and planning to deployment and commercial operation. As municipal WiFi can still be considered a "grand experiment" in terms of providing broadband, in some cases, as a commercial service, tools that provide public sector CIOs' and others to improve feasibility and planning processes should be pursued.

4. **Use a framework of best practices and lessons learned from other municipal wireless projects being implemented across the country.**

A framework for municipal WiFi best practices should provide instruments that help the County to improve planning processes and assess feasibility[39]. This can be done by:

a) Identifying a set of categories that will estimate tangible value of a project, including pole attachment fees, revenue, cash compensation, and prices;
b) Accurately estimating the upfront and ongoing costs of each player in the value chain;
c) Identifying assumptions and estimates for the non-quantifiable elements: rate of economic growth, social benefits;
d) Providing a way to evaluate partners (service providers and other ancillary vendors) and proposals during the proposal process;
e) Allowing for comparisons of different initiatives to be made: projects of different size, population, usage, and other demographic characteristics should be benchmarked against each other;
f) Analyzing other comparable municipal wireless projects to use as baseline metric for proposed and future projects, and;
g) Establishing a means for measuring and reporting on individual initiatives over time so that effectiveness can be assessed.

5. **The County should create a funding stream that may include grants and corporate funding, and internal and external funding to provide the devices to citizens that will allow them to make use of Internet access through a WiFi network.**

This should be considered particularly if LA County chooses to move ahead with digital inclusion projects. St. Louis Park, MN is using revenue bonds and city enterprise funds for the capital expenditure required to pay its wireless for infrastructure. The County can also apply for government philanthropic grants. The Dept. of Homeland Security has billions of dollars in grants available for projects that enhance pubic safety and the ability of first

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[39] Greg Richardson, "A New IT Value Framework for Municipalities," State of the Market Report, October 2006, Conducted and published by MuniWireless.com

responders to act in emergencies; and such funds have been used for WiFi projects in New York City.[40] State, Federal and nonprofit funding sources for broadband and other telecommunications services should be explored. Some applicable sources include the California Teleconnect Fund, E-Rate, Community Connect Grant, Distance Learning and Telemedicine Loan and Grant, Rural Broadband Access Loans, and the Bill and Melinda Gates Foundation. Within the County, there are technology grants available from the Information Technology Fund, (ITF), and the Quality and Productivity Commission. The Chief Executive Office may also be able to provide adjustments to the budget to provide project funding as well.

6. **Start with smaller scale (pilot) projects that can be scaled up or down based on need, available resources, and effectiveness.**

This is the clear preference based upon the sometimes hard-learned lessons from other jurisdictions. Proof of concept is important before investing large sums of public monies. Initial demonstration pilots that could be considered:
- Beach/harbor project (perhaps investigating use of solar-power)
- Community and senior service centers
- Parks facilities

Installing hotspots in these areas can provide opportunity for evaluating community use and need in specific, yet varied locations that each serve a distinct variety of users. In combination with existing County WiFi presence at County Libraries and other limited locations, the benefits of WiFi may be pervasive, if not ubiquitous.

Pilot projects that are highly visible and have a high chance for success will prove valuable in garnering support for future endeavors. The case studies above have demonstrated that small projects have tended to have the greatest degree of success, which was both quantifiable and demonstrable. The enthusiastic use of the Library's wireless provision by patrons may also offer opportunities for County workers who are on the move to contact their office, file and get reports and work orders, and generally carry out their job in a more efficient manner. These kinds of dual-use scenarios, building on identifiable needs, should be encouraged.

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[40] http://www.strixsystems.com/case-studies/homelandsecurity.asp, http://wi-vod.com/press/press_05-03-18.pdf

Appendix A - The Challenges of WiFi Network Deployment : Cost, Timing, Technical and Security Overview

In contemplating a WiFi deployment it is important to take a close look at every aspect of this technology to fully understand requirements, capabilities and whether WiFi is the best technology match with the needs of the County and user-needs.[41]

WiFi Defined

WiFi is based on the family of IEEE 802.11 standards. This standard describes wireless network technology that operates in the 2.4GHz unlicensed radio frequency spectrum and occupies multiple channels in this spectrum. In a WiFi network, computers with WiFi network cards connect wirelessly to a wireless router. The router is connected to the Internet by means of a modem, typically a cable or DSL modem. Any user within 200 feet or so of the access point can then connect to the Internet, though for good transfer rates, distances of 100 feet or less are more common. Newer WiFi technologies extend to a range of 300 to 600 feet and beyond, while boosting data transfer rates. WiFi networks can either be "open," so anyone can use them, or "closed," in which case a password is needed. An area blanketed in wireless access is often called a *wireless hotspot.*

WiFi technology uses radio for communication, typically operating at a frequency of 2.4GHz. The technology designed to cater to the lightweight computing systems of the future, which are mobile and designed to consume minimal power. PDAs, phones, laptops, and various accessories are designed to be WiFi-compatible.

Two other frequently discussed technologies (and utilized with WiFi) are mesh technology and WiMAX. Mesh technology is related to WiFi and can be considered a way to leverage a wireless infrastructure in a more effective way. The main advantage of mesh technology is that it reduces the amount of wired backhaul links, thereby reducing costs. It accomplishes this by connecting multiple access points together as nodes within a larger network, or mesh. This has the added benefit of eliminating points of failure. To accomplish this, some additional software technology is needed to manage the peer-to- peer routing between nodes. Vendors that offer this technology include: Cisco, Nortel, Motorola, Strix, SkyPilot. Costs range from $50,000 to $100,000 per square mile.

Worldwide Interoperability for Microwave Access (WiMAX)

WiMAX is a telecommunications technology aimed at providing wireless communication over long distances in a variety of ways, from point-to-point data links to full mobile cellular type access. It is based on the IEEE 802.16 standard. [42]

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[41] Sources for WiFi and WiMAX discussion: http://www.gsmworld.com, http://www.wikipedia.com, http://www.wisegeek.com

The name WiMAX was created by the WiMAX Forum, which was formed in June 2001 to promote conformance and interoperability of the standard. The forum describes WiMAX as "a standards-based technology enabling the delivery of last mile wireless broadband access as an alternative to cable and DSL."

WiMAX may in the future replace WiFi as the technology of choice for municipal wireless networks. WiMAX differs from WiFi at the communication layer. WiMAX offers two advantages: longer range, wider area coverage and operation in a licensed as well as unlicensed spectrum. The technology is still in its infancy and widespread integration into consumer devices is not expected until 2010. WiMAX is being used, though, as part of some wireless backhaul networks. This standard was designed to bring wireless broadband connectivity into buildings from and ISP or other carrier, offering an alternative to wired broadband access.[43]

Despite a semantic similarity, WiFi and WiMAX are aimed at different applications. WiMAX is a long-range system, covering many kilometers that typically uses licensed spectrum (although it is also possible to use unlicensed spectrum) to deliver a point-to-point connection to the Internet from an ISP to an end user. Different 802.16 standards provide different types of access, from mobile (analogous to access via a cellphone) to fixed (an alternative to wired access, where the end user's wireless termination point is fixed in location.)

WiFi is a shorter range system, typically hundreds of meters, that uses unlicensed spectrum to provide access to a network, typically covering only the network operator's own property. Typically WiFi is used by an end user to access their own network, which may or may not be connected to the Internet.

WiMAX and WiFi have quite different Quality of Service (QoS) mechanisms. WiMAX uses a mechanism based on setting up connections between a base station and the user device. Each connection is based on specific scheduling algorithms, which means that QoS parameters can be guaranteed for each flow. WiFi has introduced a QoS mechanism similar to fixed Ethernet, where packets can receive different priorities based on their tags. This means that QoS is relative between packets/flows, as opposed to guaranteed. WiMAX is highly scalable from what are called "femto"-scale remote stations to multi-sector 'maxi' scale base that handle complex tasks of management and mobile handoff functions.

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[42] IEEE 802.16e Mobile WirelessMAN (R) Standard is Official" [electronic version from http://standards.ieee.org/announcements/pr_p80216.html,]
[43] IEEE 802.16e Mobile WirelessMAN (R) Standard is Official" [electronic version from http://standards.ieee.org/announcements/pr_p80216.html,]
Monica Paolini, "Building End-to-End WiMAX Networks," Senza Fili Consulting, April 2007; [electronic version from http://www.wimax.com/Forms/whitepapersforms/solectek-white-paper-download, accessed October 23, 2007].

WiFi's Technical Capabilities

Wireless technology was developed to operate inside of an office setting. Considering this fact, it is easy to understand its optimal environment; an open environment not impeded by heavy concrete or steel structures, and with close physical proximity.

WiFi technology can provide essentially the same kind of access that a user can get on a home or office wireless network. First, it is possible to deploy a LAN (local area network) without the need for wires for client devices. WiFi also provides access to the Internet over devices: PC, game console, dual mode cell phone, MP3 player, PDA, digital cameras. Next, WiFi can facilitate peer-to-peer connectivity between devices and wireless voice applications.

WiFi's Limitations

WiFi networks are in use around the world, however there are some aspects of the network that need to be considered as potential limiting constraints. The first issue to consider is access point density. In order to canvass a large area, multiple access points need to be deployed. The actual number of access points that are needed will be a function of the topography and build out of the terrain. For example, a relatively flat and uniformly developed city such as Tempe, AZ would require a lower density of access points per square mile than a more challenging topography such as LA County. The need for access point density will be also be greater when there is a need to access the network from inside of buildings.

The opposite problem to having too few access points in an area is having too many. This can cause a problem known as WiFi Pollution where there are too many WiFi signals competing on the same channels. This can cause a reduction in the signal-to-noise ratio (SNR), which means that the sharpness of the communication is reduced leading to connectivity problems.

In addition, mounting sites need to meet certain requirements: they should provide ready access to power, they should be in close proximity to backhaul data lines, they need to be easy to access for deployment and maintenance, and they should be relatively unobstructed, so they provide the best communication link. A common mounting location that meets these criteria is utility poles.

Wireless networks operate in the 2.4GHz frequency that is an unlicensed spectrum in common use. This means that there are no exclusive rights to this spectrum and poorer service could result from sharing this bandwidth. Another limitation of any wireless network is its ability to handle movement while maintaining a connection. WiFi is able to accomplish faster mobility access through increasing the number of WiFi access points which increases redundancy and reduces the size of the cells.

While it is common to have a strong WiFi network inside the home or office, it is a challenge to provide that network from access points that are often hundreds of feet away. Most

public access points operate at a maximum power level of 1 watt (100 milliwatt outside of North America) at 2.4GHz. This challenge is compounded by the fact that in dense urban areas, where the usage would be the highest, buildings and other urban development create interference with the wireless communication. To overcome the challenge of poor indoor coverage, an antenna may be required either in the window or mounted externally on some buildings. In addition, since network providers are under cost pressure, they often overestimate the level of acceptable quality that can be achieved from the unlicensed WiFi spectrum at a reasonable maintenance cost.

Overall, some of the problems that have been encountered by vendors and municipalities include: 1) unreal expectations by users in regard to coverage, 2) deployment taking longer than anticipated due to permitting, unknown city asset information/ownership, cost vs. ROI, and some of the other issues noted above.[44]

WiFi Network Costs

Costs for ubiquitous municipal WiFi service depend upon several factors, including access to light poles, availability of uninterrupted power, terrain, user access speeds, minimum coverage areas and signal strength and back-haul fiber access. Industry representatives estimate that 40 to 50 access points are typically required per square mile. This represents an implementation cost of $100,000 to $150,000 per square mile. In addition, there are ongoing operational costs for pole attachment fees, maintenance/repair, and help desk/customer support). Service providers are looking for 'anchor tenants' to provide 50% to 100% of the initial investment capital for infrastructure build out and/or ongoing operational cost support. If there are too few paid subscribers, the anchor tenant may have to make up the difference. One wireless carrier notes that they need 2,000-3,000 households per square mile to be viable.[45]

In lieu of ubiquitous WiFi build-out, the County could opt to expand its existing Library WiFi system to additional County buildings to provide public, as will as employee, wireless access. Costs for installing and maintaining the County WiFi network vary depending on the density of access points needed, the intended use of the network, and other variables. In general the number and placement of WiFi access Points is highly dependent upon the building architecture. Also, the existing local area network must have available ports and the location needs to be connected to the County's wide area network. A site survey of each building is needed to determine the number and locations of access points for optimum coverage. Assuming the infrastructure is adequate, the estimates range from $4,000 to $4,800 per access point. This includes procurement, installation configuration and test, and project management.

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[44] Industry interview, Earthlink, August 21, 2007, Cole Reinwand and Stephen Salinger, (interviewed by CIO's office).
[45] Ibid.

WiFi Implementation Timing

Estimating the time required to expand the existing County WiFi network is dependent on many factors including the existing topography, the scale and scope of the project in addition to other factors. For example, if there are 50 locations (parks, community centers) with about 2 access points per location it will take 6 months from the start to do the site surveys, engineering, and procurement. Installation can then begin with a phased schedule of two locations per week. Configuration, testing, and turn-up can immediately follow each location, so the entire project could take about one year to be complete. With this example the project cost is about $400,000 to $480,000. However, an unanswered question is who is going to pay for the ongoing bandwidth, maintenance, and support? For the Library project (338 access points at 84 locations for $2,000,000), the Library is picking up the ongoing support costs while all the County users are picking up the increased bandwidth for public access. This model may not be applicable for other locations.

The implementation of a municipal WiFi system is dependent on the size of the area and complexity of accessing the supporting resources such as light poles. Below is a sample project timeline based on the City of Mountain View, CA; a city with a population of 72,000 and a geographic size of 12 square miles of relatively flat terrain.[46] (For comparison, Los Angeles County counts over 10 million residents, and its extremely varied geography comprises 4,061 square miles.) Mountain View's network, which took approximately 19 months to initiate service, has been available for public use since August, 2006.[47]

1. Project Definition and Technology Partner Selection – 6 months
2. Environmental Review and Permit Acquisition – 2 months
3. Approval Process and Final Agreements – 3 months
4. Hardware Deployment – 3 months
5. Testing – 2 months
6. Community Education and User Training – 2 months
7. Services offered – 1 month

Securing the Network: devices and user's information and activities

Along with healthcare and financial services, government is required by law to safeguard and maintain strict security control of sensitive information. Best practice security management for mobile-based municipal services is less feasible for public use WiFi broadband access, as most municipal WiFi offerings do not have comprehensive security policies. When contemplating the "dual-use" model for LA County, security protection needs to be built into the design and carefully calculated to ensure compliance with all County policies and law enforcement requirements.

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[46] Ellis M. Berns, "Adventures in Municipal – Wide Wireless or 'Un-wiring' the City of Mountain View," Economic Development Manager, City of Mountain View, CA, [electronic version from www.northcoastprosperity.com/files/Mountain%20View%20Wifi.pdf accessed October 23, 2007].
[47] http://www.mv-voice.com/story.php?story_id=1938

WiFi hotspots found in most public areas are usually vulnerable to hacking since most providers do not require encryption. Estimates vary, but some contend that 95% of WiFi data traffic is unencrypted.[48] WiFi eavesdropping has been considered a security issue for some time, since it is not difficult for someone to do this with free or low cost WiFi monitoring programs. An eavesdropper can sit 100 feet away and monitor another user's Internet activity. The extent of such activity has not been measured and reliable estimates do not exist. Nonetheless, many contend that WiFi hackings definitely do take place; and given the ease with which this can occur, there are expectations that this is a potentially significant security issue for municipal WiFi users. Malicious code, such as software viruses, is also a potential threat to individual users, companies, and government departments.

The most common wireless encryption standard, Wired Equivalent Privacy (WEP,) is easily breached. WiFi Protected Access (WPA and WPA2) addresses the weaknesses of WEP and is becoming more widely available. Typically, WiFi access points default to an encryption-free mode, and users are comfortable with the "out of the box" device that does not require any configuration. With the convenience and efficiency that the mobile device provides also comes a greater vulnerability to theft, loss and malicious use.

A common set of security issues exist for municipal WiFi users: network identification, authentication, transmission security, and finally, device protection.[49]

Network Identification
Network identification involves the process of determining which network the user will join. When the user chooses a network, they are given alternatives – people operating the access point are free to name the network whatever they choose. This provides an opportunity for what is called an "evil twin attack." Essentially, fake access points are created; users join these networks and the attackers operating the fake access points then have the connection details at their disposal.

Authentication
Authentication involves demonstrating to the network operator that a particular user should have access to the network. Usually, this entails a username and password. Once verification occurs, access is allowed. There are a host of authentication schemes; each has their own strengths and weaknesses. Enacting basic authentication requirements for public users, and more advanced enforcement and password policies for municipal departments, will help secure devices using WiFi networking.

Transmission Security
Transmission security refers to the measures taken to secure what is sent over the network – or "over the air." Most discussions of WiFi focus on snooping by attackers within the wireless transmission range.

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[48] Byron Acohido, "Public WiFi use raises hacking risk," *USA Today*, Aug.6, 2007.
[49] http://www.symantec.com/enterprise/security_response/weblog/2006/07/muni_WiFi_security

Device Protection

Protection of the users' device (laptop, smart phone, etc.) is necessary as individual users without the protection of a closed encrypted network with strong authentication are more vulnerable in a muni-WiFi scenario. Businesses can secure their data using a virtual private network (VPN) or secure web page. Corporate users can also rely on an IT staff to set up encryption keys and provision authentication. With a public network serving thousands of users, such measures will not be feasible, especially if access is priced very low. Mobile devices in general tend to have insufficient encryption to withstand hacker attacks. Making matters worse, some of the most basic security mechanisms like password requirements and data encryption are still not utilized even when available.

While enterprise level security measures will be necessary for local government applications, extension of the appropriate level of security to the individual user will need to be calibrated to resources and intended service usage. User and device authentication for LA County employees could require a database of all authorized users and devices, with the IDs, passwords, certificates, etc. integrated into a unified "security management system." Compliance would require installation of third-party software onto devices, and periodic assessment to ensure that requirements are being met. Appropriate security policies are also a component of user compliance. Without such measures, vulnerabilities might easily attract attacks.[50]

Technology/Business Partner Challenges: existing wireless networks

One challenge to municipal wireless deployments is the overlap of this technology with incumbent wireless telecommunications networks. Part of the competitive advantage of wireless phone companies is their networks. While these networks are comprehensive and nationwide (even international in some cases) the area surrounding densely populated urban centers can become contentious when cities start to deploy municipal WiFi. Voice communication is possible on a WiFi network from specially designed mobile phones, which should foster competition with traditional mobile phone carriers. WiMAX technology could also have a broad impact on vendors and operators plans for next-generation broadband wireless technology. Finally, if broadband access through advanced wireless networks becomes more widely available and affordable, this development will provide another alternative to WiFi access for many. All of these alternatives, private sector options will become competitors for the potential customers of any public, government-supported WiFi network.

Technical Coordination and Business Complexity

The wireless industry is made up of several types of firms that contribute to the building, operation and maintenance of the network, as well as provider of services to the users. The table below, Figure 5 shows how different partners in a WiFi value chain are likely to view three key

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[50] Motorola, "Mobile Device Security, Securing the Handheld, Securing the Enterprise," *Motorola White Paper*, 2007.

dimensions of a project: project size/scale, system complexity and number of users.[51] Two key points stand out. First, few of the parties that contribute to the functioning of the wireless network partner ecosystem have the same motives. Secondly, most parties would likely favor a larger project size/scope, which may be in direct opposition to the objective of the municipality, especially if financial constraints exist. Given the recommendation that LA County begin with small scale deployments, the conflicting preferences in the industry value chain should be appreciated.
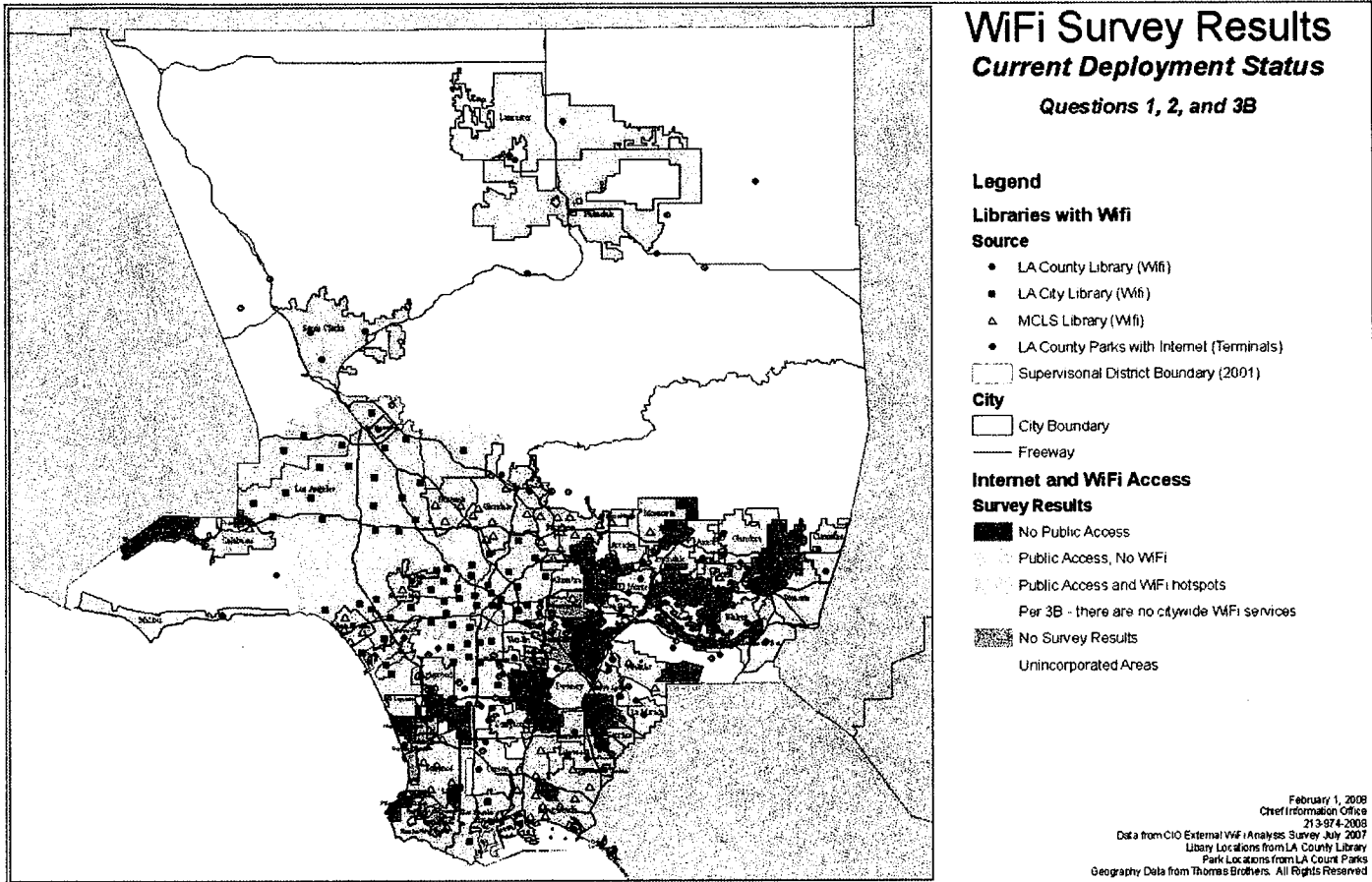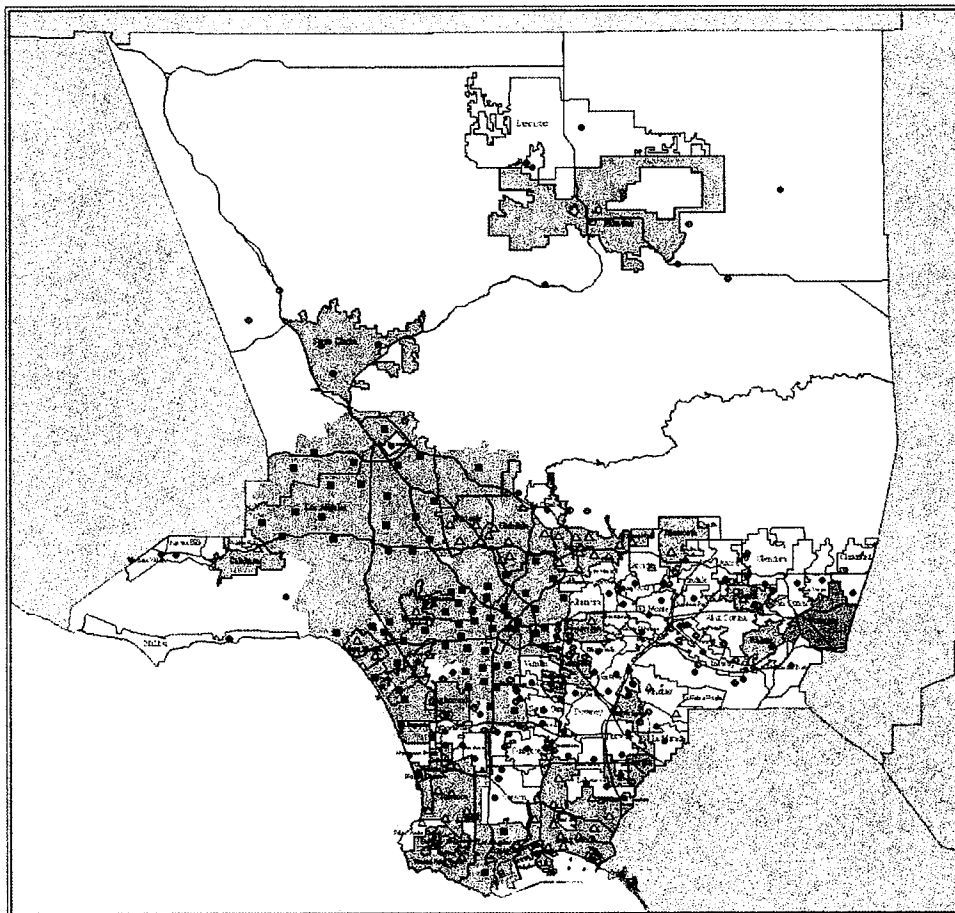
Figure 5

	Motives		
	Project Size/Scale	System Complexity	Number of Users
Service Providers	●	●	●
System Integrators	●	●	○
Commercial Advertisers	●		●
Hardware Manufacturers	●	●	○
Application Providers		●	●
Operating System	●	●	
● Support ● Oppose Neutral			

Source: Adapted from Gartner Group, 2006

[51] Ian Keene, "What Local Governments Should Consider in Planning Municipal Wireless Networks," Gartner Research, April 26, 2006 [electronic version from http://www.gartner.com/resources/139000/139010/what_local_governments_shoul_139010.pdf].

Appendix B – Maps of LA County WiFi Survey Results

WiFi Survey Results
Current Deployment Status

Questions 1, 2, and 3B

Legend
Libraries with Wifi
Source
- LA County Library (Wifi)
- LA City Library (Wifi)
- MCLS Library (Wifi)
- LA County Parks with Internet (Terminals)
- Supervisonal District Boundary (2001)

City
- City Boundary
- Freeway

Internet and WiFi Access
Survey Results
- No Public Access
- Public Access, No WiFi
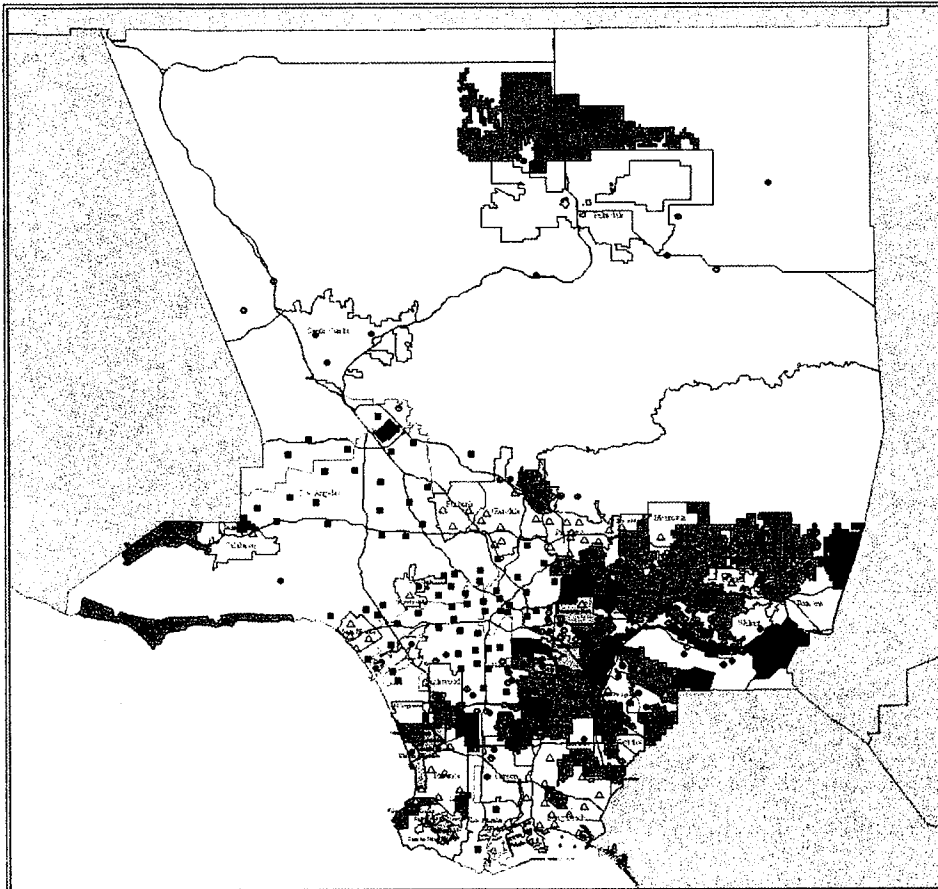- Public Access and WiFi hotspots
- Per 3B - there are no citywide WiFi services
- No Survey Results
- Unincorporated Areas

February 1, 2008
Chief Information Office
213-974-2008
Data from CIO External WiFi Analysis Survey July 2007
Library Locations from LA County Library
Park Locations from LA Count Parks
Geography Data from Thomas Brothers. All Rights Reserved

WiFi Survey Results
Current Fees
Question 8

Legend

Libraries with Wifi

Source

- LA County Library (Wifi)
- LA City Library (Wifi)
- MCLS Library (Wifi)
- LA County Parks with Internet (Terminals)
- Supervisorial District Boundary (2001)

City

- City Boundary
- Freeway

Current Fees

Access Charges

- Free Access
- Access Charges
- No WiFi
- No Survey Results
- Unincorporated Areas

February 1, 2008
Chief Information Office
213-974-2008
Data from CIO External WiFi Analysis Survey July 2007
Library Locations from LA County Library
Park Locations from LA Count Parks
Geography Data from Thomas Brothers. All Rights Reserved

WiFi Survey Results
Deployment Plans
Questions 10 & 13

Legend

Libraries with Wifi

Source

- LA County Library (Wifi)
- LA City Library (Wifi)
- △ MCLS Library (Wifi)
- LA County Parks with Internet (Terminals)
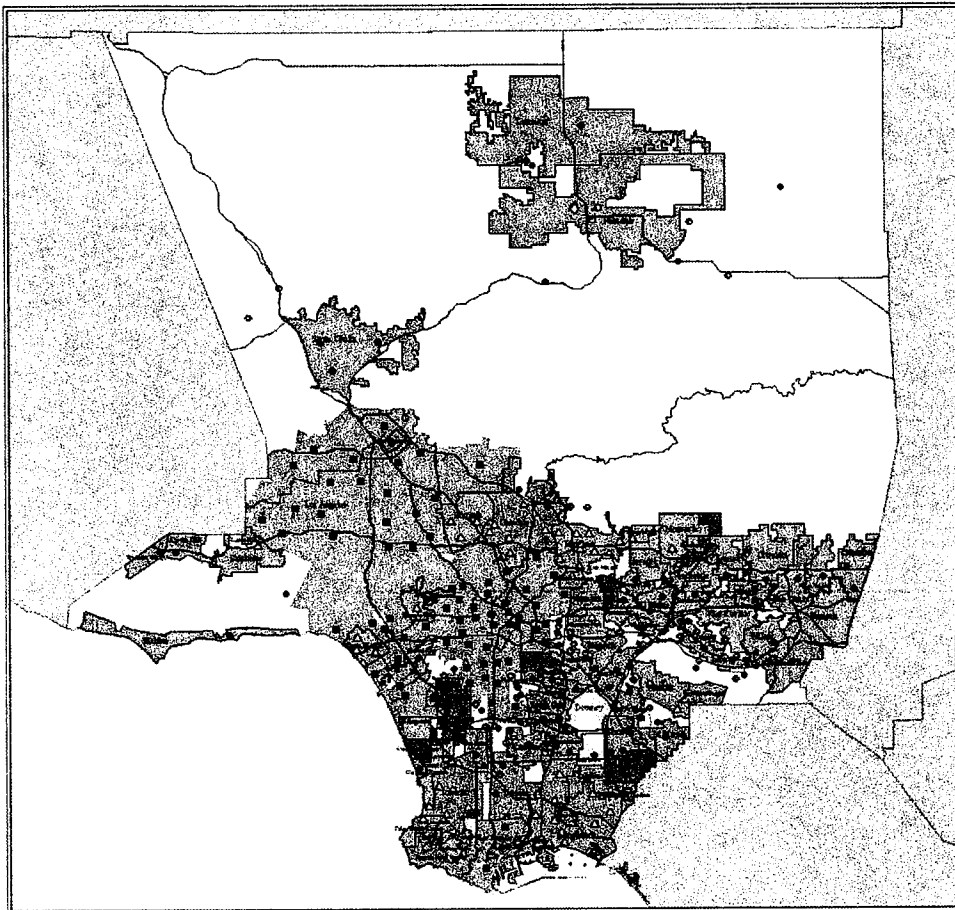- Supervisoral District Boundary (2001)

City

- City Boundary
- —— Freeway

WiFi Deployment plans

WiFi Deployment plans

- No plans
- Yes - Public only
- Yes - Internal Only
- Yes - Public and Internal
- Already deployed
- No Survey Results
- Unincorporated Areas

February 1, 2008
Chief Information Office
213-974-2008
Data from CIO External WiFi Analysis Survey July 2007
Library Locations from LA County Library
Park Locations from LA Count Parks
Geography Data from Thomas Brothers. All Rights Reserved

WiFi Survey Results
Interest in Consortium
Questions 16 & 17

Legend

Libraries with Wifi
Source

- • LA County Library (Wifi)
- ▪ LA City Library (Wifi)
- ▵ MCLS Library (Wifi)
- ⊙ LA County Parks with Internet (Terminals)
- ☐ Supervisonal District Boundary (2001)

City
- ☐ City Boundary
- — Freeway

WiFi Consortium
Interest in consortium, and County's role

- ▪ No, and County should not create consortium
- No, and County should create consortium
- Yes and County should not create consortium
- Yes, and County should create consortium
- No Survey Results
- Unincorporated Areas