

# A Vision of a Wireless Silicon Valley

Enabling the largest community of  
mobile workers and residents in the world

November 2005



Prepared by the Smart Valley Wireless Silicon Valley Task Force



## Wireless Silicon Valley

### **About the Wireless Silicon Valley Task Force**

Wireless Silicon Valley is a project of Joint Venture: Silicon Valley Network's Smart Valley initiative. The Task Force consists of the CIO's and economic development managers of the Valley's cities and counties. Formed in early 2005, the Task Force has been meeting monthly to develop a shared vision and a plan of action.

The Task Force has been assisted by several volunteer consultants and entrepreneurs with expertise in wireless technologies and business models.

In May of 2005, the Task Force conducted a survey of cities to assess the current state of wireless deployment and to get a sense of the goals and priorities affecting each city's wireless strategy. The results of the survey helped shape the vision described in this document.

### **About Smart Valley**

Smart Valley's mission is to promote pervasive public access to information technologies in the Silicon Valley region by exploring applications that significantly improve the lives of the people who live here, and by encouraging the rapid deployment of next generation communications infrastructure.

In addition to Wireless Silicon Valley, Smart Valley is leading Smart Health, an project to network Silicon Valley's healthcare system, and Wireless Campus, a project to encourage the deployment of wireless infrastructure in the classrooms and on the campuses of the region's community colleges.

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Joint Venture: Silicon Valley Network is a nonprofit organization that provides analysis and action on issues affecting the economy and quality of life in Silicon Valley.

The organization brings together new and established leaders from business, labor, government, education, non-profits, and the broader community to build a sustainable region that is poised for competition in the global economy.

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## Overview

In the last couple years new wireless technologies have brought the vision of anytime, anywhere access to information a giant step closer to reality. It started with wireless hotspots in the downtowns. Hot spots are growing into hot zones, and cities ranging from populations of a few thousand to millions are starting to build city-wide networks. Laptop computers and personal digital assistants are adding wireless capabilities and new devices, such as telephones no bigger than a fountain pen, are being invented to take advantage of the emerging wireless infrastructure.

Despite its popularity, the availability of outdoor, high-speed, low-cost, wireless service in Silicon Valley is still very limited. WiFi service is limited to spots, and the new cell phone-based service is too expensive for many people, or too slow, or still not available everywhere.

To realize the anytime, anywhere dream, Silicon Valley needs to evolve from a collection of hotspots into a 1,500 square mile wireless region. The vision of Wireless Silicon Valley is to provide a low-cost, high-speed, outdoor, wireless infrastructure that will be available for a variety of purposes on the streets and highways, in parks and plazas, at construction sites, in recreational areas and business parks, and on buses and trains. When the network is in place, people will be able to connect to their e-mail, conduct research and execute transactions on the web while sitting in a park or getting a cup of coffee. We will only need to sign on once and we will not need to sign up with multiple service providers. Visitors to Silicon Valley will find it as easy to connect here as it is at home.

The network will support a wide variety of devices and applications. Sensors will use a low speed connection to transmit data on water levels in San Francisquito Creek, while a toxics specialist speeding to the site of a chemical spill on highway 101 uses a high-speed connection to review satellite images of the area and study municipal maps showing sewer lines and underground water flows. Personal digital assistants and game players will be able to send and receive video and music.

The network will support the region's economy in a variety of ways. Silicon Valley is home to hundreds of wireless companies that can provide equipment and software. Our community colleges and universities are training workers in wireless technologies, and venture capitalists are placing their bets on which entrepreneur will become the next Yahoo! or eBay. As the network becomes more ubiquitous and trusted, entrepreneurs will develop new devices to connect to the network, and new applications that serve mobile workers, creating high quality jobs in the community.

Silicon Valley has a long history of big ideas made possible through regional collaboration. Working together will allow us to lead the world in the use of wireless technologies for the betterment of our economy and quality of life.

## Target Users and Applications

The target users for the wireless infrastructure will be mobile workers and residents. IDC estimated there would be 105 million mobile workers in the U.S. by the end of 2006.<sup>1</sup> Gartner Dataquest estimates that professionals with wireless notebooks can save an average of 14 hours a week by not having to run back and forth to the office to collect and submit information. For workers who spend 20 percent of their time or more outside of the office, Gartner calculates a minimum savings of \$34,560 per year.<sup>2</sup>

In Silicon Valley we see four major categories of users of the network.

### 1. Public Agencies

A high percentage of public agency employees have responsibilities that keep them in the field much of the day. Examples include building inspectors, social workers, police officers, fire departments, transportation workers, and cleaning and maintenance crews. Ubiquitous networks will allow them to get their work orders in the field, update databases from the worksite, file reports, and access files remotely, speeding up responsiveness, reducing errors, and reducing time and fuel wasted driving back and forth from the office.

Emergency response teams need information at the site of the emergency and need to transmit information to coordinate the plan of action. Emergency workers and public safety personnel often cross city boundaries. It is essential for them that the network be seamless throughout the Valley – that links not be dropped as they move around at high speed, and that they not have to log on over and over again as they move from jurisdiction to jurisdiction.



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<sup>1</sup> *The Wireless City*, Intel Solutions Whitepaper, December 2003, page 4

<sup>2</sup> *Ibid*, page 3

## Wireless Silicon Valley



*A key goal is to cover the outdoor areas in all 1,500 square miles of Silicon Valley.*

Mobile hotspots – essentially powerful radio repeaters mounted in cars and trucks – are already demonstrating their value in disaster zones, such as that created by hurricane Katrina, and for major events such as concerts and the Scott Peterson trial in Redwood City.

Public agencies also need to monitor the infrastructure they manage to make sure all is well. Remote sensors and video cameras can use wireless telemetry to report on water levels in creeks and sewer lines, to monitor traffic and keep an eye on known trouble spots. The cost of installing cameras and other sensors is sharply reduced when there is no need to dig up streets or roll a service truck to pull a communications line to the device.

Utilities can use wireless telemetry to read gas and electric meters, and monitor their networks. Wireless parking meters are being installed in some cities. The meters send out a signal when their cash box is almost full, reducing the number of times a meter needs to be visited.

## **2. Visitors**

Silicon Valley welcomes hundreds of thousands of business travelers every year. People come for meetings, conferences, and trade shows. And many of them join tourists at the restaurants, museums, and other entertainment centers.

Today's business travelers need to be able to connect to the Internet where ever they are – in the hotel, at a client's office, during a convention, and even while in a taxi or on a train. Business travelers typically have a wireless account through a service such as T-Mobile, Boingo, and Wayport. They want to be able to access their favorite wireless service while in Silicon Valley to avoid creating a separate account and getting yet another bill in the mail.

Ready access to the Internet would allow visitors to find the nearest movie theater and check out show times while sitting in a park. Or browse the menus of the local restaurants and pull up a walking map for directions. Tourists could call up historical information about the Hewlett-Packard garage on their palmtop device while standing on Addison Avenue, or find out about a lecture on the history of the disk drive at the Computer History Museum.

The City of San Jose has plans to put up a variety of wireless applications for visitors coming for the International Society for Electronic Arts conference in 2006. Participants will be able to explore the city, join multi-player games on wireless devices, and call up the works of new media artists on palmtop devices.

The availability of a pervasive wireless network will make Silicon Valley more attractive to conventions and visitors, attracting new events and creating more jobs for residents.

## **3. Local Businesses**

Many businesses employ mobile workers. Construction crews work all over the Valley and supervisors travel from site to site troubleshooting problems, tracking down supplies, and working out change orders with clients. Many construction sites do not have access to wireless communications networks so they are dependent on cell phones and walkie-talkies. With wireless laptops they could easily call up contracts, send e-mail messages, place orders, and update production schedules, all from the field.

People who repair home appliances, office equipment, and factory equipment drive from site to site. Their only link to the office is a cell phone. At the end of the day they have to complete their paperwork, turn it in, and pick up work orders for the next day. A wireless network would reduce the need to visit the office and provide ready access in the field to repair manuals and instructional videos and diagrams, and the ability to send video and audio recordings to specialists for help with special cases.

## 4. Residents

The Valley's residents are mobile. They travel to work, take children to school and events, visit doctors and the library, and do their shopping. Like visitors, a wireless network will allow residents to look up restaurant and entertainment listings no matter where they are. Residents will also be able to find out about a sale at a store on the next block, compare prices with listings on eBay, and renew a Dr. Seuss book on the library's website.

Public transportation will become more convenient. Some cities in other parts of the world have already installed wireless kiosks at bus stations that report when the next bus will arrive and its destination in real time, based on wireless monitoring of each vehicle.

In a medical emergency, medics will be able to access a patient's records while in the field. They will find out about drug allergies, cardiovascular conditions, and recent medical events, greatly improving the medics' ability to deliver the correct treatment quickly.

The network becomes even more valuable as schools and libraries offer wireless connections. Already most of the libraries in San Mateo County offer free wireless to patrons. High schools and community colleges are also building and running wireless networks. As the network becomes more pervasive people will assume they can get connected no matter where they are in the Valley.

## Priorities for Wireless in Silicon Valley

Around the world, the cities building a wireless infrastructure tend to have one or two primary goals. The most common goals are,

- Provide free or affordable<sup>3</sup> broadband access to the Internet for low income communities.
- Provide broadband access to the Internet where there is no affordable supplier.
- Provide businesses and residents with an alternative supplier of broadband access.
- Achieve efficiencies and improve municipal services.
- Make the community more attractive for businesses.
- Help local businesses compete more effectively.

Based on our survey of 18 of the cities in the Valley, our top goals for wireless infrastructure are, in priority order,

1. Enable efficiencies and improvements in the provision of government services by providing mobile workers with ready access to databases in the office from any where in the community. This includes applications for public safety and emergency response.
2. Fill in gaps in access to affordable broadband services. While cable modem and DSL services are now widely available in the Valley, there are still business districts and neighborhoods that can not get service or can not afford services that are available.
3. Support the economic development of the region by attracting business visitors and tourists, and helping local businesses compete.

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<sup>3</sup> The definition of "affordable" varies by category of user. \$100/month for guaranteed symmetric 1.5 megabits might be affordable for a small business. \$20/month might be too much for a family that can not afford to own a car.

4. Make access to services more convenient for residents.

This ordering of the priorities applies to the majority of cities on the Wireless Silicon Valley Task Force, with the caveat that several cities place filling in gaps in access to affordable broadband (item 2 above) first.

## Challenges and Risks

The challenges and risks associated with Wireless Silicon Valley fall into four categories.

1. Business model
2. Technology
3. Public policy
4. Vendor reliability

We have identified strategies to address several of these challenges. Resolving the others is the work of the Task Force.

### 1. Business Model

A key challenge for wireless initiatives is the funding. Communities need to consider two factors:

- Who will pay the cost of constructing the network, and,
- How to cover the costs of operation and continuing equipment upgrades.

Cities across the country are testing a number of business models. For example,

- A private company owns and operates the network. Users typically pay an hourly or monthly fee. The company pays the city for access to towers, light poles and roof tops. E.g. Cingular, Verizon, MetroFi, Comcast.
- The city or other public agency owns and operates the network, e.g. Cerritos, CA.
- A government agency provides capital to help fund construction of a network. An example of this model may be the City of Philadelphia.
- A Wireless Internet Service Provider provides free or low cost service in exchange for advertising fees from local businesses. Many downtown hotspots use this model.
- A non-profit organization is created by members of the community to provide access at below market rates, e.g. the Bay Area Research Wireless Network in San Francisco.

**While there is no consensus on which model is best for Silicon Valley as yet, there is agreement that the cities would prefer not use their scarce capital resources to build a network.**

The Task Force is reviewing the experiences of other communities to determine which business models make sense for Silicon Valley.

## 2. Technology

The principal technology risks are,

- Rapid changes in technologies and standards can render equipment obsolete before the service has recouped the cost.
- A particular technology may not work as expected. There may be flaws in the technology, or factors in the environment that were not anticipated.
- Natural and artificial barriers, and interference with other wireless signals may affect cost and performance in unanticipated ways.

**Our research leads us to the conclusion that no one technology will meet all of our needs.** We envision a mix of licensed and unlicensed technologies with different data rates, levels of security, power requirements, abilities to pass through barriers, and communicate when traveling at high speed.

There are two broad categories of technologies: those that use unlicensed radio frequencies, like WiFi, and those that use licensed frequencies, like standard public service radios. Technologies that do not require the purchase of a frequency license tend to be cheaper than those that do, but unlicensed technologies must operate at lower power and coexist with other users generators of radio signals, such as other WiFi networks, cordless phones, microwave ovens, and garage door openers. Licensed frequency equipment tends to be more expensive to purchase and service because the deployed volume is lower than a mass market technology like WiFi.

Cell phone companies have two technologies that provide medium speed data service, EVDO and UMTS. Using licensed spectrum, these services allow users to use a cell phone or special radio to connect to the Internet at 200 – 300 k bits per second, vs. one megabit or more using WiFi. The cost of the cell phone service is about \$60 to \$70 per month, but the coverage is very wide, it can be used in a car traveling on a highway, and it is available today.

Zigbee is a new technology designed for low data rate applications. Using unlicensed frequencies, Zigbee can be for telemetry for remote sensors. Low power Zigbee devices can operate on batteries and solar cells for long periods of time.

Different technologies have different radio siting requirements. Some can be attached to light poles, some work best on towers, others work in tunnels and sewer lines. Higher elevation locations help cover hilly terrain.

It is difficult to predict what kinds of devices will connect to the network. Police departments are turning patrol cars into relay stations, picking up a signal and amplifying it so that officers can get a signal while inside a building or beyond the range of the normal wireless access point. Radios are being added to cameras, water pumps, traffic signals, and information kiosks. The network must remain flexible and adaptable to these devices and growing demands for bandwidth.

### 3. Public Policy

The regulatory environment for frequency management is in a state of flux. As mobile technologies become more popular, demands are growing for the reallocation of frequencies to enable more usage and a wider range of applications. WiFi (802.11b and g), for example, is constrained to a relatively high frequency, 2.4 gigahertz. High frequencies are good for short distances and can be disrupted by trees. Low frequencies, such as those used by broadcast television, can travel long distances and penetrate many barriers. The Federal Communications Commission is circulating a plan that would require the television stations to return the frequencies now used for analog television broadcasting by 2009. If those frequencies were made available for data and voice communications there would probably be another explosion of wireless technologies and applications.

Congress is also updating the telecommunications reform act. The act will have to recognize the overlap between the cable television system and the telephone system in order to develop a new model for city franchise agreements.

We can not wait to see what Congress and the FCC do. We need to monitor their activities and maintain flexibility.

Some states have enacted legislation prohibiting government agencies from providing wireless services to the public. **The cities and counties in Silicon Valley do not know if they want to provide services to the public, but they want to ensure that they have the option to provide service if it makes sense in their communities.**

**Locally, city and county agencies need to establish policies for wireless companies to operate in their jurisdictions.** Wireless companies want access to building tops, communications towers, utility poles and light poles. Light poles are particularly useful because of their pervasiveness and ready access to electrical power for radios. Cities need to establish policies to cover several dimensions of wireless service:

- How much to charge for access to rights of way.
- Whether or not to require a bond that would finance the removal of equipment should the vendor go out of business.
- Esthetic and safety guidelines for the placement of radios and supporting equipment.
- Procedures for identifying and resolving signal interference disputes.
- Whether or not to provide incentives to an operator to serve certain communities at below market rates.

**Local governments can play a critical role in attracting wireless service providers by acting as the anchor tenant**, i.e. agreeing to purchase services for their own use. Vendors can then more easily afford to build a network that can be used for public agencies, businesses and consumers.

## 4. Vendor Services and Reliability

In considering which vendors to work with, cities will need to consider several questions, including,

- Is the organization financially secure?
- Will the company provide reliable support services?
- Will the service reliably provide special quality of service levels for emergency response personnel during a crisis?

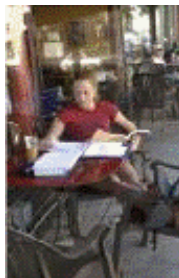
The wireless boom has led to the formation of many Wireless Internet Service Providers (WISPs) and manufacturers of equipment. Silicon Valley is home to many of these startups and a number of them have approached local cities for permission to install and test their products in our neighborhoods and business districts.

Silicon Valley cities should encourage and support local entrepreneurs, but without taking on substantial risk or cost. Everyone remembers the boom and bust of Metricom, leaving radios scattered around the Valley, unused, but still consuming power.

Cities will need to enforce policies that ensure redundancy and backups in case of power failures, routine equipment problems, and business failure, particularly when installing wireless technology for mission critical applications, such as emergency services,

Cities will require Quality Of Service (QOS) levels that exceed the requirements of visitors and residents. Technologies are now available that allow certain users, such as police officers and emergency medics, to have priority on the network, in order to ensure a high data rate during emergencies.

Cities will also need to ensure that companies providing services for cities and consumers achieve certain network reliability standards, adequately staff help desks, and provide reasonable customer service.



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