

## **Broadband Wireless Networks provides Low Cost Alternative for Utility**

### **Applications**

Broadband networks, by definition provide a real time, two way data communications link between the city/utility and the end use customer. The telecommunications infrastructure and its inherent data handling (information throughput) is the core difference between this type of solution and the traditional one way broadcast (Power Line Carrier or Radio) type of solutions. As more cities and communities adopt the wireless approach to provide broadband to their citizens other opportunities for other utility based applications becomes increasingly attractive. Having a robust (possibly broadband) communications infrastructure, whether wi-fi, wi-max, or fiber as part of the solution provides an extensive array of advanced applications that will not be limited by capacity or proprietary protocols and data structures. More importantly it is these networks that will be the most cost effective going forward due to the appetite for mobile connectivity.

From a cost perspective, we believe that wireless will win due to the overwhelming desire for people to have high speed broadband Internet access whenever and wherever. The deployment of wide-spread wireless broadband networks among cities is exploding. Much like the explosion of fiber optic deployments in the 1990's to support the growth of data and voice communications, the expected growth over the next 10 years will be in the wireless arena. This wireless frenzy will result in dramatic cost reductions for wi-fi enabled chip sets and radios that will communicate over standard TCP/IP networks, which means IP addressable appliances, breaker panels, thermostats and yes meters. To understand this better let's review where the telecommunications networks were with respect to cost and availability.

## **Background and History**

After World War II, the need for better 2-way wireless communications on the battlefield funded the development of high quality Frequency Modulated (FM) technology. In the 1970's, when Illinois Bell tested the first cellular system; AT&T was credited with developing the first cellular technology.<sup>1</sup> The cellular system used hand-off technology that enabled the use of multiple low-powered transmitters to better utilize the frequency band. By the mid-1980's cellular telephones became commercially available and were more affordable than previous wireless telephone systems. In the late 1980's, the bigger players like AT&T dominated the market, but some upstarts found opportunities to enter the market. Sprint, MCI Worldcom, GTE, Nextel, CellularOne, plus the Baby Bells like US West and BellAtlantic all offered cellular service.

In parallel with the growth in demand for wireless telecommunications, the demand for Internet access also grew dramatically in the late 1980's throughout the 1990's. In the last few years these two technologies have begun to converge as the demand for high speed Internet access has migrated to an environment where consumers want access anywhere and anytime. As the convergence of wireless and Internet technologies evolves, the devices that link the two will become multipurpose (e.g., wireless telephony, personal digital assistant, web browser, MP3 audio player/recorder, eBooks, etc.). Wireless Internet will fundamentally change the way consumers connect their portable device to the Internet. The capabilities currently built into the wireless and Internet infrastructures will provide a clear advantage to those companies already established in the business. Players like IBM, AOL and other traditional ISP's will partner to deliver a range of solutions.

## **Wireless Technology Overview**

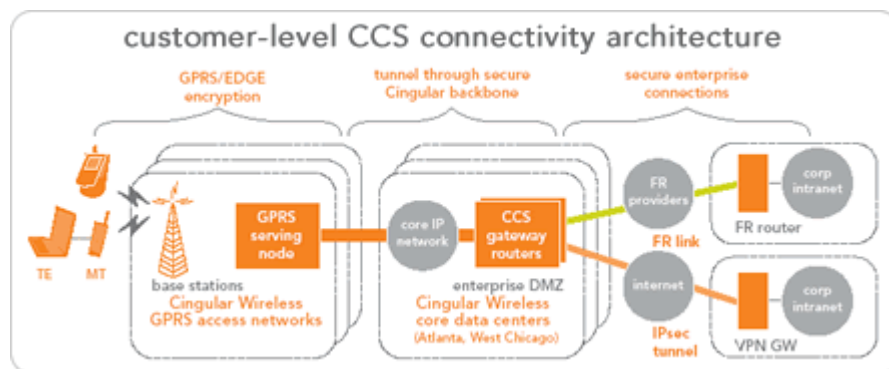
The change in regulations and the availability of additional frequencies within the radio spectrum enabled new players with new products to enter the wireless market. Originally, wireless cellular was an analog service (Generation 1). During the 1990's digital services were implemented that greatly enhanced the quality and flexibility of the cellular service (Generation 2). Compared to the first generation analog

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<sup>1</sup> "Cellular Radio Telephone," Microsoft® Encarta® Online Encyclopedia 2000  
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phones, the second generation digital phones improved reception and provided a wide range of increasingly complex services including voice-mail and call waiting. The third generation wireless phones on the market provide increased data rates that support Internet access.

One of the key issues in the global wireless market is the adoption of uniform standards that will enable a consumer Internet access anywhere on the globe at anytime. Currently, Europe uses a standard known as the Global System for Mobile Communications (GSM), while Japan established the Personal Digital Cellular, or PDC, standard. However, the United States has not adopted any standard, allowing the market to determine the prevailing technology. This free-market approach has resulted in four separate technologies in the U.S. alone: GSM, TDMA (Time Division Multiple Access), CDMA (Code Division Multiple Access), and iDen. If the vision of global roaming and ubiquitous global wireless Internet access is ever going to be achieved, an international standard must be uniformly adopted. While each standard has its strengths and weaknesses, few companies could afford to rebuild their established infrastructure to accommodate a new standard. Therefore, the companies who will succeed in the future wireless Internet access market will be those who have made investments in the technologies that will survive as a part of the international wireless standard. Unfortunately, since the U.S. government does not regulate wireless technology standards, any attempt to establish a national standard or adopt an international standard will be more difficult in the U.S. than in other nations (e.g., in Europe and Japan, government agencies distribute bandwidth and determine the standards for its transmissions). Shown below is just one example of a GPRS cellular networks for providing two-way data for utilities.



## Competing Technologies & Industries

Between 1999 and 2003 the number of households with Internet access grew at almost 50%, from 51 million to 78 million. This group represents 63% of total households in the United States. Similarly, the number of individual users grew 57%, from 100 million users to 157 million users. This represents an increase from 37% to 56% of the population. This has led to a number of new business and traditional service providers researching T1, DSL and Broadband solutions. An while access to the Internet from a centralized location is best suited for wired broadband, field device applications and a mobile work force are driving the demand for high speed wireless access. As we will more fully describe this access is also being driven by the machine to machine communications needs of businesses throughout the world. We you access the telecommunications platform; you must understand the limitations associated with each. Although the amount of data being transmitted associated with a monthly meter read is very small, data throughput is very important with respect to other applications including outage management data, power quality data, demand response programs, and of course pre-pay programs which must be able to accommodate on not daily reads but on-demand reads and daily transactions. The volume of data will reduce network performance if there is insufficient data throughput.

There are several competing technology platforms from power line carrier to fixed radio frequency both private and public networks to wireless radio to fiber/Ethernet. Shown below is a breakdown relative to data throughput capacities.

<u>Technology</u>	<u>Typical Speed</u>
• <b>Power line carrier</b>	<b>&lt; 100 bps</b>
• <b>Circuit switched data</b>	<b>9.6-14.4 Kbps</b>
• <b>GPRS</b>	<b>20-40 Kbps</b>
• <b>GSM</b>	<b>75-135 Kbps</b>
• <b>Frame relay</b>	<b>56 Kbps-1.544 Mbps</b>
• <b>WiFi/Ethernet</b>	<b>11 Mbps</b>
• <b>WiMax</b>	<b>up to 75 Mbps</b>

## **Wireless Growth and Costs**

So what does all of this mean? In 1992, the average monthly cellular retail cost to the consumer was \$ 70 per month. In 2004 that cost was under \$30 per month. At that same time, in 1999 there were approximately 200 million wireless connections and 200 million Internet users. By 2009, industry forecasts project there will be 1 billion wireless connections and 1 billion internet users<sup>2</sup>. The convergence of these two markets/technologies is expected to result in approximately 39.6 million wireless Internet access users<sup>3</sup>. One of the factors driving the technological revolution in wireless communications and Internet access is the unbridled global demand for voice, video, and data services. As a result the costs for providing these technologies plummet. A retail customer can now acquire a hand held data device that can access the commercial cellular infrastructure at a cost of \$5/month and \$0.01/ kilobyte of data. The expectation is that the global demand for wireless communication and Internet access will give birth to devices that provide the business user with all the necessary voice, video, and data communications services anywhere in the world. This technological and market revolution is expected to continue for at least the next 10 years<sup>4</sup>.

## **Utility Applications via Broadband Technology**

As the wireless broadband networks continue to explode, opportunities for growth are illustrated by notable levels of interest in wireless data services among key consumer segments. Groups outside of the consumer segments are expressing the greatest desire for new applications and services. These users include electric, gas and water utilities that are looking for cost effective technologies that would allow them to reduce costs and expand services to their customers. With high speed wireless networks, there are few restrictions to applications due to the higher data throughput. These applications are not just restricted to automated meter reading but include pre-pay metering, automated disconnect/reconnect services, power quality management, home monitoring, security and many others. Most importantly the rapid growth of these networks will spawn substantial reductions in cost for wi-fi enabled appliances, and intelligent meters,

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<sup>2</sup> Source: tele.com, December 13, 1999

<sup>3</sup> Wireless Week , “Into the Internet”, 10A+, October 27,1997.

<sup>4</sup> Source: Standard & Poor’s Industry Survey – Telecommunications: Wireless (December 1999)

which will be those capable of being accessed via TCP/IP protocol with benefit of secured socket level and encryption protection. Below is just a sampling of the benefits that could be gained by approaching utility applications via a broadband IP network: These applications not only improve efficiency and reduce operational expense but they also allow the foundation for building a stronger relationship with your customers. Some of the business process impacts can be summarized as Operational Savings, Energy Delivery Resource Savings and New Product/Customer Service Revenue Opportunities. A quick summary of some these opportunities are listed below:

**Operational Impacts (Reduced Costs)**

- Meter Reading
- Service Disconnect/Reconnect
- Voltage Profiling
- Meter Maintenance
- Load Profiling
- True Interval consumption/demand metering
  - Interval data retrieval from customer sites requires a very robust telecommunication infrastructure due to the file (data) size that must be transported back to the utility.
- Outage Detection and Management
- Pre-Pay Energy which allows the customer to pay in advance to avoid deposits while at the same time reducing financial risk to the utility. Industry numbers support that Pre-Pay energy users use on average 15 % less energy than non Pre-Pay customers. Recent surveys indicate that 91 % on Pre-Pay programs like them.
- Demand Side Management System Performance Monitoring (verifiable demand and energy impacts on a customer by customer basis).

- This allows for customized appliance control options that are uniquely tailored for each individual customer vs. an aggregate control model for the one way broadcast type solutions.

Demand Side Management control options that optimize customer comfort impacts and allow for the customer's interactive relationship with how the system operates. These capabilities are delivered via the internet. Instead of communication to a customer display for usage information it transmits information to our DSM modules which act to cycle off air conditioning, water heater and pool pump loads.

- Real Time Pricing applications for energy awareness
- Utility and community First Responders can access wireless networks (Wi-Fi/WiMAX) networks for mobile data applications, i.e. work order processing, trouble call response and close-out, crew scheduling, etc.

**Energy Delivery Impacts:**

- T&D Planning and Asset Optimization
- Load Forecasting

**New Revenue Opportunities and Enhanced Customer Service:**

- Intelligent Metering whereby the information is displayed in real time to the customer via a ZigBee wireless device located in the home. This allows the customer for the first time to have information about their energy/water/gas consumption in a near real time environment. With the data now available to the customer and with the software tools the customer can make intelligent choices about when and how they use energy.
- Power Quality Monitoring- A service can be provided to notify the customer anytime their voltage sags or swells beyond acceptable limits.

- Proactive Power Outage Notification via text messaging or e-mail. Automatically notifies customers if an outage has occurred at a premise of interest and when the power is restored to that residence.
- Customer Usage Consulting and Energy Consumption Optimization for businesses primarily, allows usage to be controlled by parameters driven by economics.

It is the convergence of these technologies and applications on one unified open broadband IP platform with the necessary security and stability that generates the value. Security, Outage Management, Mapping, Permitting, Demand Response, Intelligent Metering and Pre-Pay applications are now just a marginal expense based on a strategic business plan.

Since Carina Technology has had substantial work experiences in utility based software applications we are in a unique position to assist with the deployment of these applications, including the process flow changes and metrics that will be required to ensure a successful project.

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