Beyond The Hot Spot: Wireless For Knowledge

Overview

Introduction:

The CitiWide Wireless Network (CitiWide Wireless™), as its name suggests, is a Wide Area Wireless network dedicated to offer a very low cost, high bandwidth network infrastructure and applications to consumers that can use it.

With the recent commoditization of high speed (>10Mb/s) license exempted wireless radios such as 802.11a/b/g frequency protocol, wireless networking has dropped several magnitudes in price. No longer does it cost tens or even hundreds of thousands of dollars to move data via high-speed wireless links tens of miles. Also, the monopoly strangled "last mile" link is now opened to anyone. We feel that this technology has great potential to tie communities together, help with emergencies and erase the "digital divide". At this point, the technology is in its infancy to reach these goals, a number of problems need to be solved to get there. CitiWide Wireless™ is designed to address them.

Objectives:

The current objectives of CitiWide Wireless™ can broken down into:

- Deployment of long range (>2 mile) wireless networking using very low cost, commodity licensed-exempt radio transceivers.
- Be a wireless network for new protocols or "tuning up" current protocols such as dynamic routing protocols originally designed for "wired" networks.
- Experimentation with true broadband access to the home using electrical copper wiring with features including: VoIP, IPTV with data throughput of minimum 14 Mbps,

The first objective is looking to develop and document cheap long distance networking. We would like to see alternatives to the high cost of high-speed long distance links. Currently low-end "carrier class" equipment such as Western Multiplex's Tsunami radios have list prices about $12,000 per radio. This does not include low loss wave-guide, and high gain dishes. An installation of this class of gear can mean costs of up to $50,000 per backbone link. These costs can be out of the range for many low income communities such as Native Canadian reservations or underdeveloped countries. We believe we can get this price down below $5,500 per link with some sacrifices in uptime that can be partially solved with Web Cache Technology and redundant links or more frequent installations on a wireless network path.

The Customer Premises Equipment (CPE) costs for licensed-exempt radios for CitiWide Wireless™ will be under $300.
A number of third-world countries will benefit and can build on this development as this hardware has low power consumption and in the case of limited power infrastructure can be use with solar arrays and hydroelectric systems such as the type used by the EcoPartners Project directed by Jon Katz.

The second objective is designed to increase the speed of which public safety professionals can access data. Current technology such as Motorola's Private DataTAC2 network is limited to 19.2Kb/s. There is an increasing demand in public safety for more bandwidth. Graphics intensive data such as identification photos for police or weather maps for fire, can seriously tax a 19.2Kb/s network. Networks that are shared over a large area and also used for other communication such as vehicle positioning will magnify this problem.

An example of such an application would be as a police car or fire truck equipped with a laptop with a high-speed radio and a directional antenna which when once stopped and pointed to a high mounted access point, could actually stream back live video of the incident with plenty of bandwidth to spare on a 11Mb/s network.

Other examples of "broadband" applications for public safety could include streaming web cams, Voice over IP (VoIP), GIS mapping such as differential GPS, etc.

Also, many of these public safety networks rely on proprietary equipment that are expensive to deploy and replace. It is possible that with the low cost of licensed-exempt radios, that a network nearly 600 times faster than 19.2Kb/s and with far more security, as any level of well tested, openly-published encryption can be used, can be deployed at below 1/10 the cost.

The third objective understands that with the lower cost of equipment there is a trade off of shorter distance and uptime. Redundant, self-healing networks will be needed to address this problem. Dynamic routing protocols will be needed. As most ISO layer-2 (ie. spanning-tree) and layer-3 (ie. OSPF) protocols were developed for wired networks, additional tuning of the protocols will be needed to address the profile of failure for wireless networks. We expect to do this with the help of other technical groups such as Demarc Technologies, Wi-Lan Communications, Advanced Inactive Inc, All Stream Communications the research center Packet Clearing House, Dynamic Domain Name Service Inc and many more.

The final objective is meant to address the increasingly asymmetrical access to the Internet. Low cost broadband access to homes and small office is provided through providers using cable modems or DSL technology. Typically this will mean that the client has access to hundreds to thousands of kilobits of bandwidth down to them but will be limited to just 128 Kb/s up. With more multimedia rich demands on publishing, 128 Kb/s will limit how many uses can access a server or the kind of data that can be published.

On top of that most broadband providers will use dynamic IP address assignment so it would be difficult to find any servers that a client would use to publish materials. In some cases such as cable-modem broadband providers, they will even filter content (through port filtering) so it would be impossible to publish from a client.

This problem has become so significant even non-Internet organizations like the ACLU are taking action to stop it. In order to encourage the true democratic communication tool that the Internet could and should be, we would like to start to deploy high speed bandwidth to the home that does not have the restrictions commonly encountered by current broadband providers as outlined above. We are interested in seeing the Internet become to what it was originally imagined to be a resource sharing and publishing tool that provides equal access to all.

Strategies

High Places:
CitiWide Wireless™ feels that many of the problems identified here may be solved by obtaining access to strategically located communications sites. Traditionally mountain tops and towers have been seen as having the advantage of clear line-of-sight to other mountain tops and can view significant terrain such as populations areas. By anchoring our backbone on these sites we can provide connections to the network to other communities and provide "last mile" connections to end users.
This differs from what other community networks are doing through mesh networks as we do not have to wait for the critical mass of random “technically advantaged” individuals to show up and help. We see this network design as supporting these organic networks through bandwidth and expertise. The network would have a more stable infrastructure and organization.

Low Cost and Open API/Source Hardware :

CitiWide Wireless™ is concerned about proprietary protocols that bolt a user into one manufacture or service provider.

So much as been accomplished in standardizing high-speed wireless networks so they are not vendor dependent. CitiWide Wireless™ is committed to taking this further, where the equipment we will deploy on will not be dependent on a single manufacture or brand of device. Operating System support software will be chosen based on open source and it can be run on any practically any x86 PC motherboard and with the effort that almost any radio card can be used. We will gain so much in scaling and cost by basing the CitiWide Wireless™ architecture on common interfaces and open APIs such as Ethernet, Mini PCI & PCMCIA along with open platforms such as PC clones.

Hurdles:

CitiWide Wireless™ understands that each of these objectives will encounter limitations based on current regulations and the policies that surround them. CitiWide Wireless™ is interested in making this network available for others to deploy. Designs will be in accordance with local, provincial and federal regulations and laws encountered in Canada and other countries with the foresight for deployment outside Canada.

Current status and Milestone(Since October 2004)

Phase 1 – Planning and Alpha Development:

During the last 12 months of the planning and development phase it was identified, through the feature specifications, that current off-the-shelf low cost licensed-exempt equipment would not support the high level (layer 2 and above) dynamic routing protocols that CitiWide Wireless™ would expect to use and provide the flexibility needed for development and upgrades. During the months of software and hardware development CitiWide Wireless™ created a flexible low cost system that can be scaled to as many radio links as needed for a single regional site.

Phase 2 – Live Deployment:

We will complete a regional link by May / 2005 with a deployment of an 54 Mbps / 11Mbps link in Victoria to a central Access Point supply by "Telus". This site has the ability to supply up to 54Mbps of bandwidth to the Internet to anyone in an 8 miles radius who points a high gain antenna to it.
CitiWide Wireless™ will also secure access or currently negotiating access to a number of cities in Canada with telcos such as Telus, Bell Canada, Allstream (A division of Manitoba Telcom) to provide maximum bandwidth to supply backhaul broadband connection for the Inter City Link. The next steps are to provide backbones to these locations and additional connections to the Internet to increase bandwidth and reliability.

Near Future

Internet bandwidth is or will be provided through at least three transit providers: Allstream Communication (Inter Cities and Regional Network), Bell Canada (Eastern Canada), Telus Canada (Western Canada). We expect the (wireless) connection to UL Peering will eventually be provided through our own CitiWide Wireless™ Internet Exchange (CitiWideIX) via a wireless link.