

**Business White Paper
Broadband Wireless Access**

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The Road to Broadband Wireless – an Industry Overview

The telecom industry has been experiencing constant change in the past 20 years. As market conditions and technology evolve, we are witnessing an unprecedented interest and commitment to the adoption of broadband. In particular, the broadband wireless market is poised for explosive growth in the months to come. The growing momentum in broadband is being driven by a number of factors, ranging from economics and market conditions, to new technology advancements and standards development.

Following is a brief overview of the evolution of the telecommunications/networking market, the current trends in broadband wireless and where this technology is expected to go in the near future.

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Two Decades of Telecom Evolution

Over the past 20 years, the telecom industry has gone through three distinct stages.

Early 1980s to 1996

Until 1996, telecommunications in the local loop was highly regulated. The opening up of the long distance market with the break-up of the Baby Bells in the early 1980s created the first wave of disruptive operators, including MCI and Sprint.

The business model of choice was focused on low risk in both business and technical development in order to deliver a guaranteed rate of return for shareholders. It was not uncommon to see large, wholesale network upgrades from analog to digital in both urban and rural environments. This was also a period where core switching control infrastructures migrated from channel associated signalling to common channel signalling systems.

1996 to mid-2000

From 1996 until mid-2000 the telecom industry experienced an unprecedented spending bubble. In the spending frenzy, carefully managed programs with clearly understood goals and objectives were often ignored. Simply put, the industry was adopting a “land grab” mentality. CLECs, DLECs, BLECs and other such operators, began populating the landscape. Many companies executed ambitious business models characterized by huge business and technical risks that offered uncertain rates of return. At the same time, as the price per bit transported plummeted, many enterprises switched from wholesale conversions to incremental upgrades in core networks.

Mid-2000 to present

Since that time, the industry has retrenched. Having found itself operating in a capital constrained era, the watchwords became cost control and capital constraint. Investors were unwilling to speculate. This has been a period of tremendous upheaval for incumbent network operators. Uncertain revenues and rates of return, combined with slashed capital programs, led many to try to rationalize their existing asset base. This resulted in very small incremental access network upgrades on an “as needed” basis.

At the same time, there has been a significant refocusing of effort on expanding market penetration in several key sectors, especially broadband and wireless. There is overwhelming evidence for example, that wireless ISPs can generate profit on both an accounting basis and a cash flow basis for businesses today. Although the industry is still proceeding with caution, the growth in broadband promises to set the stage for a new communications era.

The Broadband Market

Broadband demand is significant and growing. As such, there is a tremendous worldwide need for cost-effective and easy to deploy broadband wireless systems to help communications service providers address the last mile access challenge. The continuously increasing need for high performance voice, data and video communications coupled with a worldwide trend towards deregulation have fostered the emergence and growing need for new broadband services.

Broadband offers countless benefits, including:

- Faster uploading/downloading of bandwidth-intensive applications including video
- Always-on communication
- Allows for delivery of Voice over IP services over general-purpose Internet backbones – at far less cost than TDM (time division multiplexing) focused networks
- Elimination of per-minute charges associated with traditional fixed and mobility PSTN (public switched telephone network) for VoIP services

With the advent of broadband in Canada and the United States, ISPs can more easily offer enhanced services over their infrastructure at relatively low cost. However, the infrastructure provided must be scalable, as well as be able to support low latency in the tens of milliseconds. It must also support various quality of service levels for each type of enhanced service.

“Always-on” also leads to increased risk. As such, the industry must evolve from providing raw bandwidth to providing application based services and standard user environments with pre-installed security applications on clients that include full security and traffic management.

Where does broadband stand today? At the beginning of 2004 according to the ITU in their report “*Birth of Broadband*” (Source: *Birth of Broadband – ITU 2003*), of the over 580 million Internet users in the world, approximately 63 million are broadband subscribers. This is expected to reach 150 million by the end of 2004. In April 2004, eMarketer estimated that there will be more than 500 million broadband users worldwide by the end of 2007.

The current leaders in broadband penetration are:

- South Korea - 21 subscribers for every 100 inhabitants
- Hong Kong - 15 per 100 subscribers

Of the G7 nations the rankings are:

- Canada - 11 per 100
- Japan - 8 per 100
- United States - 6.5 per 100

In the United States – according to the ITU (International Telecommunications Union) -- the average cost for a broadband connection is \$52.99 or \$3.53 per 100 kbps. When measured against a customer's ability to pay, the average broadband customer in the US spends 1.81% of their monthly income on broadband services. In other words, the average broadband customer spends 0.12% of their income per 100 kbps of raw bandwidth.

However, there is a “digital divide” taking place in North America. According to a 2001 US Census report for example, upwards of 40% of American citizens do not have access to broadband services. For the most part, regional Bell operating companies do not deliver broadband – especially broadband wireless - services.

Broadband coverage is low even in the business sector. Existing broadband access technologies available today have significant deficiencies and cannot cost effectively deliver broadband to a large number of potential users. In the U.S., 95% percent of businesses are underserved by fiber.

The key issues faced by service providers providing broadband services are coverage, reduction in cost/bit per second and ease of installation. An analyst at TD Capital in New York City reports that only 3% of business buildings worldwide have fiber, and only 5% of U.S. buildings are reached by fiber. In addition, less than 10% of Class A buildings in New York City are served by fibre.

Yet broadband has compelling appeal. Installation issues aside, according to the ITU, broadband services - when measured on a per bit basis - can be up to 111 times less expensive than traditional leased line services for business users. This cost savings is motivating governments at the local, state and national level to consider broadband services beyond traditional voice and data services to include e-learning, e-government, surveillance and other bandwidth-intensive applications.

The Emergence of Broadband Wireless

The broadband “bottleneck” is rapidly changing. Today broadband wireless providers are emerging on the world scene that can deliver the performance, without the inherent deployment costs and complexities associated with traditional broadband services. Potential applications span everything from commercial and industrial to military and healthcare.

In the United States, the rural market is ripe for broadband, since it allows for greater throughput than that offered by DSL or Cable. Broadband wireless is the technology that is expected to flourish in third world countries where one billion people have never made a telephone call. There also exists a significant opportunity for broadband wireless equipment to address the data and TDM circuit backhaul requirements of mobile and fixed wireless networks.

Breakthroughs in Broadband Wireless

While technological issues have held broadband wireless back in the past, there have been some significant industry breakthroughs in recent months that are bringing it to the mainstream market. Wireless technologies today – in particular, 802.16-based Broadband Wireless products - offer a number of opportunities over competing technologies. They can extend current systems and creating robust, scalable, versatile and cost effective deployments in markets that are not currently well served.

Technology limitations of the past have now been overcome. Issues relating to line-of-sight constraints and interoperability for example, are now being addressed through OFDM (orthogonal frequency division multiplex) and the development of the 802.16 standard.

OFDM, although a relatively mature technology, has not been feasible for general use over the past 30 years. The major culprit was the cost of processing to execute the channel equalization and digital filters required to deliver analog signals in harsh multipath environments. Those costs have dropped and affordable OFDM equipment is now available that can operate reliably in non-line-of-sight (NLOS) and optical-line-of-sight (OLOS) environments.

The IEEE 802.16 Working Group and WiMAX (Worldwide Interoperability for Microwave Access) Forum, along with industry partners such as Redline Communications, have been working on creating standards for broadband wireless. The goal is to develop standards for broadband wireless access to ensure high speed/capacity, low cost, and scalability/interoperability of equipment. The recently approved 802.16-2004 standard now provides the basis for emerging WiMAX products – a move that will ensure interoperability today and in the future.

A New Era

With the demand for broadband growing exponentially, and the recent advancements in wireless technology and standards, the industry is entering a new stage of development. Over the next few years, we can expect to see a major breakthrough in delivering broadband services around the world.

As deployments grow, so will the scope of the applications. Since broadband allows for dramatically shorter download times for extremely large files, broadband is enabling a whole new class of content distribution, including two-way video feeds for mobile news delivery and security surveillance, sharing of medical images over distances, collaborative learning and, in time, digital set top boxes for distribution of video on demand.

Broadband wireless specifically will play a major role in bringing high-performance communications capabilities in areas where broadband was previously cost-prohibitive or difficult to deploy. The lower cost of deployment, increased mobility, portability, range and performance promise to make broadband wireless a significant part of the broadband landscape.

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Mr. Sutor is Vice President, Business Development at Redline Communications. He brings to Redline extensive market and technology knowledge of North American service providers and equipment manufacturers. Before joining Redline, Mr. Sutor held various senior level positions in several organizations, most recently with CopperCom's Business Development Group. Earlier, he built a solid track record at the executive level in a variety of roles with organizations such as CTI Datacom, Tekelec, DCI Digital Communication Inc. and Wandel & Goltermann. Mr. Sutor has written numerous contributed articles in a variety of industry publications and is a regular speaker on topics such as WiMAX, ATM, Gigabit Ethernet, Virtual Private Networks and Voice Services.

Attributing company: Redline Communications Inc.

Redline Communications is a technology leader in the development of standards-based broadband wireless access solutions. Its groundbreaking and award winning products feature longer range, more robust performance, and higher capacity than competing products. Redline is a principal member of the WiMAX Forum™, and was first in the world to market an 802.16 compliant product.

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