EION WIRELESS

White Paper

WiMAX Benefits Applications & Solutions

Introduction

This paper provides guidelines for network providers on how best to take advantage of the IEEE 802.16 standard for wireless broadband equipment, which will be certified by the WiMAX Forum, to grow their business while managing risks. We begin by identifying the key challenges currently facing service providers, and providing a brief introduction to WiMAX technology. We go on to describe some of the ways in which WiMAX can help service providers meet those challenges and the main risks involved in making the move to WiMAX. We then provide detailed recommendations on how and when service providers should transition to WiMAX so as to further their business goals while minimizing the risks.

What Network Service Providers Need Most

Network service providers currently face a situation in which revenues from traditional sources are either declining or stagnating. The market for services delivered via wired infrastructure is saturated, and opportunities for growth in that market are extremely limited. By contrast, demand for services beyond the reach of wired infrastructures is potentially huge, but the wireless technology required to support the delivery of broadband to those market sectors has until now been largely proprietary and marked by either poor performance (at the low end) or prohibitive cost (at the high end).

Key Challenges:

- Reverse declining or stagnating revenue flows from traditional sources

- Need to take advantage of emerging technologies like WiMAX

- Need a strategy for adopting WiMAX technology that minimizes risks while taking full advantage of the opportunities WiMAX can bring to the bottom line

- Need to move more quickly than competitors to maximize share of new markets

Network service providers need a cost-effective solution that would allow them to satisfy the demand for broadband-based services beyond the reach of wired infrastructures. They need a solution with a rapid ROI and the promise of steadily increasing revenues. They need to move more quickly than their competitors in order to achieve a dominant position in these new markets. In addition, they need to minimize the risks associated with timely deployment of new wireless technologies.

WiMAX Benefits for Service Providers

Enter IEEE 802.16, or "WiMAX"—the emerging wireless standard that promises to substantially reduce the costs required to further expand the reach of broadband delivery systems while delivering performance that exceeds that of most wired technologies. WiMAX technology offers several key benefits to network service providers. It will:

- Allow service providers to profitably deliver high-throughput, broadband-based services like VoIP, high-speed Internet access and video to business and residential users who previously could not be economically served

- Facilitate equipment compatibility, allowing all of the components of WiMAX-based broadband systems to form a cohesive network, further reducing deployment and maintenance costs

- Facilitate equipment interoperability, allowing service providers to avoid having to commit to single vendors, diversifying vendor-dependent deployment risks

- Reduce the initial and incremental capital expenditures required for network expansion

- Provide vastly improved performance and extended range compared to existing wireless technologies

- Overcome many technical limitations of current wireless technology—for example, it will support service to customers that could not be economically served by legacy "line of sight" wireless technologies

- Allow service providers to achieve rapid ROI and maximize revenues

The potential for providers to achieve a faster ROI by deploying emerging wireless technologies than they could by deploying wired networks has been widely recognized. For example, a recent Gartner Research study describes the business advantage of emerging wireless succinctly:

"Looking at the basic pricing mode, a leased T1 line can cost $7,200 per year ($600 per month). Basic wireless point-to-point metropolitan-area network equipment ranges from $1,000 to $10,000 per unit (not including towers, additional routers, shelters, cables or installation, which can add less than $5,000 to the project), depending on speed needed. An enterprise can get a return on investment in less than a year on many systems, and in less than 18 months for most systems."

Source: P. Redman, Research Note, Gartner Research Inc., July 2003

WiMAX Technology

The following section is excerpted from *Can WiMAX Address Your Applications?*, published by the WiMAX Forum

The WiMAX standard has been developed with many objectives in mind. These are summarized below:

Flexible Architecture: WiMAX supports several system architectures, including Point-to-Point, Point-to-Multipoint, and ubiquitous coverage. The WiMAX MAC (Media Access Control) supports Point-to-Multipoint and ubiquitous service by scheduling a time slot for each Subscriber Station (SS). If there is only one SS in the network, the WiMAX Base Station (BS) will communicate with the SS on a Point-to-Point basis. A BS in a Point-to-Point configuration may use a narrower beam antenna to cover longer distances.

High Security: WiMAX supports AES (Advanced Encryption Standard) and 3DES (Triple DES, where DES is the Data Encryption Standard). By encrypting the links between the BS and the SS, WiMAX provides subscribers with privacy (against eavesdropping) and security across the broadband wireless interface. Security also provides operators with strong protection against theft of service. WiMAX also has built-in VLAN support, which provides protection for data that is being transmitted by different users on the same BS.

WiMAX QoS: WiMAX can be dynamically optimized for the mix of traffic that is being carried. Four types of service are supported:

- **Unsolicited Grant Service (UGS)** UGS is designed to support real-time data streams consisting of fixed-size data packets issued at periodic intervals, such as T1/E1 and Voice over IP.

- **Real-Time Polling Service (rtPS)** rtPS is designed to support real-time data streams consisting of variable-sized data packets that are issued at periodic intervals, such as MPEG video.

- **Non-Real-Time Polling Service (nrtPS)** nrtPS is designed to support delay-tolerant data streams consisting of variable-sized data packets for which a minimum data rate is required, such as FTP.

- **Best Effort (BE)** BE service is designed to support data streams for which no minimum service level is required and which can be handled on a space-available basis.

Quick Deployment: Compared with the deployment of wired solutions, WiMAX requires little or no external plant construction. For example, excavation to support the trenching of cables is not required. Operators that have obtained licenses to use one of the licensed bands, or that plan to use one of the unlicensed bands, do not need to submit further applications to the Government. Once the antenna and equipment are installed and powered, WiMAX is ready for service. In most cases, deployment of WiMAX can be completed in a matter of hours, compared with months for other solutions.

Multi-Level Service: The manner in which QoS is delivered is generally based on the Service Level Agreement (SLA) between the service provider and the end-user. Further, one service provider can offer different SLAs to different subscribers, or even to different users on the same SS.

Interoperability: WiMAX is based on international, vendor-neutral standards, which make it easier for end-users to transport and use their SS at different locations, or with different service providers. Interoperability protects the early investment of an operator since it can select equipment from different equipment vendors, and it will continue to drive the costs of equipment down as a result of mass adoption.

Portability: As with current cellular systems, once the WiMAX SS is powered up, it identifies itself, determines the characteristics of the link with the BS, as long as the SS is registered in the system database, and then negotiates its transmission characteristics accordingly.

Mobility: The IEEE 802.16e amendment has added key features in support of mobility. Improvements have been made to the OFDM and OFDMA physical layers to support devices and services in a mobile environment. These improvements, which include Scaleable OFDMA, MIMO, and support for idle/sleep mode and hand-off, will allow full mobility at speeds up to 160 km/hr. The WiMAX Forum-supported standard has inherited OFDM's superior NLOS (Non-Line Of Sight) performance and multipath-resistant

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operation, making it highly suitable for the mobile environment.

Cost-effective: WiMAX is based on an open, international standard. Mass adoption of the standard, and the use of low-cost, mass-produced chipsets, will drive costs down dramatically, and the resultant competitive pricing will provide considerable cost savings for service providers and end-users.

Wider Coverage: WiMAX dynamically supports multiple modulation levels, including BPSK, QPSK, 16-QAM, and 64-QAM. When equipped with a high-power amplifier and operating with a low-level modulation (BPSK or QPSK, for example), WiMAX systems are able to cover a large geographic area when the path between the BS and the SS is unobstructed.

Non-Line-of-Sight Operation: NLOS usually refers to a radio path with its first Fresnel zone completely blocked. WiMAX is based on OFDM technology, which has the inherent capability of handling NLOS environments. This capability helps WiMAX products deliver broad bandwidth in a NLOS environment, which other wireless product cannot do.

High Capacity: Using higher modulation (64-QAM) and channel bandwidth (currently 7 MHz, with planned evolution towards the full bandwidth specified in the associated IEEE and ETSI standards), WiMAX systems can provide significant bandwidth to end-users.

Introducing Libra MAX™

Network service providers have been waiting for a solution that can quickly help them achieve the business benefits of WiMAX. They know they have to move quickly. Now there is a solution that removes this risk and offers all of the benefits of WiMAX—Libra MAX™ from EION. With Libra MAX, service providers can act now to begin realizing the benefits WiMAX technology.

Libra MAX Allows Service Providers to Offer WiMAX-based Services

With Libra MAX, service providers can realize the technical, marketing and financial benefits of deploying a WiMAX-ready system now. They can:

- Gain immediate experience with the technology, and tackle any technical hurdles much sooner than they would with a delayed deployment

- Gain immediate experience with the "last mile" market—allowing them to quickly enter and establish a leading position

- Achieve rapid ROI and revenue growth

WiMAX Opportunities

Libra MAX can be used to replace wired E1/T1 networks, provide connectivity to Multiple Dwelling Units or Multiple Tenant Units, power urban hotzones and provide backhaul for cellular networks. It supports wireless delivery of advanced broadband-based value-added services like high-speed Internet, VoIP, and video applications. Libra MAX allows service providers to profitably deliver these services to more subscribers by incrementally expanding their network coverage without having to invest in expensive new infrastructure.

Hotzones

A hotzone covers a large area of outdoor city geography, providing Internet access to users located anywhere in the vicinity—whether sitting on a park bench, on a job site, in a café, or in the lobby of an office tower. The result is increased productivity for the typical casual or business user seeking high-speed Internet access from a laptop or personal digital assistant (PDA). Because of the proliferation of WiFi devices, hotzones offer you the opportunity to increase customer spending on existing products and services, and to generate new sources of revenue.

Hotzones bring with them a set of challenges—subscriber acquisition, billing, security, device safety, and installation obstacles—that small business and home WiFi deployments don't face. Your customers not only expect reliable, high-speed internet service, but they expect service that meets their unique needs.

EION's hotzone solution has what it takes to meet these challenges—raising the bar for reliability, speed, and coverage. Using the global wireless standard IEEE 802.11b, or WiFi, along with Turbo W-OFDM backhaul products, EION-based hotzones enable your customers to simultaneously connect to the Internet or their corporate data networks at speeds of up to 11 Megabits per second (Mbps) in virtually any public place, without the constraints of wires or cables. EION's field-proven fixed wireless products provide a cost-effective backhaul by eliminating the need for expensive fiber. EION's experience in providing industrial-strength wireless solutions combined with a rich feature-set, make it the natural choice for your hotzone implementation.

Wireless MDUs/MTUs

The provision of wireless broadband services to Multiple Dwelling Units or Multiple Tenant Units represents another significant opportunity for service providers. Until now, the business model has not been compelling enough to make these projects highly profitable. The case for selling services into the MDU/MTU market is now strong: with Libra MAX, service providers can sell more services to more people, using

fewer base stations and subscriber stations than required by competitive offerings.

Cellular Backhaul

The market for cellular services is becoming more and more competitive. To stay in the business, cellular operators are constantly looking for ways to reduce operating costs. Backhaul costs for cellular operators represent a significant portion of their recurring costs. WiMAX can provide Point-to-Point links of up to 30 miles (50 km), with data rates capable of supporting multiple E1/T1s Cellular operators can therefore use WiMAX equipment to backhaul Base Station traffic to their Network Operation and Switching Centers.
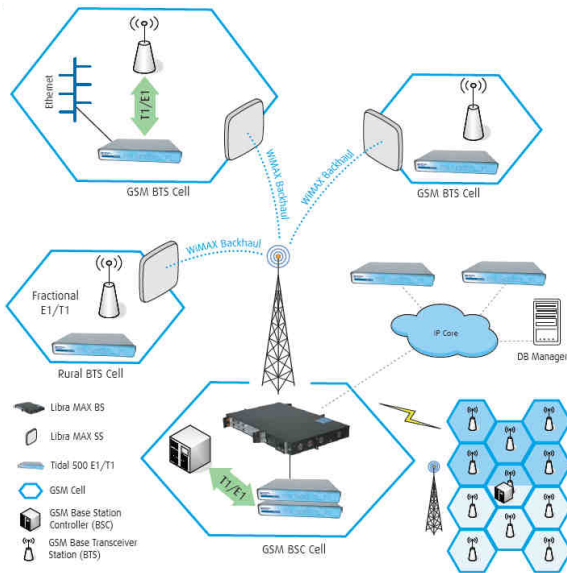

Figure 1 EION Libra MAX GSM Backhaul Solution

The capacity and coverage of Libra MAX also make it the ideal backhaul product for cellular service providers who need to meet the demands of today's voice networks and an easy and less expensive alternative to E1/T1 lines, which translates to cost savings for enterprise customers.

Cellular traffic is a mix of voice and data, for which the built-in QoS feature of WiMAX is highly suited. Leasing backhaul facilities from local telephone companies can be cost prohibitive, and deploying a fiber solution, which is both costly and time consuming, could negatively impact rollout of service. Wired solutions for providing cellular backhaul are seldom cost-effective in rural or suburban areas, and most versions of DSL and cable technology cannot offer the required bandwidth, especially for backhauling upcoming 3G networks.

Banking Networks

Large banks can connect branches and ATM sites to their regional office through a private WiMAX network carrying voice, data and video traffic. These banks are normally spread over a large area and need high security and bandwidth to handle the traffic.

WiMAX data encryption offers excellent link security, however, banks will most likely also need end-to-end security, such as that provided by SSL, to protect against undesired interception and manipulation of sensitive banking traffic. The broad coverage and high capacity allows the bank's regional office to be connected to a large number of diversely located brand offices and ATM sites. WiMAX networks also offer a high degree of scalability, so that low-data-rate traffic between the regional office and ATM machines can co-exist with the high levels of traffic needed to support branch-to-regional office communications. This is made possible by the WiMAX QoS, which is used to prioritize voice (telephony among branches), data (financial transactions, email, Internet, and intranet) and video (surveillance, CCTV) traffic.

It is desirable for banks to own their own networks, for a number of reasons. Besides eliminating the repeat costs charged by telephone companies, this will provide banks the ability to quickly redeploy their network if an ATM or branch is temporarily or permanently relocated. In addition to their inability to be quickly deployed, most versions of DSL and cable technology will not provide the bandwidth required to support and sustain branch-to-regional office communications.

Education Networks

School boards can use WiMAX networks to connect schools and school board offices within a district, as shown below. Some of the key requirements for a school system are NLOS, high bandwidth (>15 Mbps), Point-to-Point and Point-to-Multipoint capability, and a large coverage footprint.
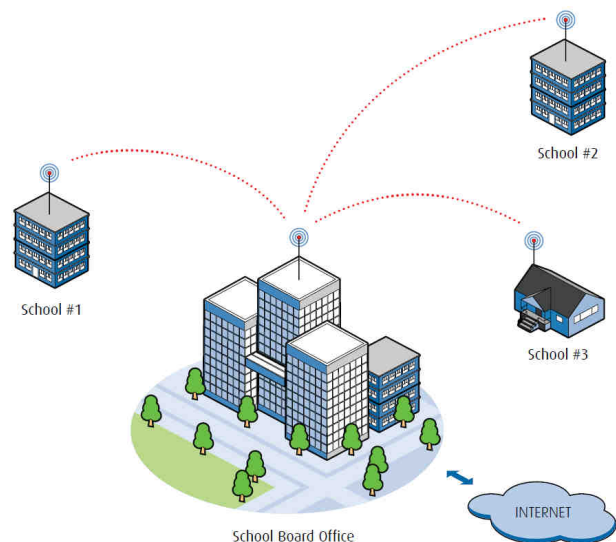

Figure 2 EION WiMAX Solution for Educational Institutions

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WiMAX-based education networks, using QoS, can deliver the full range of communication requirements, including telephony voice, operating data (such as student records), email, Internet and intranet access (data), and distance education (video) between the school board office and all of the schools in the school district, and between the schools themselves.

The WiMAX solution provides broad coverage, making it very cost-effective, particularly for rural schools, which may have little or no communications infrastructure, and which are widely dispersed. When school boards own and operate their own network, they can be responsive to changes in the location and layout of their facilities. This will significantly reduce the annual operating cost of leased lines. Wired solutions cannot offer a quickly deployable, low-cost solution, and most versions of DSL and cable technology do not have the throughput required by these education networks.

Oil and Gas Industry

In today's competitive and highly volatile energy markets, it is imperative that oil and gas companies optimize their exploration and production activities. Fast decisions, facilitated by instant data and voice communications, are keys to sustained revenue generation and cost reduction.
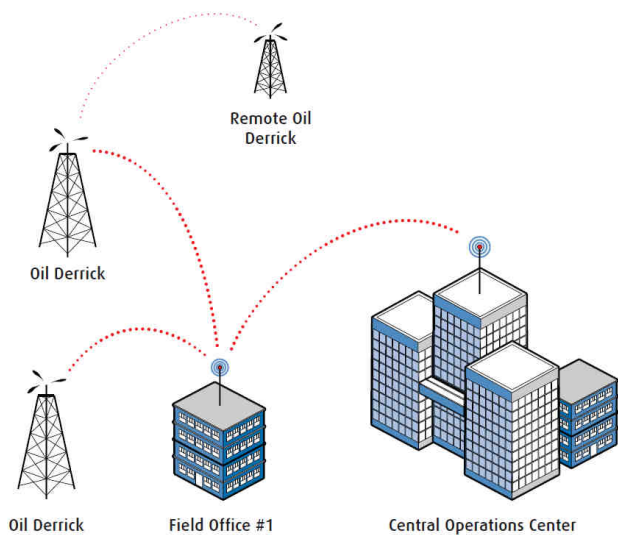

Figure 3 EION's e-Field Solutions at Work

Much of today's oil and natural gas production occurs in largely remote areas of the world beyond the economic range of traditional wired communications. Oil and gas companies must regularly collect critical data from remote well sites, offshore drilling platforms, and outlying production locations, and from SCADA systems set up to monitor facilities, such as storage tanks, pumping stations, or pipelines. Company personnel require high-speed voice and fax services, email and web browsing (e.g. training).

Establishing the required broadband network links between multiple locations can be extremely difficult and cost-prohibitive, given that these activities generally occur where wireline links are not practical.

The answer to these business problems is EION's WiMAX broadband access infrastructure. Providing flexible and reliable wireless connectivity not only ensures reliable data, voice, and video, but delivers a return on investment in short order – measurable by reduced costs and increased revenue, as well as peace of mind.

Public Safety & Video Surveillance

Government public safety agencies, such as police, fire, and search and rescue, can use WiMAX networks to support response to medical and other emergency situations.
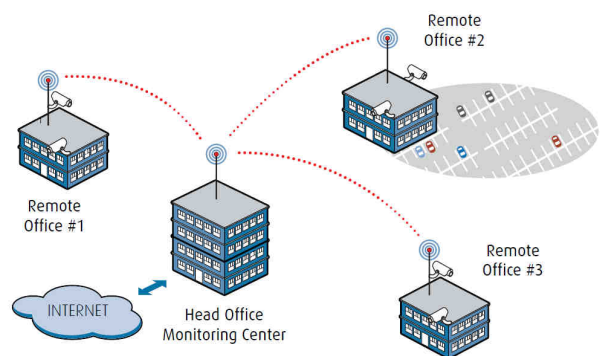

Figure 4 Video Surveillance Solutions using WiMAX

In addition to providing two-way voice communications between the dispatch center and on-site emergency response teams, the network relays video images and data from the site of the accident or disaster to the control center. This data can be relayed to expert teams of medical or emergency staff, who can analyze the situation in real-time, as if they were on site. WiMAX QoS allows the network to handle these diverse types of traffic.

WiMAX solutions are highly deployable, so the initial response team can set up a temporary wireless network at the site of the accident, event, or natural disaster, in a matter of minutes. They can also relay traffic from this network back to a control or dispatch center, over an existing WiMAX network. Wired solutions are not appropriate situations like these, due to unpredictability and instability of accidents and disasters.

As well, there may be a requirement for mobility, such as, for example, a policeman having to access a database from a moving vehicle, or a fireman having to download information about the best route to a fire scene or the architecture of the building on fire. A video camera in the

ambulance can offer advance information about the condition of a patient, before the ambulance reaches the hospital. In all of these cases, WiMAX provides support for mobility and high bandwidth, which narrowband systems cannot deliver.

Wireless Internet Service Providers

Wireless Internet Service Providers (WISPs) use WiMAX networks to provide connectivity to both residential (voice, data and video) and business (primarily voice and Internet) customers.
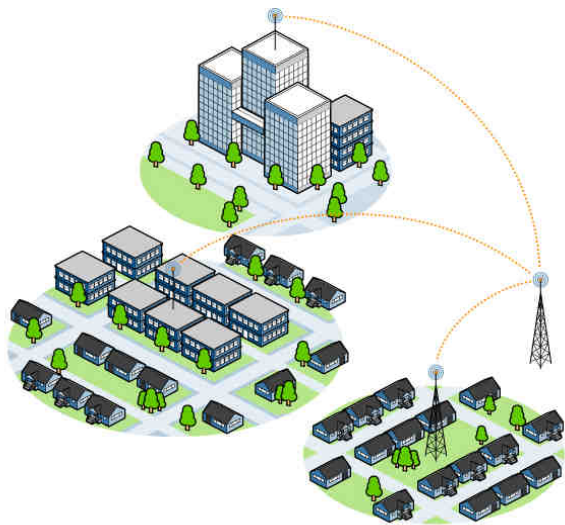

Figure 5 Libra MAX Solution for Service Providers

The WISP could be a CLEC (Competitive Local Exchange Carriers) that is starting its business with little or no installed infrastructure. Since WiMAX is easy to deploy, the CLEC can quickly install its network and be in position to compete with the ILEC (Incumbent Local Exchange Carrier).

The WiMAX built-in QoS mechanism is highly suited for the mix of traffic carried by the CLEC. The QoS MAC also offers multi-level service to address the variety of customer service needs. A common network platform, offering voice, data and video, is highly attractive to end customers, because it presents a one-stop shop and a single monthly bill. Support for multiple service types allows for different revenue streams, yet it reduces customer acquisition cost, and increases ARPU (Average Revenue Per User). The WSP needs only one billing system and one customer database.

Cellular operators may also be interested in applying WiMAX in their networks. These operators already have towers, billing infrastructure and a customer base in place,

but the deployment of a WiMAX solution will expand their market presence in their service area.

All of the wired solutions, including fiber, DSL, and cable, require substantial up-front costs for implementing the wired infrastructure. In particular, wired solutions are not suited for markets in developing countries, where there is very little infrastructure, or in the less-populated areas of developed countries, such as rural areas, small towns or the suburban edges of major centers.

Rural Connectivity

Service providers use WiMAX networks to deliver service to underserved markets in rural areas and the suburban outskirts of cities.

The delivery of rural connectivity is critical in many developing countries and underserved areas of developed countries, where little or no infrastructure is available.

Rural connectivity delivers much-needed voice telephony and Internet service. Since the WiMAX solution provides extended coverage, it is a much more cost-effective solution than wired technology in areas with lower population densities. WiMAX solutions can be deployed quickly, providing communication links to these underserved areas, providing a more secure environment, and helping to improve their local economies.

VoIP over WiMAX

Voice-over-IP (VoIP) is a revolutionary technology that is reinventing voice communications. Forrester Research predicts that nearly 5 million U.S. households will have VoIP phone services by the end of 2006. Using the Internet's packet-switching capabilities to provide phone service, VoIP promises to change the business model for telephony, and in doing so, create new business opportunities for those service providers for whom this market was closed.
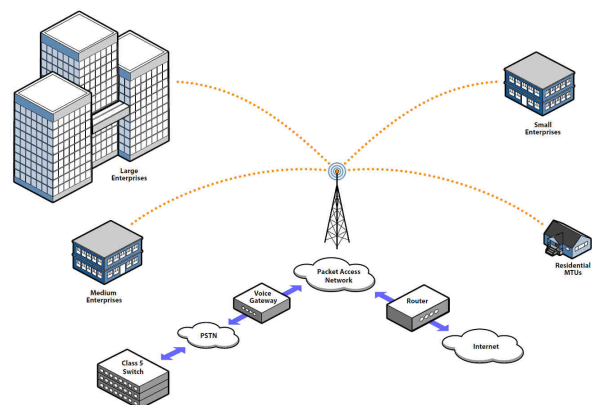

Figure 6 WiMAX VoIP Implementation

EION's WiMAX VoIP solutions allow the transmission of voice communications over EION broadband wireless access systems with carrier-class Quality of Service (QoS). With Libra MAX, EION offers an extremely economical alternative to traditional wired service for voice traffic. It's also an excellent solution to allow competitive local exchange carriers to avoid leased line charges to incumbent carriers.

Conclusions

WiMAX is presenting both great opportunities and risks for network service providers. Network service providers need a way to leverage the opportunities that WiMAX makes achievable as quickly as possible in order to penetrate and dominate the new markets in areas beyond the range of existing wireless networks. They need to gain experience with the new technologies, and the markets themselves, to stake out this new territory and get an edge on the competition. And they must do so while managing the risks involved in committing resources to new technology.

Libra MAX provides the leverage service providers can use to seize the WiMAX opportunity now to achieve rapid ROI and revenue growth. With Libra MAX there is no risk of being left with network components that turn out to be incompatible with WiMAX-certified equipment. Libra MAX delivers all of the performance of WiMAX with guaranteed migration to a certified WiMAX system for minimal cost and with no disruption in service. With Libra MAX, service provides can begin building a WiMAX-ready wireless network now, and be the first to deliver the high bandwidth-dependent services their customers will expect in the WiMAX world.