A Review of Wireless Business and Technology

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The rapid deterioration of financial markets and economic conditions of the past few months dramatically changed the outlook for all business, not just the wireless industry. Our plans for this year-end update changed accordingly. Rather than being a review of the past year, this report will be a more general review of active business sectors, along with notes on the prospects of several technologies that are in early deployment, in the final stages of development before deployment, or otherwise represent possibilities for near-term growth.

Readers should assume that any statements about market growth refer to *potential* growth, given the uncertainty of both investment capital and marketplace demand. We will not guess about the timing of new business ventures using these technologies. After all, few expert economists are willing to predict the timing of an economic recovery, much less the speed at which a recovery will proceed.

With these caveats in mind, we proceed.

WiMAX Begins "Real" Deployment

2008 had numerous news releases announcing either initial deployment or an agreement with a vendor to provide equipment for an approaching deployment. The first U.S. WiMAX system went on line in mid-summer, with similar timing for various systems elsewhere in the world.

It remains unclear whether WiMAX is the best choice for a "mobile phone" type of wireless provider such as Sprint, which is in the early stages of WiMAX deployment. Several international announcements emphasize the value of WiMAX as a wireless Internet access service, or as a business service instead of a consumer service. We assume that the marketplace will make a logical decision, and are certain that each WiMAX service provider is closely watch all other providers to see what type of usage gains the biggest customer base.

What is not in debate is the capability of WiMAX to deliver a high data rate service, filling demand for greater bandwidth, faster downloads, and support of applications such as video with acceptable quality (full-speed, high resolution).

WiMAX is driving many technology developments, as evidenced by the first technical article in this issue. Power amplifiers are a point of high interest since they draw the most power, and improvements in efficiency translate into lower costs—power consumption, equipment size and weight, cooling requirements, and reliability. Achieving high efficiency within WiMAX's requirement for high linearity is a challenge being pursued by many creative engineers.

At the other extreme, WiMAX may also be a strong market for picocells, which are the cornerstone of network models that combine elements of the cellular concept and Wi-Fi ad hoc or re-configurable networking. This is an area we will be watching as companies deploy their systems and consumers begin to use them.

Although WiMAX has undergone extensive trials, there are a few critics who believe that the 5-6 GHz frequencies for WiMAX will have more difficult propagation than has been expected, particularly for mobile users. The OFDM technique has been proven, but large-scale deployment may uncover a few unforeseen idiosyncrasies.

LTE: The Other High-Speed Mobile Access System

3GPP LTE (Long Term Evolution) is a follow on to the GSM "3G" high speed UMTS system. Like WiMAX, LTE uses OFDM, but operates in the 2.6 GHz band (or other worldwide allocations that essentially extend the present mobile wireless bands). At least one major U.S. carrier (Verizon) has adopted LTE, and AT&T is expected to do the same. Wireless providers have established protocols that are "downward-compatible" in that they will continue service at a lower data rate in areas outside of LTE. This allows a pace of deployment that can follow demand rather than require anticipation of demand.

In the area of technology, the topic of greatest interest related to LTE is multiple antenna technologies—ranging from classic diversity reception to

MIMO (multiple input multiple output). These technologies improve reliability and increase the net data rate by either reducing the number of repeated packets (the simplest result), or by increasing the effective data rate in the channel (the contribution of MIMO technology).

Consumer Low Power Wireless

Several wireless technologies targeted to consumer applications have been developed, but not yet turned into products.

For example, 60 GHz home networks have been the subject of many research papers, as well as speculation in the consumer press. The target application is a home network that can support high definition television (HTDV), distributing cable, satellite or recorded programming throughout the user's residence. Demonstration systems have been shown, and major consumer electronics firms formed the wirelessHD consortium to coordinate standards and public relations. Although products were anticipated as early as 2007, the first announcement of product availability is expected at the January 2009 Consumer Electronics Show.

Among existing technologies, it has been interesting to watch the growth of Bluetooth for short-range, modest data rate transmission. Although not a new technology, the number of new applications, such as wireless MP3 headsets or links between a computer and digital cameras, wireless handsets and PDAs.

Another existing technology with a strong suite of applications is the 315/433/900 MHz family of simple OOK modulated RF links. Again, the growing number of applications makes this an interesting area to watch. Products include keyless entry, home security, surveillance video and tire pressure monitors, as well as classic garage door openers, wireless doorbells and remote-reading weather sensors. Undoubtedly, more applications will be developed as more everyday function are converted from wired operation to wireless.

A consumer application that appears to be abandoned during 2008 is the ultra-wideband (UWB) wireless USB computer connection. Slow early consumer interest and technical performance issues seem to be the combined reason for companies like Intel to shelve this product line.

Industrial Systems

Although RFID is an established technology, there are many advancements in development. This industry segment is seeking simpler, cheaper RFID tags, plus readers that have improved discrimination of tags. Two specific application goals are quickly reading a pallet of items at a receiving dock, and reading an entire shopping cart at a grocery checkout. More ambitious applications include RFID-tagged legal documents, both on paper and in plastic, such as a driver's license. RFID tags on license plates, for fast reading by law enforcement, is in limited use now and expected to grow in the future.

IEEE 802.15 systems (including ZigBee) have gained a high level of interest now that a wide range of products is available. The top application is still building controls, mainly environmental systems, but with some security applications as well. A major area of development is autonomous sensors that never need an external connection or even a battery, since they harvest operating power from light or vibration.

Automotive Systems

Much-touted before the economic crisis that has hit the automakers hard, wireless systems will certainly be a part of future vehicle systems. One of the advantages of wireless systems is the elimination of hard wired connections. This saves weight—a necessary part of obtaining high gas mileage—and saves labor, which helps keep costs down.

Future electric, alternative fuel, or hybrid automobiles will require complex sensor and control systems to achieve the desired performance. A wireless network may be the best choice for those sensor and control systems.

Entertainment, navigation and operating conveniences are expected to continue their growth. Wireless interconnection with personal devices (phones, PDAs, MP3 players) will continue to be an important feature that supports the mobile "connected" habits of many consumers.

Near-Future Outlook

We see no glaring problems within the wireless industry that will prevent this business segment from recovering as fast as any when financial markets are finally stabilized and consumer confidence returns. You may recall that the downturn of 2001-2002 included problems at several major companies within this industry segment, which resulted in the wireless industry suffering more than many others at that time.

Another positive factor is the appreciation of wireless technology by consumers and commercial users alike. Over the past 10 years or so, it has been proven that wireless interconnection is sufficiently capable and reliable to support an exceptionally wide range of applications. When you add a similar appreciation of the technology by the military, the scientific research community, and other important groups, it seems clear that this industry segment may be a major contributor during the earliest portion of an economic recovery.

Perhaps at the end of 2009 we will be able to deliver a report in less troubling times!