productGENESIS

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Disruptive Wireless?

Part I

Dan Mooers, Vice President, Product Genesis, February 2005

Whether you call it wireless, ubiquitous, invisible, untethered, or pervasive computing, the market for networked devices is enormous and the biggest opportunities won't be in computers.

The idea of smart, connected inanimate objects networked and their ability to provide huge quantities of information is going to substantially change the world we live in, the businesses we run, and the professions in which we practice. Technology, unlike anything else, permanently changes the human experience. The innovations employing wireless technology could have as much impact on our lives as the internal combustion engine did in altering our world.

All major innovation represents disruptive technology. The challenge is to be on the right side of the disruption. Technology expands exponentially and this translates to time compression for the Product Development Professional and everyone involved in the business decision-making process. Today's executive is faced with an experience similar to piloting a commercial jetliner at 500 feet—high speed, tremendous responsibility and no margin for error. Fortunately there are some excellent instruments available.

This report will broadly define some of the wireless markets and applications with a view toward the strategic processes required to meet the outlined challenges. It is not a comprehensive review of the technologies. The tools covered in the conclusion of the report will have utility across markets and applications in emerging technologies.

Introduction

This report differs from previous papers. It will be presented in segments and will be interactive. We will ask you, our client base, to identify the challenges posed by the subject (applications, markets, business disciplines etc.) as you see them. Our intention is to focus on those areas and topics that will make the report most meaningful to you and to gain insight as a group. It is like capturing the voice of the lead customer before developing a solution. The information you provide should be generic, broadly applicable, and will be confidential.

The term wireless covers a broad range of markets, applications, and products. Most non-technical people think of wireless as telephones or computers not requiring hook-up to landlines and cables. Shortly everyone will have their lives enriched or at least changed by the reality of previously "dumb" objects that will be transmitting information to one another or to receiver/collector/interpreters. They will, in turn, utilize the data in a variety of ways in their home, at work, at the super market, in their automobiles, or at a visit to the hospital. New applications will emerge where the "dumb" objects are communicating with each other in value-adding ways that are hard to imagine.

The soldier in the field will relay copious amounts of information on his or her personal condition and environment. The safety razor or bottle of perfume will be tracked from the point of manufacture to the point of sale by pallet, carton, or individual package. This will create enormous amounts of marketing, logistic, security, and asset management data. The physician will be able to make faster life saving diagnoses by devices in the hospital environment, including the patient's bed. Marketing managers will better understand the choices their customers make enabling them to provide better products. Many workspaces will be truly virtualized and executive management will be able to receive critical information simultaneously with the rest of the organization.

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The Wireless Landscape

Wireless data is transferred over three broad categories of networks: WANs (Wide Area Networks), LANs (Local Area Networks) and PANs (Personal Area Networks). These networks are similar to their wired counterparts but use radio waves (or other parts of the electromagnetic spectrum) instead of fiber or metal wires. The usual operating distance between the sender and the receiver of the radio signal has created these categories but the technologies can overlap. We have decided to focus more on the LANs and PANs because they represented greater opportunities for our client base.

Wireless WANs can cover areas as large as a continent (mobile phones). The first generation WAN was analog voice, which was used in early cell phones. The second generation was digital, which was more efficient and could handle data up to 14.4Kbps. US carriers are now at the 2.5-generation or 2.5G transmission rates, which can carry up to 114Kbps. The next generation, 3G, promises theoretical transmission rates of 5Mbps. These networks have recently been rolled out in Asia.

Wireless LANs can cover about a mile indoors and up to 4 miles outdoors but they are best within a 500ft or less range. While they cover a smaller area, LANs can transfer data much faster, with speeds of 50+Mbps. Most LANs use some standard of the IEEE 802.11 or 802.15 families, which address security and clarity. Here is a brief overview of some LANs as well as other networking technologies.

802.11a is a LAN standard that operates in the 5GHz spectrum and allows speeds of up to 54Mbps from up to eight different access points. You need all of them to operate and hence portability is sacrificed, but you have lots of bandwidth.

802.11b or WiFi protocol dominated the market first and uses the 2.4GHz spectrum and allows speeds of 11Mbps for each device. It is a pretty busy space with cordless phones, microwave ovens, baby monitors etc, but it is not yet over crowded. WiFi still operates well for many applications.

802.11g is known as the next generation of 802.11b, which also operates at 2.4GHz but with the speed of an 802.11a and 802.11.b, and is compatible with existing 802.11b infrastructures.

Wireless Telemetry WMTS currently no industry standard exists but it is widely used in hospital devices, principally ambulatory patient monitoring. FCC regulations prohibit the use of WMTS outside of a hospital setting.

Wireless PANs are personal area networks, as the name implies, which usually operate in a rather close environment to the single user and employ multiple devices or require devices in close proximity.

802.15.1 Bluetooth radio technology operates in the 2.4GHz band and provides a total bandwidth of 1Mbs. It can support up to 8 devices on a piconet. Designed for moderate speeds it uses very little energy, is compatible with the above protocols and is used with them in a number of interesting applications including medical devices.

802.15.4 ZigBee is primarily used to enable communication with wireless sensors and networks of sensors. There are three frequency bands used: 868MHz for one channel; 915MHz for ten channels; and 2.4GHz for 16 channels. ZigBee also allows for star and mesh topologies with minimal complexity. These capabilities could have a number of interesting applications.

Ultra Wide Band UWB there is no IEEE standard but it is generating a lot of buzz and it is being tested in a number of hospital settings as well as in home entertainment devices.

IrDA (Infrared Device Association) refers to optical transmitters and receivers of data originally used for television remotes. It is widely used in laptops and palm sized organizers. IrDA requires line of sight operability but does

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provide a secure link. There have been some interoperability issues but there are some very interesting applications in development.

Other Wireless Technologies groups don't fit neatly in the above categories but are comprised of transmitters and receivers, and can comprise or interface with a PAN, LAN, or WAN.

RFID (Radio Frequency Identification) an RFID system is comprised of a tag, which consists of a microchip with an antenna and a reader (sometimes called an interrogator) also with an antenna.

In a Passive RFID system the reader emits electromagnetic waves to the tag that is tuned to receive them. The tag draws from the field created by the reader and uses it to power the microchip's circuit. The chip then modulates the waves and sends them back to the reader that then converts the waves to digital data.

In a Semi-passive system the chip uses a battery to run the chip's circuitry but communicates by drawing power from the reader.

In an Active Tag system the tags have their own power source (most commonly a battery), which runs the chip's circuitry and transmits a signal to the reader.

RFID systems use many different frequencies but the most common are: 125KHz (low); 13.56MHz (high); and 860-960 MHz (ultra high or UHF). The 2.45GHz (Microwave) is used in some applications.

Selecting the right frequency for an application is critical and complicated, as each frequency has its own characteristics.

This promises to be an enormous and important area with many applications.

Mesh Networks are essentially LANs that either have full topology in which all devices are connected to one another or partial topology where some devices are connected to all others but some devices are only connected to the devices with which they share the most data.

Historically, the cost of cabling has been a major drawback but wireless obviates that and has some added bonuses. For example, in a traditional wireless network there is a fixed bandwidth shared by all the devices within the range of an access point. The more devices there are the less bandwidth per device. In a wireless mesh network, each device doesn't just send and receive data itself, it also routes information on to others. Each device can reduce its power until it contacts only the devices closest to it. The other nearby stations are then free to reuse the frequencies to make connections to their own neighbors and thus the total bandwidth goes up. The more devices you have, the more bandwidth becomes available. The implications of this technology in many applications can't be overstated.

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Markets	Applications
There are some large markets, in no particular order. Some have high value/low units, others the reverse, so size predication varies, but they are all important and the list is not complete.	**Here are some broad categories of networked applications in predicted ascending order by number of units.**
D.O.D	Computers
Medical/Health Care	Hand held devices
Manufacturing	Vehicles
Materials Handling	Machinery
Distribution	Home Appliances
Retail	Pallets and cartons
Automotive	Consumer items
Aerospace	
Banking	
Financial Services	

Existing IT providers will most probably realize the lion's share of the hardware and software revenues but new technology always germinates new companies. All of the players, who are involved in any of the markets, even in a peripheral way, are assessing their position.

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Challenges and Opportunities

These technologies present challenges that are as large and complex as the opportunities themselves. They will require a complete reassessment of many company positions in aligning strategy to the new reality particularly as it relates to innovation. Some organizations will reap huge rewards but everyone has to evaluate the information, if only from a defensive posture.

This is Where We are Asking for Your Input

We now will attempt to better identify the issues and challenges as you see them. By e-mailing your answers to the following questions, we will be able to provide the most useful solutions to meet these challenges.

Do you view the advent of the new wireless technologies as having major implications for:

- Your life?
- Your market segment?
- Your business?
- Your profession?

If so how?

What do you feel are the greatest opportunities?

What are the types of challenges you face in approaching these new opportunities:

As a:

- CEO?
- Senior Executive?
- Marketing Manager?
- Product Development Professional?
- Design Engineer?
- Practitioner?
- Other type of Professional?

Please e-mail your responses and comments to: Dan_Mooers@ProductGenesis.com

Meeting the Challenge

This will be the subject of the next segment of the report