

The Cutting Edge of Wireless

By Jesse Cryderman

Do you remember what life was like before smartphones? It shouldn't be too difficult-- the culture-changing cellular smartphone is a mere eight years old. The history of wireless telecommunications, on the other hand, is much older. How old? Turn the page back to 1880. That's when Alexander Graham Bell tested and [patented the photophone](#), a wireless communications device that transmitted and received voice and sound on beams of light. Bell believed this invention was his crowning achievement, "greater than the telephone." Bell's implicit observation persists to this day: connecting with wires is cool, but connecting wirelessly is infinitely cooler.

Today, wireless connectivity is all around us. We are literally swimming in wireless signaling, and wireless technology advances faster each year. Smart cars and connected homes, once the subject of science fiction, are now a reality. The cutting edge of wireless technology brings even more magic to the plate. Wearable technology, wireless sensor networking, ambient backscatter networking, and 5G offer exciting new ways for service providers to differentiate and deliver compelling products to the market.

Wearable technology

News flash: nothing in wireless is hotter right now than wearable technology. It's on the cover of numerous publications, from tech mags to fashion and lifestyle rags. By the time this article is published, every company from Intel and Qualcomm to Epson and Samsung will have showcased wearable wireless tech at CES 2014. Google Glass got the discussion going—now it's a global chorus as device manufacturers jump whole hog into wearable tech. It may seem unlikely that people would eschew iPhones for smart watches, but as Wired magazine [pointed out](#) in December, ten years ago the thought of using cell phones for email and web surfing (which were, at the time, desktop tasks), seemed foreign. [Juniper Research](#) predicts the wearable tech market will be worth more than \$1.5 billion in 2014, and [Business Intelligence](#) forecasts that the market will grow to more than \$12 billion by 2018

Wearables pull data and functionality that already exists in a smartphone and pushes it into the field of view, thus making important data accessible when and where it's needed most. Much of the early development work, therefore, has centered on devices that deliver activity sensing and tracking for use in physical fitness and healthcare.



"The furor about wearable technologies, particularly smart watches and smart glasses, is unsurprising," [wrote Josh Flood](#), senior analyst at ABI Research, in February 2013. Even though they aren't readily available to the public, smart glasses are set to boom. [Futuresource predicts](#) that nearly seven million smart glasses will be sold by 2017, generating close to two billion dollars.

While gallons of ink has been spilled on smart glasses and watches, Angela McIntyre, research director at Gartner, [provided some insight](#) into other types of devices that manufacturers will showcase in 2014:

"At CES, we will see athletic shirts with sensors woven in to track heart rate and respiration during training and competitions. Smart undershirts for infants will monitor their heart rate, breathing and sleep. Wearable devices for home health monitoring of the elderly will include clothing and accessories, such as wristbands that can track heart rate, monitor activity level during the day, detect falls, provide location information and send alerts to caregivers."

Other novel products include ski goggles with a Predator-style [heads-up display](#), a [smartwig](#) that offers GPS navigation, and [a ring with an embedded NFC chip](#) that can be used for payments, loyalty tracking, event access, and more. Still, this is just the tip of the iceberg. From manufacturing and assembly to training, applications for heads-up displays are countless, as are wearable devices for law enforcement, field technicians, and more. The future is all about integrating wireless into daily life in a seamless manner and reducing the time it takes to access important data. Just as they have with connected cars and smart home suites, service providers should build business cases around wearable technology now, while the market is in its infancy.

Not for distribution or reproduction.

Wireless sensor networking

Wireless sensor networking (WSN) is the underlying story of the internet of things. WSN encapsulates machine-to-machine (M2M) computing, but is distinct. According to Susan Eustis, [WinterGreen Research](#), “Wireless sensor network markets are evolving as smart phone devices and technology find more uses throughout the landscape of the Internet of Things. Sensors can provide monitoring that has not previously been available. Differential diagnostic tools support provide differential information that helps manage our daily lives from traffic patterns to crime detections, to medical treatment.”

Libelium, a manufacturer of wireless sensors, lists the [top 50 applications](#) for wireless sensors across categories including smart cities, smart environment, retail, logistics, and industrial control. (The list is summarized by this [helpful infographic](#).)

Authentication and security are crucial for many of these devices, especially in healthcare, banking, public safety and business use. Service providers are well-positioned to offer these capabilities as part of a branded sensor networking suite, such as a manufacturing efficiency offering, or a field service support product that bundles asset tracking, videoconferencing, and sensor networking. Quality of service is another metric that can be monetized.

Ambient networking

One of the most interesting developments in wireless technology is the discovery that ambient radio frequencies can be [harnessed to power devices](#) and can be used as a communication medium. The first capability is referred to as energy harvesting. Energy harvesting technology will rapidly accelerate the deployment of wireless sensor networks and wearable devices. Using existing radio frequencies to communicate is called [ambient backscatter networking](#).

Research into this cutting edge technology is underway at the University of Washington. Shyam Gollakota, lead researcher and UW assistant professor, [wrote](#) that the technology is “hopefully going to have applications in a

number of areas including wearable computing, smart homes and self-sustaining sensor networks.”

“Our devices form a network out of thin air,” added co-researcher and UW assistant professor Joshua Smith. “You can reflect these signals slightly to create a Morse code of communication between battery-free devices.”

Now it’s important to note that this form of networking isn’t breaking any bandwidth records. In fact, it so far has only achieved 1 kbps transfer rates. But it doesn’t need to be faster for most sensor-based applications. In this [video](#), for example, the researchers demonstrate power-free payment processing using the technology.

5G

The fifth generation of cellular communications technology, 5G, will be realized with a combination of several next-generation wireless technologies.

In the realm of spectrum, the implementation of the Licensed Shared Access (LSA) and Authorised Shared Access (ASA) concepts will become crucial. [LSA and ASA](#) enable international spectrum to be used by more than one operator.

In terms of sheer speed and capacity, LTE-Advanced must become ubiquitous. So far, only networks in South Korea ([SK Telecom](#) and [LG U+](#)) and Russia ([Yota](#)) have live LTE-A networks. In the Philippines, [Smart Communications](#) is testing the high-speed tech, Telefonica and Vodafone are trialing LTE-A [in Gernay](#), and EE is [testing LTE-A](#) in London.

Inherent to the commercialization of LTE-A is a spectral efficiency technology called carrier aggregation, which enables devices to leverage multiple carrier spectra, thus increasing bandwidth and bitrate. [Qualcomm](#) has lead the charge in carrier aggregation technology, and Huawei recently helped Australian operator Optus implement carrier aggregation in its TDD LTE network. The result is pretty amazing: 160 mbps data rates in a live environment. In another example, [Sprint Spark](#) leverages carrier aggregation for higher data rates which Sprint says can scale up to 2 Gbps.

In terms of network topology, 5G will be typified by programmable heterogeneous mesh networking. The programmable nature will derive from the NFV standard and SDN, and the heterogeneous mesh refers to the seamless combination of multiple access technologies (LTE, HSPA+, Wi-Fi) and multiple node types (small cell, macro cell).

How far off is 5G? The reality is that there is a lot of work to be done, and it's unlikely that any true 5G service will be available before 2020. The time to prepare, though, is now. Network engineers should take care to select products and suites that offer a path to 5G by accommodating carrier aggregation, LTE-A, NFV/SDN, and heterogeneous networking.

Leveraging the cutting edge

Communications service providers stand to benefit from the cutting edge of wireless technology, but only if they are prepared to change the way they operate. From a strategic standpoint, service providers must define and monetize the value they can add to the next wave of mobile: wireless sensor networking and wearable technology. [AT&T's Digital Life](#) home security and automation suite, [Telefónica's Latch](#) cyber-security portfolio, [Sprint's Velocity](#) connected car platform, Orange's [NFC Service Center](#), and [Verizon's Telehealth](#) business offer good examples of this strategy.

In terms of the network itself, 5G will not happen overnight, but the path must be built today. Capital expenses, such as a small cell deployment, must be judged not only on their specs and cost, but on their ability to bring about the future. Platforms that offer interoperability will eventually dominate the landscape, so the sooner mobile network operators (MNOs) can move in that direction the better. Lastly, in many ways, service providers deliver a product that, at times, seems magical. As such, they should not allow themselves to be shut out of any discussion regarding cutting edge wireless technology and, instead, should market themselves as the stewards of the future.