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## Get Ready for the 3G/4G Wireless Data Explosion

Gary Breed  
Editorial Director



This past summer, I began noticing a lot of underground utility construction wherever I traveled. Manufacturers of guided boring machines must be very happy to see their equipment hard at work placing gas pipelines and water mains, or helping a phone company upgrade from copper to fiber. But lately, I realized that the majority of the work is running fiber optic cable for wireless network backhaul. It wasn't hard to figure this out—the construction passes by every cell tower!

The issue of backhaul capacity has been a big item in wireless industry news in the past couple years, so we shouldn't be surprised. However, after watching the development of some recent trends in wireless usage, I just hope they are laying enough cable to handle the coming demand.

And I mean LOTS of demand for wireless data services!

The 3G/4G smart phone phenomenon is just starting to take off. All those apps require bandwidth (sometimes a lot), and with the growth of other devices like pad computers, the availability of larger screens and more computing power will only accelerate the desire for anywhere/anytime connectivity. Wireless service users are just beginning to understand that many unique services are possible, and will soon become accustomed to Internet access on their handheld devices wherever they are. "The World at Your Fingertips" is no longer just a marketing slogan—it's reality.

### Technical Implications of All That Data

The picture is not entirely rosy. Besides the need for a backbone infrastructure, there are other serious challenges to be overcome before the full potential of wireless broadband can be realized.

The first is basic wireless network coverage. The amount of data carried by wireless providers is doubling every 10 months, and there is evidence that the rate of growth will increase. For example, as the provider of choice for the Apple iPhone, AT&T has reported that it experiences a large jump in data traffic whenever a popular new app is introduced. A couple of the early ones caused serious temporary outages.

Imagine the size of the problem as more Windows, Android and other

highly capable Internet-connected devices reach the market. All those users downloading the online release of a blockbuster movie, watching streaming video of the Super Bowl or NCAA Final Four, or trying out the latest release of a popular video game, will create a huge increase in wireless network traffic.

Dealing with that traffic means network operation must be maximized with smart antennas, MIMO, and other transmission technologies. Uninterrupted coverage will require difficult locations to be filled in with microcells or picocells. Transmitting wide bandwidth data reliably requires maximum signal-to-noise ratio, so the handsets must be optimized for low noise figure, high dynamic range performance, including better ways to avoid degradation due to the embedded, miniaturized antennas

used in most wireless devices. It's a big problem to solve.

There are other, more subtle problems, too. A well-known annoyance with some smart phones is short battery lifetime, so when a new app to help this problem was released a short time ago, it was widely downloaded and put to use. Unfortunately, part of that app's power reduction procedure was to place the phone in "sleep" mode quite often. This does save batteries, but every time the phone wakes up, it contacts the network and goes through a series of registration procedures. The amount of overhead generated by tens or hundreds of thousands of phones re-establishing network sign-up over and over again is enough to bring a network system engineer to tears!

Of course, the answer is to establish some kind of standards for software apps that will run on

wireless devices—creating a type of bureaucratic overhead that discourages creativity. However, it's still required, because of the inherent "laws of physics" limitations of a wireless connection.

Which brings me to a final point, one I try to get across to friends, neighbors and colleagues whenever possible—that the wireless device in their hand is first, and irrevocably, a *radio*. Yes, it is also a computer, telephone, navigation aid, camera, game console and video player. Those things are secondary to the fact that, at the heart, every wireless device is a two-way radio—a fact that was forgotten for a while by wireless device engineers, who are once again realizing that radio performance is key for reliable wireless broadband service.