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Finding Space: Solutions for the Wireless Data Capacity Crunch

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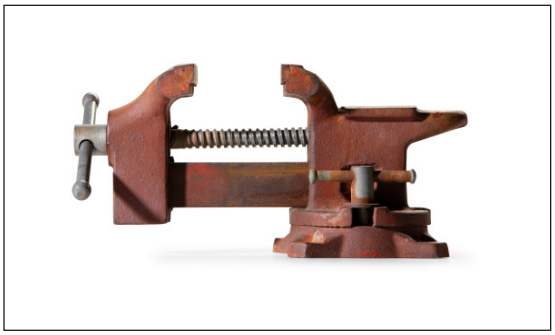

We all know the challenges of wireless data capacity in an era of exploding demand. A report just out from Amdocs indicates that 94 percent of service providers are planning for a 20-fold increase (or more) in the next five years. IP traffic is up everywhere, and even if the hyper-explosive growth rates of the past few years are cooling slightly, the growth that remains is still exponential.

What's more, the data glut is coming from everywhere. Gone are the days when a few bandwidth hogs gobbled up most of the network capacity with P2P applications and other such niche activity. With video especially, growing more and more prevalent, the massive bandwidth usage is coming from grandmothers viewing the first steps of far-away babies, or coworkers using video chat applications, or children streaming episodes of The Wiggles on their mothers' iPad.

Even more still, these customers are generally chomping through all this data within the constraints of their existing data plans. Most aren't exceeding data caps and triggering resulting additional revenue. As Kevin Fitchard of GigaOm put it, pointing out the situation of one major wireless operator, "Customers are finally growing into the data plans, and they're eating up all of AT&T's mobile data network capacity in the process."

But, of course, it's not just an AT&T problem, nor just a Verizon Wireless problem, nor a Telefonica problem. It's a reality any number of CSPs are dealing with around the globe. Customers are taking more and more data-hungry devices. The CTIA reported last October that, for the first time, the number of wireless devices in the U.S. had grown larger than the number of people in the nation. Traffic is up, and between eroding revenue streams due to increased OTT usage and spectrum crunches in numerous markets, there is not a clear and established idea of how all that traffic can be handled in a cost-efficient way.

However, there are potential areas of relief on the horizon, and there are ways for service providers to handle the data capacity crunch with one eye on the present and the other on the future.

LTE to the rescue?

We've heard a lot over the past few years about the potentially beneficial effects of LTE on data speeds, but less has been said about the increased capacity of LTE networks over their 3G counterparts. The all-IP LTE can serve more subscribers simultaneously than HSPA 7.2 or HSPA+ networks, even if the latter networks can claim speed parity with the former at the moment.

However, LTE's additional capacity is only useful for as long as the wireless technology has spectrum on which to operate. According to a recent FCC filing by Verizon Wireless, the carrier expects its LTE traffic to exceed its CDMA traffic by 2013. Nevertheless, the carrier's recent uphill battle with regulators to swap spectrum with erstwhile competitors indicates the headaches associated with attempting to get past FCC and antitrust impediments to secure new airwaves.

White space

Then again, anyone familiar with the LightSquared controversy knows that, especially in a relatively saturated market like the United States, spectrum is hard to come by for all CSPs, not just those regarded as potential monopoly threats. Whether this scarcity is the result of heavy traffic or excessive regulation, the fact remains that creating room for additional traffic is not always as simple as it seems.

Sometimes, however, the freeing up of previously set-aside bandwidth creates opportunities.

Such is the case with so-called spectrum white space, the unused bandwidth between television channels created by the FCC to avoid programming interference. A rider nestled into a tax cut law signed by President Obama in February (ah, the arcane joys of the lawmaking process) opened up those white spaces for unlicensed development. These strong signals have potential for carrying wide-area versions of Wi-Fi, thanks to the capacity for long distance transmission and strong building penetration.

White space isn't a panacea for crowded networks, however. Crowded urban and suburban areas that need the bandwidth the most simply don't have much white space to go around. However, rural areas and smaller cities and towns might just find relief for network crowding in the spaces between.

Smaller cells

But there's another reason why wireless data capacity is tricky: it isn't a matter of what people are doing online, but when they're doing it. It's easy to see traffic as something of a constant, but we all know that there are peak times and off-peak times, and that traffic is not evenly distributed across space or time. A business district may be slammed with downloads and phone calls at noon on a Wednesday, but have hardly any traffic on a Saturday morning. A stadium may be as still as a graveyard, in terms of data traffic, 350 days a year, but impossibly busy the remaining 15.

Fortunately, networks are getting smarter, which often means they're getting smaller.

"We're headed toward a world of 1GB a day of data consumption per user," said Stephane Daeuble, Small Cell Global Product Marketing Manager with Nokia Siemens Networks. "In that environment, more macrosites may just mean more noise."

Indeed, some areas may need little additional infrastructure in the near future, while others may need a 10x or 20x deployment to meet rising levels of demand. To meet the needs of these hot zones, an approach that includes small cells, including both home- or business-based femtocells and larger-scale deployments, is needed.

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However, the deployment of small cells creates lots of new considerations for service providers, Daeuble said. Replacing a centralized macrosite with an array of small cells means that each of those miniature cells must be independently placed, powered, and maintained. Are the cells placed on street lights, drawing power from those lights? What happens when those lights are turned off during the day? How do you keep hundreds of small cells clean and free of everyday urban grime? How do those small cells stay plugged into the central network? Fiber isn't everywhere, even in high-density markets, so how do you bridge those gaps?

All of these considerations should be a part of the network planning and management process, Daeuble said, if a small cell strategy is to live up to its sizable promise.

Smarter cells

What's more, the potential for even macrosites to be much smarter is still on the table. In talking with rural carriers, especially, and with vendors like CHR Solutions that deal with many rural carriers, it's surprising how many network antennae still need someone to climb a ladder in order to be adjusted. There is a huge amount of low-hanging fruit left in implementing network elements that can be optimized from a central location, minimizing truck rolls and other associated labor costs.

Once these strategies are fully implemented, cell sites can be coordinated in a much smarter way. If

a financial district goes dark at night, making many sites redundant, many can be put to sleep and those that remain can be adjusted from the NOC, or even adjust automatically, to cast a wider net and provide coverage for those still in the area. Furthermore, self-organizing networks (SON) can accomplish these and other functions, including self-configuration and self-optimization, further reducing unnecessary headcount and increasing efficiency.

Hitching a ride

Mobile backhaul is also becoming more and more prevalent in the capacity conversation. What's more, thanks to metro Ethernet, it's becoming more and more cost effective. Ovum estimates that by 2015, 88 percent of mobile backhaul will be carried over Ethernet, due in large part to its overwhelming cost efficiency over existing backhaul technology. Furthermore, additional cost savings can be seen by leasing, rather than building, backhaul networks. And this all helps the bottom line. It does, however, complicate the monitoring scenario, as visibility is limited both by new technology and non-ownership of stretches of the network. However, monitoring capabilities of several product lines of OSS software are keeping pace with these developments, though that may require additional software for CSPs. However, even with these costs, overall savings are tangible, both in terms of reduced wireless network strain and reduced backhaul roll-out costs.

Looking ahead

There are other solutions that promise to help ease data capacity needs, too. Since video, especially, is the source of much network strain, better video compression technology is being developed that could help ease some unnecessary strain. Of course, since much of this video is over-the-top, it's tough to facilitate such a push without either some measure of coopetition between CSPs and content developers or much more draconian bandwidth controls. But

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better policy control, all around, could be an answer unto itself. New data traffic management and policy control products and solutions are making it easier to ensure that subscribers are carrying their fair share, and that premium traffic is dealt with accordingly.

And pushing even further out, who knows what speeds and capacities may be possible. Recent lab tests utilizing "twisted light" lasers saw transmissions of up to 2.56 terabytes per second through open space. While these speeds don't translate to what's currently possible in earthbound wide-area wireless networks, due to terrestrial radiation interference, they may be some hint of the unbelievable speeds and capacities that may become reality sooner than we think.