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Fixing the future of 5G

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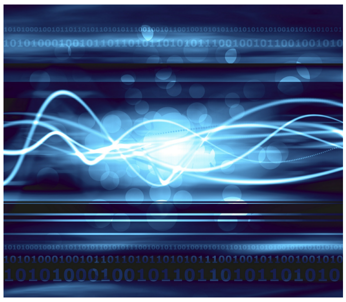

The telecom industry has set its sights on delivering a 5G future. The fifth generation of wireless technology promises to be significantly faster than the current 4G standard, and to connect more complex data-intensive fixed and mobile applications with little or no latency. Internet service providers (ISPs) are now weighing up their options for deploying 5G as quickly and efficiently as possible in order to leverage the benefits.

Against expectations, fixed-broadband adoption is increasing rapidly. Meanwhile, in developed markets like the UK, mobile data usage has slipped to represent only 5 percent of total internet traffic, according to recent research by 451 Group. This is because the consumer value per gigabyte is significantly more expensive on mobile versus broadband internet. Subsequently, the industry is seeing mobile providers are moving to fixed broadband solutions to remain competitive

The wireless answer for 5G

The standards for 5G have yet to be defined in the mobile realm, but this has not deterred ISPs and vendors, which have already begun testing the technology in order to influence its introduction. Early tests from Verizon, AT&T, U.S. Cellular and Nokia in North America suggest that whereas 4G was a pure mobile play, 5G will initially be deployed purely for fixed wireless applications.

Verizon's CEO Lowell McAdam stressed that this is because fixed wireless offers ISPs "the return on capital you need" Expanding on Verizon's rationale, McAdam further explained that "connecting consumers and businesses to a fiber network is expensive, and it's possible to reduce that cost by getting a fiber connection within 1,000 meters of a building and then connecting that building to the fiber network *wirelessly* via a 5G router on the outside of the building."

Indeed, fixed wireless provides high-performance connectivity that can be established and scaled at ease, at a low price point. It is the obvious choice for commercialising 5G within a strict time frame. The next step for the industry is to define which wireless bands are most appropriate for fixed wireless applications.

Testing the viability of the mmWave spectrum

In 2016, there was a concerted effort to raise the profile of the high-frequency mmWave spectrum (above 24GHz), to prove its viability with 5G players. Verizon has begun tests using the 28GHz spectrum after the U.S. Federal Commission opened it up for commercial use, in addition to a number of other frequency bands including 70GHz. However, the viability of these bands should now be scrutinised for both mobile and fixed applications, and whether integrating handset and home solutions in common infrastructure and spectrum makes sense at all.

The mmWave spectrum has been proven as successful for point-to-point infrastructure links that have total line-of-sight, as demonstrated by companies such as Webpass, which was acquired by Google. However, delivering mmWave broadband connectivity in non-line-of-sight (NLOS) environments, such as suburban areas, is extremely problematic over the last quarter mile. This is because signals can be affected by environmental factors such as foliage. This is typically found in suburban areas, where almost 80% of the U.S. citizens reside. In higher frequency bands, weather can also negatively impact signal propagation, disrupting connectivity.

Service distance between links can be reduced; however, this is more costly and the obstacles that disrupt mmWave frequencies still remain. ISPs face a dilemma: there is a need to provide connectivity over long distances, and which can penetrate foliage. However with limited availability of mmWave line-of-sight links, this frequency will not deliver.

Connectivity in the sub-6GHz spectrum

Fortunately there is an alternative. Rather than using limited mmWave channels, ISPs should switch their focus to re-using the sub-6GHz spectrum encompassing both unlicensed and various licensed spectrum which are better suited for fixed wireless propagation in neighbourhoods. Over 14,000 wireless ISPs globally have quietly proven in rural areas that the sub-6GHz bands are extremely effective at delivering fixed wireless services at long distances. Plus, unlike the relatively high costs of high frequency 28GHz, sub-6 GHz costs come in below $100 per subscriber, making it a cost-effective alternative.

These bands have traditionally been considered out of bounds because there is less spectrum available when compared to mmWave bands. However, new spectrum reuse GPS technologies are emerging which can coordinate transmissions across a network. This makes it possible to run an entire network on only two operating channels. Interference between signals can thus be avoided with spectrum recycled across dense geographic areas.

Massive MIMO (multiple-input multiple-output) technology can also help to solve interference by using a large number of antennae at the base station, serving many users in densely-populated areas, while staying within the confines of the spectrum. This results in considerable cost savings; the current cost of subscriber equipment in the mmWave spectrum can be more than seven times that of sub-6GHz equipment, which is already in use today. This new wireless architecture is poised for large scale use in high-density neighbourhoods for multi-point deployments for the first time.

Spectrum sharing proves its worth

The viability of spectrum-sharing techniques will be widely proven in the U.S. this year, with the introduction of the Citizens Broadband Radio Service band. This is a new sharing plan for ISPs in the 3.5GHz band, making 150MHz of the spectrum available. It also offers a new Spectrum Access System (SAS) database to allow spectrum sharing. The SAS has two critical functions that can enable this to happen: it can keep track of current incumbent use of spectrum so that it can be protected, and issue new licenses or access in the band. Completely clearing out existing use by government and other wireless applications can be extremely expensive, so we can expect that if the SAS is successful, we'll see it proposed as a solution to add new fixed and mobile applications into a variety of underutilized bands.

Google is actively conducting experiments in this 3.5GHz band in up to 24 areas in the U.S., and preparing for the new SAS spectrum-sharing database to go live in early 2017. With new innovations in spectrum re-use, using the 3.5GHz spectrum could further extend the value of the spectrum sharing in the sub-6GHz spectrum and help ISPs unlock the capabilities of unlicensed bands. This trend will not be limited to the U.S., and we're likely to see other countries across the world seek to replicate this technique and open up alternative bands to deliver connectivity at a lower cost.

With 5G tests and trials being announced across the globe, fixed wireless will undoubtedly play an important role in the commercial roll-out of the technology. By carefully deploying and comparing different models, we're now able to witness the impact of different spectrum in varying deployment environments, applications, and resulting costs. With the licenced mmWave spectrum falling short in terms of cost and usability, operators must consider the use of the sub-6GHz spectrum, which can reliably deliver connectivity in built-up areas. With continued trialing of technologies and methods, we are closer than ever to an efficient 5G infrastructure that can serve all environments on a global scale.