The mystery of 5G for network operators

A regular column on the information industries

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Everyone knows that 5G is coming, but no one knows precisely what it is. This is a very different scenario from that envisaged when 4G was first floated because the main objective at that time was to speed up data transfers either by using the existing licensed spectrum re-farmed for the new, more efficient technology long-term evolution (LTE) or by opening up new bands such as 700 and 800 MHz for licensed mobile services using LTE.

It is still the case that speed matters and LTE-Advanced (LTE-A) – which, unlike LTE, meets the technical specifications for 4G – is getting progressively faster through technical improvements in carrier aggregation (CA), multiple-input multiple-output and the like. But, the reality is that once, say, a downlink of 30 Mbps or more is accessible – which is generally true of fixed-wire networks and patchily true for mobile networks, at least in advanced economies – then customers will welcome more speed, but the great majority will refuse to pay for it. Not surprisingly, therefore, network operators are not rushing to speed up their live networks unless competitive pressures make this expedient, and it must be borne in mind that CA requires LTE networks to be progressively rolled out across spectrum in multiple bands some of which, such as spectrum in the 800 MHz band, can only be obtained via expensive auctions.

But, it must be noted that the proponents of 5G see it as less to do with human-to-human connectivity than with human-to-machine and machine-to-machine connectivity. Accordingly, the first key thing to note about 5G is that it is not really about speed and not much to do with licensed spectrum below 3 GHz. Furthermore, it is not altogether clear whether lightning-fast connectivity (minimal latency) is needed in the majority of cases. Rather, 5G has to do with linking up in some as yet unspecified manner some slices of licensed mobile in the bands below 30 GHz, wireless fidelity (Wi-Fi) and the internet of things (IoT). The latter operates in unlicensed spectrum in bands above 5 MHz which is why so much research and effort is being expended in determining which spectrum bands are best suited to unlicensed use and how unlicensed spectrum can best be allocated among competing users.

These are the sort of issues that the World Radiocommunication Conference in 2015 (WRC-15) largely failed to address. Harmonising licensed spectrum has

never been easy, and problems still remain in relation to, for example, the 700 MHz band, but harmonising unlicensed bands is vastly more difficult. The USA, in particular, has evidently decided to approach this difficulty by independently opening the 28 GHz and other similar bands, predominantly, but by no means exclusively, for unlicensed use without worrying what is going on elsewhere in the world.

Bandwidths between 30 and 300 GHz are referred to by the ITU as "extremely high frequency" and are reserved for IoT use. Because wavelengths in these high bands vary from 1 to 10 mm, they are commonly known as millimetre wave (mmWave), and, in terrestrial use, the range cannot generally exceed a kilometre. Unobstructed line of sight is required and weather conditions can easily degrade the signal, but the short wavelength allows the use of modestly sized antennas with a small beam width. The growing interest in mmWave and other new technologies reflects the fact that different interfaces are needed for different sorts of provision, but this is effectively a technical challenge that concerns equipment vendors and to a lesser extent university researchers. However, it is predominantly the network operators that will have to decide whether they are willing to invest in 5G after they have tested its viability on live networks.

The underlying problem is that their customers increasingly expect more for less – they are unwilling to extend their overall budget on mobile communications and readily switch networks if they feel they are not receiving a good deal. Hence, either the operators must find a way of persuading customers that the new services that 5G will bring forth are worth paying extra for or they must absorb the cost of new services and accept lower profit levels. However, the former choice is really not that viable because many services can be provided at little or no cost by over-the-top players of which Skype is an example. Furthermore, increasing the range of services, which might provide the opportunity to reduce unit costs, only appears to offer marginal benefits when adding 5G services, and, if operators want to reduce unit costs, they would do better to upgrade their LTE-A networks.

As noted, competitive pressures cannot be discounted – if a large rival network introduces a new service it is risky not to follow suit – but many such services are not driven by an explicit demand from customers who typically feel no "need" for such services until they become available. Hence, one must expect operators to be wary of leading the way in the introduction of expensive new services, where they know that if rivals follow suit then they will all become less profitable.

This exposes some of the difficulties with mmWave solutions because the huge number of cells needed for short-range transmissions can only be provided economically in dense urban areas. The evidence is piling up – as noted recently in the UK with respect to 2G let alone 4G – that where mobile provision is much better in some parts of a country than in others this generates a massive wave of complaints from those who feel left out, and, if there is one thing operators do not need, it is a new wave of complaints which lead to fines for poor service. In any event, much of what is expected of mmWave can be delivered by Wi-Fi, especially where indoor provision is concerned, and urban authorities are growing less-tolerant of the erection of new equipment on outdoor sites.

What the above indicates is that network operators would be well advised to stick to what they know – how to make profits from customers in licensed spectrum bands. Large-scale providers of Wi-Fi networks already exist, and their main aim, other than to raise speed, reduce latency and reduce the need for passwords, should probably be to achieve better integration between themselves and mobile operators with a view to improved traffic control. As for the IoT, attention should be concentrated upon the narrow band internet of things (NB-IoT) which can be described as a standard that uses licensed spectrum to provide a two-way communication involving long distances and relative inaccessibility. Its key quality is that it supports very large numbers of cheap devices that need very little power to function.

It may be noted that the above discussion has been rather hazy about the new services that 5G will provide. Handset owners tend to be directed to the relatively attractive possibilities which include the remote provision of health services and the ability to turn on one's central heating before leaving the office. However, there is inevitably a darker aspect: for example, as has recently happened on a number of occasions, the ability of hackers to acquire control over a huge number of unprotected devices to bring down important components of the internet has become a matter of great concern.

During the period to 2020 when, in principle, 5G is to be revealed in all of its glory, the way forward that will achieve the maximum benefit for society appears to involve the likes of better mobile coverage in licensed bands, simplification of Wi-Fi, the extension of services such as contactless payments and better traffic control. All of these are

achievable without the need for constant technical progress beyond what is already realisable. Refer to the package of services expected to become available in 2020 as 5G if you wish – although for now some operators are hedging their bets by referring to what will be available as 4.5G – but the public will remain in a state of confusion given that very few people even understand the difference between 3G and 4G other than that the latter is a lot faster and enables clever technical tricks such as contactless payments. What they want is to access (allegedly) better handsets and obtain access to even more services that they did not really know in advance that they needed – provided they do not have to pay more for data and they can get a connection.

In reality, there will of course be no slowing down in technical progress – there never is. And, maybe the public will discover that they do indeed need services that have so far barely registered in their consciousness, in which case 5G, whatever it turns out to be, may be acclaimed as a success. But who, if anyone, will make money out of it is quite another matter.

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