Innovation Briefing Issue 6 | Looking to 2025

Unlike the move from 3G to 4G, the transition to 5G has been fairly seamless. It is expected that 5G coverage will have reached 60 per cent of the world's population by 2026, making it the fastest ever mobile network deployment. Chris Williams looks into his crystal ball.

Over the next decade, 5G will play some, if not a critical, part in transforming every industry. Success will be driven by the options it provides to application developers, businesses and consumers.

As well as offering the well-known features of high capacity and low latency, 5G promises to improve coverage in rural areas, provide better building penetration and offer high-availability networks to the point where service can be assured. These network features mean we're moving from a one-size-fits-all solution to application-specific choices and dedicated, refined solutions. To do this we need to understand which applications will be the early adopters and decide what else needs to happen for the 5G promise to be realised.

Most internet-of-things devices are engineered to be ultra-low cost. Fitting an expensive 5G radio could make them uneconomic. How appropriate the technology is depends on which part of 5G the application requires. The current low-power, wide-area network, or LPWAN, in the form of LTE-M and narrow-bandwidth IoT, will continue to evolve as part of 5G specifications, supporting low-power, low-cost devices and opening up opportunities. NB-IoT & LTE-M will open the door for massive-IoT device applications. Experience has shown that costs of data on 5G are likely to remain the same. But it's worth noting that we're currently in the new radio part of the 5G rollout, in which the core part of the network remains LTE.

Applications that demand high capacity, ultra-low latency, high availability and service-level agreements will require dedicated networks, support and more complex solution components that lead to overall higher costs. These higher costs will be justified by the very nature of the type of applications of the high-end services. Take a moment to imagine that the year is 2025 and think about how the digital landscape has changed. Let's assume that 3G has been consigned to history. A little 2G is hanging on, particularly in the UK, to support historical, hard-to-reach devices such as utility meters. LPWAN, NB-IoT and LTE-M rollouts have been complete for some time and they provide the ubiquitous coverage and roaming agreements that, in 2021, the industry craved. LTE-4G has benefited from the release of the spectrum previously used by 2G and 3G, due to its widespread adoption and low cost compared with 5G technology. It remains a viable option for

many IoT applications; however, 5G is now fully operational. We see dedicated 5G networks supporting a range of applications from immersive gaming, healthcare and industry robotics to the beginning of the realisation of driverless cars.

Monitoring and management of energy and utilities have been revolutionised. Electric vehicles are far better supported by an upgraded connectivity ecosystem, so it has become far more realistic for the majority of vehicles to be electric and charged from home, thanks to the support of 5G.

This is a future we are well on our way to. Standardisation in the form of the 3GPP standards 15, 16, 17 and 18 provide a clear path, giving service providers and application developers assurances around the availability of LPWAN and 4G LTE as we progress to 5G. Collaboration within the IoT ecosystem will be key to making the most of 5G. It will inform the ways in which devices and applications interact with the network, as processing will occur on the device, the edge and the core as appropriate. Collaboration between device manufacturers, application developers, application programming interfaces and mobile network operators, as well as the availability of open resources will determine optimisation for each application.

Just like anything new, there will be teething problems, but it's clear that the advantages outweigh any bumps in the road. Rollout is quite slow and that's just as well otherwise our infrastructure would be overloaded by data. Cell sites require updating, particularly the physical links between the sites and networks. Once updates are in place, we can begin to virtualise the network, making any future rollouts far simpler.

By 2025, much of the world should be experiencing true 5G. This is when we'll begin to see big changes, exciting leaps in the tech world. LPWAN will be taking care of use cases such as smart cities, agritech and metering, which require frequent connections but only deal in small amounts of data. The connectivity will enable us to make exciting changes in artificial intelligence, industrial decision-making and utilities. We can expect seamless transitions between wi-fi and 5G to make for a very comfortable user experience.

The technologies of electronic SIMs and universal integrated circuit cards sit alongside 5G. Having eSIM hardware and eUICC software in place is an excellent way to futureproof. It's hoped that it will be possible to update current 4G SIMs seamlessly by using over-the-air updates when 5G profiles become available.

Exciting developments

It's not just the advances in individual use cases, but how they can be combined to add even further value that is exciting.

In agriculture, more precise weather prediction will aid decisions regarding watering, planting and fertilisation. Connectivity will help to bridge the divide between urban and rural areas by providing access, information and decision-making through the whole supply chain rather than just parts of it.

With the ever-growing concern about climate change, it is imperative that we improve how we manage energy and water usage. Utilities will be pioneers of 5G, no doubt with high costs, initially, but with a great deal to gain.

Once our infrastructure has been upgraded, we can expect to see incredibly accurate monitoring, which will enable up-to-the-minute data on energy and water usage, flood risk and leak detection. Visual inspections that employ unmanned aerial vehicles will become the fastest and safest way to manage infrastructure, whether in routine checks or after natural disasters, accidents or weather events.

Today, most smart meters use 2G but, as manufacturers future-proof devices by opting for LPWA modules, we will see improvements in at-home utility monitoring. This will enable consumers to control their energy usage and to see the benefits of choosing low-powered lighting and technology in their homes. Therefore, they will be encouraged to use smart technology and, in turn, to reduce their energy and water usage and wastage.

While 5G will be more expensive than 4G in the short term, in the long term, redevelopment led by utilities will accelerate the adoption of smart city technologies. Collaboration with telecommunications companies will encourage the offering of faster and faster data transmission rates, which will enable data sharing and monitoring that can bring to our fingertips building and road management, connected lighting and more. Utilities will also benefit from being able to provide services to remote locations in a way that has not been possible before.

The ability to construct private 5G networks will prove popular, with benefits including greater security than is possible in commercial networks, lower latency, improved coverage, and even the ability to operate when power sources are unavailable.

Industry will enjoy new and improved possibilities, particularly in the areas of machine learning, AI and industrial decision-making, particularly edge network decisions. This will be a real bonus when it comes to streamlining business practices, reducing losses and increasing security and safety.

Choosing the right connectivity solution is key to being ready for 5G. For example, use of eSIMs is a good option for high data-use cases, in order to avoid having to change SIMs in hard-to-reach or mobile devices.

LPWA is still the best future-proofed option for low-data applications, especially if you are designing and developing right now.

A fantastic example of this can be found in Voi Technology's electric scooters. The scooters are supplied with global eSIMs, which currently work with 4G LTE. These are an excellent choice because over-the-air updates are likely to be available and therefore a seamless upgrade to 5G will be possible. By opting for this solution, Voi has futureproofed its e-scooters; the company won't have to spend time and money on expensive hardware updates or software deployments.

Nordic Semiconductor has also thought ahead when it comes to designing and developing its wireless connectivity solutions; it has opted for LPWA modules. Its nRF9160 session initiation protocol works on 4G and 5G; the integrated modem supports both LTE-M and NB-IoT; it can operate globally; and it enables OTA upgrades. This is an example of technology ready for the future but able to work fully in the current climate, or, as Nordic Semiconductor puts it: "The nRF9160 SiP is 5G-ready but the marketing success is not reliant on 5G rollout."

Navigating the cellular ecosystem

The advent of 5G can feel unsettling. Technology can advance at such a speed that often it may seem as if you have just got to grips with one development when another comes rushing in. The joy of switching from 4G to 5G can be found in the ease with which it will occur; there will be a lot less need for new hardware thanks to OTA updates. The key is to get into the best position now by starting to move towards LPWA solutions.