The Battle for 5G Moves Indoors

By: Per Lindberg

It's 2020 and the race for 5G is accelerating—and changing course. First, it's moving indoors, and it's important to understand why it matters and how it will happen. In addition, the drive for more automation and openness with the increasing influence of the O-RAN Alliance is further shaping the shift. And looking forward amid today's mounting environmental crises, dynamic self-optimising networks will help the industry make a valuable contribution to saving the planet.

Traditionally, operators have owned the outdoor space and relied on macro cells to penetrate indoors. This is at best a compromise, leaving many without coverage and reliant on Wi-Fi, if available. The fact is that, while some 80 percent of all data is consumed from indoors, only about two percent of buildings in urbanized environments have dedicated indoor cellular networks. The problem is only going to get worse as the 5G rollout accelerates. This is because higher frequencies find it harder to penetrate most building materials such as bricks and concrete, steel frames, glass, insulation and wood, leading to increased penetration loss and weak indoor coverage, or none at all.

Operators are waking up to these challenges. In 2020 and beyond, they will focus much more on the in-building environment to provide ubiquitous connectivity and a seamless user experience both indoors and out. In addition to Tier 1 sites such as large hotels, shopping malls, stadiums and campuses, attention will be turning to offices, residential buildings, smaller hotels and hospitals, for example. This rush indoors will continue to gain pace, and by 2030 we expect to see the percentage of buildings with their own indoor networks to grow to around 10 percent, with 5G connectivity present in millions of buildings worldwide.

The 5G indoors challenge

There are two options to deal with the indoor challenge: by deploying small cells or DAS (Distributed Antenna Systems), which can deliver greater speed, throughput and agility. The large capacity of DAS is well-suited to venues such as stadiums. It is also much less expensive to deploy a DAS for in-building coverage than to install hundreds of small cells. DAS tends to involve higher upfront costs with heavier design work than small cells in low-density applications. The challenge is determining where the tipping point is. Over the next 12 months, we expect to see the ramping up of small cell deployments, whether as an integral part of DAS or as separate units.

Whether using a small cell or DAS system, however, there is a need for a new generation of indoor-outdoor network design and optimization tools. These new tools must be capable of planning and deploying densified indoor and urban networks, allowing users to easily and accurately plan and simulate the performance of complex coordinated multilayer and multi-technology networks both indoors and out.

Another design challenge is the need to prevent interference between indoor 'private' networks and outdoor public networks. For example, if a hotel wants a cellular indoor network, there is a need—and possibly a legal requirement—to consider leakages between indoors and outdoors.

Another driver for better indoor cellular coverage is the industrialization of mobile networking and the creation of smart factories and enterprises. This industrialization of

5G is being pioneered in China based on the new core network, called ‘5G standalone.’ Consider the industrial 5G use cases such as machine control, robots and unmanned vehicles, or the need to link IoT networks and AR/VR vision systems inside the factories of the future. These use cases will require ultra-low latency and much higher capacities. This is only feasible with higher-frequency SA 5G NR and the 3GPP core network architecture for 5G Core (5GC). Companies will be able to link up different factory sites and locations using seamless 5G networks and not rely on using disparate Wi-Fi networks in buildings.

Meeting the needs with automation

One of the problems of delivering coverage and capacity for buildings and complexes is that demand can change drastically. For dense urban environments, hot spots and indoor networks, there is a need to cater for peak usage. This is crucial in sports and entertainment stadiums, where usage may go from zero to 80,000 people very quickly—all on their phones trying to send pictures and videos at the same time. A stadium of this size can generate higher levels of traffic than a city of a million people during major events. Yet it can also stand empty 90 percent of the time.

In offices and shopping malls, data traffic will also have significant peaks and troughs in different locations at varying times. While networks currently have to be planned to cater for maximum fixed demand, anytime, anywhere, automation could make it possible to dynamically change the network so it can adapt to the differing volumes of traffic and demand, across different locations. And it’s not just people with their mobile devices. Networks will also have to adapt to demands from connected machines, systems and IoT devices to communicate.

This is where the introduction of AI-led automation, managed in the cloud, will come into its own. It will be possible to use the same tools, algorithms and network analysis used to plan and design wireless networks to monitor network traffic—and deliver a level of automation to provide optimized configurations in minutes.

Networks doing it for the planet

A vital spin-off from this move to dynamic, self-optimizing networks is the reduction of power consumption. We estimate that in the future, 5G networks may consume up to 10 to 20 percent of the electricity supply in major cities around the world. In these increasingly climate-aware times, this is an important factor to consider. By changing the antenna tilt, power output and frequencies dynamically, cellular networks should automatically be able to adapt to the lowest level of use and therefore the least amount of energy consumption.

And there are other ways 5G can help save energy. One example is that networks could be designed to control Internet-connected thermostats on radiators by identifying people in a room and resetting the heat settings accordingly.

Openness, interoperability and spectrum liberation

2020 will also be the year of increasing interoperability and openness, led by the O-RAN Alliance. The alliance was created to evolve radio access networks and drive the move towards open interfaces, which is rapidly gaining more support and traction. Open interfaces are essential to reduce network deployment costs, enable multi-vendor deployments, stimulate innovation and enable smaller vendors and operators to be part of the growing new 5G ecosystem.

As well as increasing competition and reducing the dominance of the major equipment vendors, open RAN will encourage greater sharing of network infrastructure and equipment, which will in turn mean greater flexibility and reduced costs. The move is currently being driven by the major operators, but it will benefit the whole industry, along with the acceleration of 5G deployment. At the TIP (Telecom Infra Project)

Summit in 2019, Vodafone announced it is putting its entire European footprint, comprising 100,000 mobile sites, up for a possible redesign based on O-RAN technology.

Another open and collaborative initiative expected to grow over the next 12 months is the coming together of operators to deliver both 4G and 5G in rural areas based on shared RAN agreements. Meanwhile, regulators will also play a part in the liberation of more unlicensed spectrum and encourage more AI-enabled collaboration initiatives along with dynamic access and spectrum use.

While people have different views on the future of the cellular and wireless networking industry, the next few years and the decade ahead will certainly have a major impact on how we work and live our lives. It will provide the platform for technology innovation as we rely on an increasingly fully-connected, intelligent world—both indoors and out.