

All about 5G and how to prepare for it...

Everyone is talking about 5G...

but what is 5G really? Until now, new generations of cellular technology, such as 3G or 4G were designed for better spectral efficiency and a better voice or data experience. 3G was UMTS, 4G is LTE (Advanced) but which air interface technology, so called New Radio, will ultimately be developed for 5G? 5G, it seems so far, is the development of multiple technologies that will converge to serve different use cases. One principle aim for 5G will be to provide enhanced mobile broadband enabling extremely high data rates for streaming 4K+ video and downloading of very large files whenever and wherever, in near real time, giving the impression of infinite bandwidth. 5G network architecture will be designed such that latency can be pushed to its physical limits, necessary to enable many new applications and networks such as the Internet of Things (IoT), the self driving car, and the digitalization of the industry such as the concept of Industry 4.0, the smart industry, or the smart city. The Internet of Things, which collects data wirelessly from a large number of connected objects, will provide intelligence to improve processes and increase productivity. Virtually every industry will benefit from IoT applications, such as infrastructure, transportation, oil, gas, and mining, utilities, healthcare, agriculture, retail, insurance, agriculture, logistics, to mention just a few.

Richard V. Womersley, Director Spectrum Consulting, and Saul Friedner, Associate Director Spectrum Services, at LS telcom, answer our diverse questions on 5G and tell us how LS telcom can support industries to fully exploit 5G and IoT to their advantage.

What will be the potential spectrum for 5G and when is 5G due?

Saul Friedner: Bands now being identified for 5G are the 700 MHz, the 3.5 GHz and



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the 26 GHz band as well as other mmWave bands (above 30 GHz). More certainty about their use and availability should be established around 2020. Standardization of 5G will not occur before the WRC 2019. Although, some operators, such as Verizon Wireless or SK Telecom, as well as numerous research institutes are already undertaking trials and planning commercial networks albeit based on pre-standard technology and predominantly focusing on enhanced Mobile Broadband use cases.

LS telcom, for example, has recently become a technology member of the 5G Innovation Centre (5GIC) part of the University of Surrey. As such, we will participate in the latest technology developments for 5G and will be contributing to research, white papers and 5G testing.

What are the major differences of 5G technologies compared to current cellular network technologies?

Richard V. Womersley: There will be an increased densification of sites, especially in heavily populated areas. There will have to be an overhaul of the backhaul and backbone network to support increased data throughput. 5G will depend heavily on modern computing techniques, such as Software Defined Networking (SDN) and Network Function Virtualization (NFV), technologies

which make the behavior of the network devices programmable, and allowing them to be controlled by a central element, as well as Mobile Edge Computing (MEC) and large scale storage at cell sites.

What about changes on the device side?

Saul Friedner: There will be a much greater variety of end-user devices. We need to think beyond the smartphone and supporting ever increasing data rates. There will be connected objects, such as street lamps, and autonomous devices such as self-driving cars, industrial robots, and healthcare implantable devices. There will be many more methods of interaction between devices and networks, which will be self-learning and self-aware. A new ecosystem will emerge with a focus on embedded smart devices, ubiquitously connected that can instantaneously adapt to their environment. Thus, development of these (truly 5G) devices both in terms of the processing capabilities, signaling and highly varying RF environment will pose non-trivial engineering challenges to device and silicon/filtering manufacturers.

5G challenges and actions to take will obviously depend on the different stakeholders.

What are the major challenges for regulators and how can they be overcome?

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Richard V. Womersley: Regulators and regional organizations have to pave the way for 5G with a sound regulatory framework. Access to 5G spectrum and in addition, licensing methods have to be well defined. Spectrum re-farming, for sure, will be on most regulators' 5G agenda.

We can help regulators to prepare for 5G with spectrum licensing and re-farming (for example in the 700 MHz, 3.5 GHz and the 26 GHz bands). We also carry out coexistence and compatibility studies as well as spectrum demand studies. We have recently delivered a report on 5G infrastructure requirements to the UK Government* used to make recommendations on infrastructure investment. Currently we are working on a study for the European Commission on Spectrum Assignment for the EU.**

Regulators will also benefit from our expertise of white space databases and dynamic spectrum access methods.

What about challenges on the network (operators') side and how can they be tackled?

Saul Friedner: The challenges stem from two major issues. One is the "5G-go-round problem". As consumers are expecting vastly faster connections, more infrastructure is required or larger pieces of spectrum to supply the much needed capacity, typically in hot spot areas. The wide bandwidths needed for 5G, though, are only available in frequencies say above 10 GHz. The cell range at frequencies above 10 GHz, again, is quite small and thus more infrastructure is needed to provide the necessary ubiquitous capacity expected from 5G using the higher frequencies. A denser network is also potentially more prone to interference. The second challenge arises from the greater number of different end-user devices as mentioned above and the very many methods of interaction between the devices.

Therefore, 5G networks have to be very carefully and accurately planned to meet the varying performance (Quality of Service) criteria for each of these devices and applications essentially accessing the same network and guarantee technically sound and robust as well as profitable networks.

Richard V. Womersley: LS telcom has planned numerous radio networks of all types and applications all over the world, including cellular, mobile, fixed, broadcasting, V-SAT, SCADA, smart grid and smart metering networks. We also look back on extensive experience of critical communications network planning, where reliability, redundancy as well as economic feasibility are decisive. We can address all steps in the network life cycle, from network design, planning, procurement to implementation as well as measurements, analysis and network optimization.

Technology partnerships with major universities and research institutes and memberships in pioneering industry associations make us a thought leader in the market.

What are typical questions that you can answer?

Richard V. Womersley: We provide spectrum planning and spectrum demand studies as well as technology studies. We answer questions such as 'how much spectrum do I need? How much will I need in the future? What is the best technology for my business case? How many sites are necessary? What are capital expenditure and operational costs?' We also manage tenders, bids, and procurement. As we are vendor independent, we pinpoint the technology mix, which fits best to our customers' business case.

Who else benefits from your solutions?

Saul Friedner: Besides regulators and telecom operators, our solutions can address the challenges within industry associations, device manufacturers (for independent studies and feasibility), particularly the vertical markets and vertical sector associations (such as ERA, EUTC, ACEA) who will be accessing these new 5G networks and need to understand how their technical and commercial requirements can be adequately fulfilled.

Digitalization will generate new business models in the vertical markets, but it is not their core expertise and many vertical markets are new to the wireless world. What is your specific message to them?

Richard V. Womersley: The network is a core element to the success of digitalizing processes and to higher productivity.

We can help vertical markets define the underlying network requirements for their digital strategy and provide them with the necessary hard facts on the network side, defining and delivering the technical parameters, capital expenditure and operational costs. The vertical markets will need this support to finalize their business case for digitalization. They can count on us for the best network solution for their industry-specific processes.

We also establish the timeframe for digitalization, with all the necessary steps from planning, design, requirements analysis, procurement, and transition period to final operation.

**further info:*

<https://www.gov.uk/government/publications/connected-future>

***further info:*

<https://ec.europa.eu/digital-single-market/en/news/study-spectrum-assignment-eu-smart-20160019>

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