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experience

5G Boosting Operator Business

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A pressing concern for many operators is to identify what 5G means for the existing business in the immediate future. Smart deployment of 5G can relieve LTE capacity issues in high-traffic areas. The 5G impact on existing business is limited by both the consumer terminals and the coverage of the spectrum band planned for first deployment. Omnitele offers quick and precise insights on how to make the right decisions regarding 5G.

Introduction

5G, the fifth generation of mobile network technology is close to commercial availability. The auctions for new 5G spectrum bands are being carried out or planned across the globe.

The fourth-generation LTE networks have continued to evolve towards 5G and, in many networks, can provide peak data rates of over 300 Mbit/s in widespread areas. However, the amount of suitable spectrum bandwidth capacity for LTE networks is limited, therefore requiring either investment in new network base stations, additional spectrum resources or a new technology to improve the efficiency of spectrum utilisation.

Operators face the challenge of deciding how much to invest into 5G spectrum, and when to deploy 5G in the network. With intelligent network analytics, operators can identify when 5G provides better cost-efficiency compared to LTE and how much they still need to invest in LTE networks in the near future to satisfy the increasing data demand of their customers.

Biggest Changes

In terms of technology development, 5G compared to 4G LTE is more an evolution step than a revolution of wireless communication. The primary method of transmitting symbols on electromagnetic frequency waves remains the same as in 4G. However, there are multiple advancements that improve the spectral efficiency and the quality of service of the next generation mobile networks.

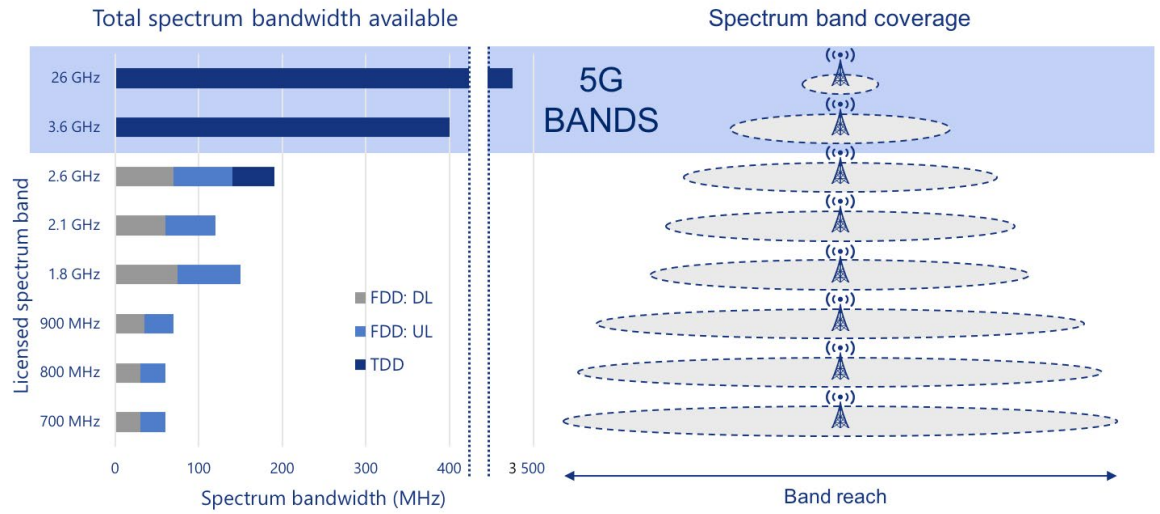
Amount of spectrum – much more capacity available in hot spots

5G will enable the use of higher spectrum bands, where there is much more spectrum bandwidth available. Typically, the higher the band, the more bandwidth available. In many mature markets, new 5G spectrum bands can effectively multiply the spectrum that is used to transmit data to customers. The drawback is that higher spectrum bands provide weaker coverage because the signal strength will attenuate faster in higher frequencies. The ideal use cases for higher bands are in hotspot locations where there is plenty of customer traffic demand in a relatively small area.

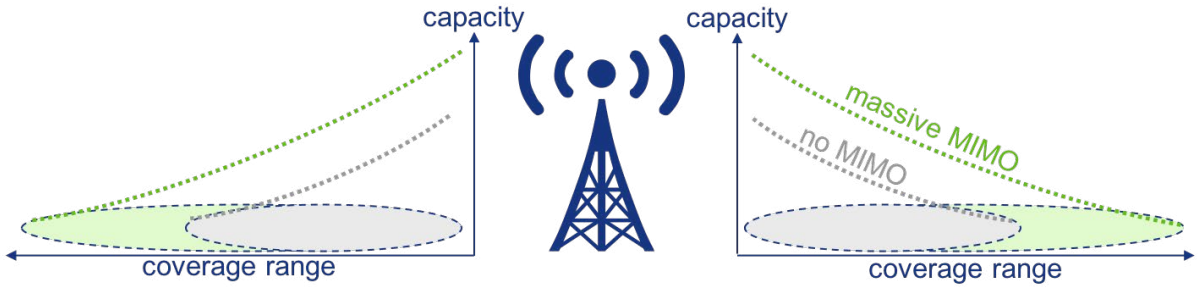
The initial 5G network deployment in many countries will be on the 3.4 to 3.8 GHz spectrum range (3.6 GHz). The first allocations of the band have already been carried out and several regulations authorities are preparing to auction or allocate the spectrum band to operators still in 2018. In total, there is 200 – 400 MHz of spectrum to be allocated to operators, much more than on any LTE band. On the 26 GHz band, over 3 GHz of bandwidth is expected to be available at a later time. Due to the higher frequency compared to existing mobile network frequencies, the first 5G band is not able provide comparable coverage to existing LTE networks.

Massive MIMO – advanced antenna systems improve coverage and capacity

With the high-band 5G frequencies, the spectrum efficiency can be improved with further evolved antenna systems, i.e., massive MIMO systems. Several parallel antenna streams can be used to increase coverage through transmit diversity, or improve spectral efficiency with spatial multiplexing for higher data rates. Transmit diversity, i.e. sending the same information in different streams can strengthen the signal at the receiver, thus improving the coverage. Spatial multiplexing, i.e. sending different information in different antenna streams will fit more data in the air, improving the spectral efficiency.



Typical mobile broadband spectrum bands



Massive MIMO improves coverage and capacity

The practical limitations for increasing spectral efficiency with massive MIMO deployment arise from the used frequencies. The lower the spectrum band, the more physical separation between antenna elements is needed in both transmitter and receiver. With the currently used LTE spectrum, and the physical end-user device size limitations the spatial multiplexing is limited by the receive antennas that can be fitted in the end-user devices. Typically, smartphones have 2 receive antennas, with some models having been fitted with 4 receive antennas. With higher 5G spectrum bands, more antennas can be fitted in the end-user devices to improve spectral efficiency. On the network side, antenna systems ranging from 8 to 64 elements are expected to be available for network operators in the 3.6 GHz band. Effectively, the advanced massive MIMO antenna systems can improve the 5G downlink coverage to similar levels as the higher LTE bands.

Network slicing – opening new revenue streams

5G allows reserving spectrum capacity for specific customer groups' use, a dedicated network slice. This allows tailoring the connectivity to the specific needs of a customer group. The dedicated network slice is not impacted by the capacity concerns of the consumer network, thus being more resilient and can guarantee a level of service quality for certain use.

However, the more resources are reserved for the dedicated network slices, the less capacity is available for the consumers. Moreover, the network slice may require extra bandwidth to guard it from interference from other communications on the adjacent spectrum. Therefore, the most lucrative use cases for network slicing could be user groups with small bandwidth requirement but e.g. low-latency communication needs.

5G Devices

It is expected that the first commercial devices with 5G support will be available during 2019, although the two biggest manufacturers, Apple and Samsung, have been quiet about their plans. The first devices will likely be in the high-end category, therefore limiting the 5G penetration development in many markets. The more affordable 5G devices are expected to be available to consumers from 2020.

Operator View

There are several motivation factors behind 5G development. The key drivers for operators to deploy 5G include the marketing power of new technology, potential new revenue sources from new customer segments and the additional capacity provided to existing customer base by new 5G spectrum and technology.

On one hand, 5G has the potential to increase the available peak data rates and decrease the latency of connections notably. On the other hand, the demand for data rates above 1 000 megabits per second or latencies below 1 millisecond is dependent on the uptake of new 5G-enabled services.

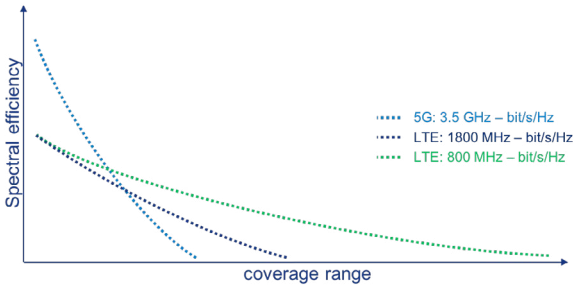
The more pressing concern for many operators is to identify what 5G means for the existing business in the immediate future. Smart deployment of 5G can relieve LTE capacity issues in high-traffic areas. However, the 5G impact on existing business is limited by both the consumer terminals and the coverage of the spectrum band planned for the first deployments.

To maximise the 5G deployment impact, careful planning of appropriate deployment locations is needed. A de-

tailed assessment is needed for all cells and potential geographical locations, on how big benefit 5G would bring in comparison to the cost and alternative solutions.

Predictive Analytics for 5G

Omnitele has been developing predictive network analytics for several years, starting already in the 3G era before LTE deployment. A key component is the Quality-Return-on-Investment (QROI) model, which predicts the impact of different network actions on the experienced technical quality. Predicting the achievable impact is based on the unique characteristics of each network sector, including the distribution of quality, customers, loading and the underlying spectrum configuration.

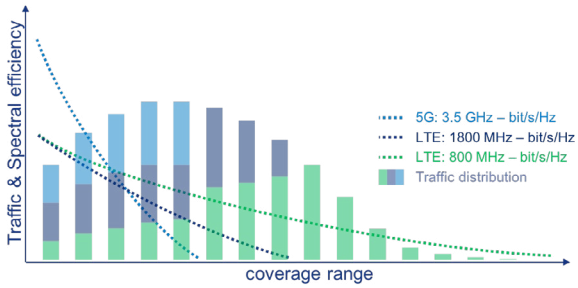


5G coverage reach is limited

The QROI model can be used to accurately quantify the quality impact of different network expansions in each sector, providing valuable information to support the investment decision making. The QROI analytics can be applied for different purposes, including:

- estimating the required investment level to reach a certain network quality target level,
- planning the investments to maximise the quality impact on the customer base or a selected customer segment
- identifying the first 5G deployment locations, where 5G will have a notable impact on customer experience,
- quantifying the impact on consumer quality from reserving spectrum resources for a separate dedicated network slice, and
- identifying how much the operator should continue investing in LTE in the coming years by comparing the cost-efficiency of LTE and 5G in the near future.

It is often the most cost-efficient to deploy 5G in existing site locations, to save in site acquisition and infrastructure deployments. Although 5G can provide significant boost to achievable data rates, the impact varies from location to location depending on the unique sector fingerprint. With intelligent network data analytics, the impact can be quantified using available network performance monitoring data.



Assessing the 5G reach and traffic migration

In locations where deployment in existing site locations does not provide adequate reach, additional information sources are needed to estimate the suitability of 5G for e.g. small cell deployment. Crowdsourced measurements and intelligent network probes can be used to identify locations where a tailored network solution is needed.

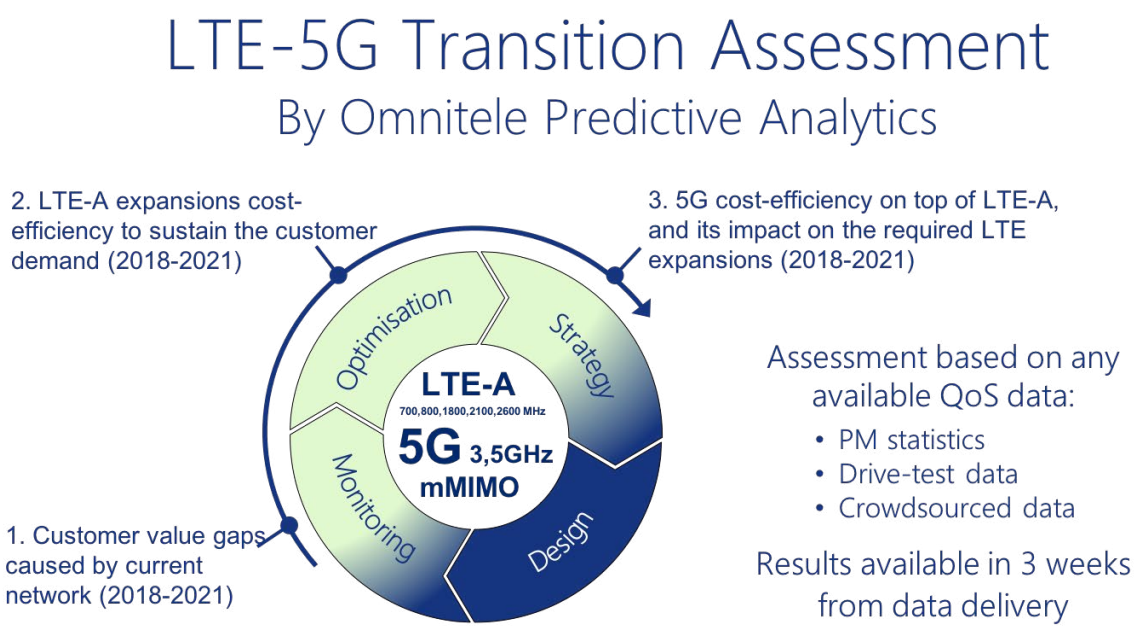
Operators possess the needed data to assess the impact of 5G deployment. Network statistics provide an accurate way of assessing the impact that 5G can have on existing customers. Crowdsourced or well-planned measurement campaigns can be used as alternative information sources or to provide additional information to complement the statistics. The key is to utilise the network data analytics to identify the optimal approach to 5G deployment, that best suit the operator's strategic targets.

LTE-5G Transition Assessment

Already now, or at least in the near future, all operators will have to consider their strategy towards possible 5G implementation. Questions like when to start investing in 5G, how much to invest, and how long will it still be profitable to invest in LTE technology, will need to be answered.

To assist you in embarking on your 5G journey, Omnitele offers quick and efficient LTE-5G Transition Assessment Service. The service is based on Omnitele's longstanding experience of applying Predictive Analytics in Network Transformation projects, and centers around quantifying the optimal LTE & LTE-A investments in the coming years, and determining the timing and scale of 5G & mMIMO transition in your network

The analysis required for Omnitele's LTE-5G Transition Assessment can be based on any QoS data readily available. There is furthermore no need for other confidential data.



The LTE-5G Transition Assessment covers the monitoring, optimisation and strategy phases of the technology lifecycle.

As the first step, based on the available QoS data, the assessment starts with a quantified prediction on how the experienced data service quality will deteriorate if no further network investments are made. A degraded data service quality will translate into diminished Customer Value in terms of an increase in undelivered data, lost ARPU and increased Churn

As the next step, the assessment determines the investments in LTE-A technology that would be required in the coming years to cater for the growing customer demands, whilst delivering an adequate level of data service quality and thus Customer Value.

As the third step, the assessment introduces 5G technology on top in order to optimise the overall network ROI levels. The deliverable of this third step is an appraisal on when to introduce 5G, within which spectrum and with what 5G technology solutions, given your network and business context. Furthermore, in this final step we will determine what part of the LTE-A investment may be omitted due to introduction of 5G, while maintaining the set data service quality level.

The figure below illustrates a high level summary of a LTE-5G Transition Assessment for an example network case.