

altran

# **BUILD, OPERATE AND MONETIZE 5G NETWORKS TOGETHER**

5G AND COMPLEMENTARY  
TECHNOLOGIES LIKE EDGE  
COMPUTING WILL BE THE CATALYST  
FOR THE NEXT GENERATION IN DIGITAL  
TRANSFORMATION. ARE YOU READY?





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# INTRODUCTION

5G networks are being rolled out around the world and the pace will accelerate through 2019 and into 2020. Unlike previous generations of cellular communications, 5G is a game changer for both consumer and business applications. Together with a host of other technologies—Control and User Plane Separation of EPC nodes (CUPS) architecture enabling Multi-Access Edge Computing (MEC), network slicing, 5G NR using ultra-low latency, millimeter wave supporting high throughput and capacity, microservices-based core—the new wireless network standard will deliver higher speed, more bandwidth, lower latency and performance magnitudes better than 4G.

Indeed, 5G is the missing link for the commercialization of emerging technologies like IoT, augmented reality, virtual reality and autonomous transportation. But with expanded capabilities come new challenges for managing the end-to-end 5G network lifecycle.



*We are the partner of choice when it comes to building, operating and monetizing 5G.*

Altran is well positioned to support clients around the world to make the transition to 5G and support their efforts to develop new business solutions. We play a crucial role in:

- Innovating new 5G use cases that span semiconductors, software, security, platform development and operations
- Providing plug-and-play software frameworks for 5G NR and 5G NGC to help speed time-to-market
- Enabling the MEC platform using open-source components
- Consulting for 5G deployments
- Providing system integration for end-to-end 5G network deployment along with applications
- Migrating existing legacy 4G networks to cloud-based, microservices-based architecture for 5G networks
- Hosting 5G core network functions on private, public or hybrid cloud
- Developing value-added solutions to automate network slice creation

# WHAT IS 5G AND IS THE HYPE TO BE TRUSTED?

**There is a lot of hype around 5G, as Communications Service Providers (CSPs) and Network Equipment Providers (NEPs) begin to roll out 5G wireless networks in the US, Asia and Europe. And there are certainly many applications—some not yet conceived of—that will take advantage of 5G’s low latency, performance and bandwidth. Some pundits predict 5G will bring a revolutionary change in concert with complementary technologies such as robotics for industrial use, MEC, Artificial Intelligence (AI), Augmented and Virtual Reality (AR and VR) and IoT that will transform daily life beyond recognition.**

For example, in 2018, Verizon and Nokia tested the transmission of live interactive VR and 4K video streaming over a 5G connection outdoors using Verizon’s millimeter-wave spectrum that reached throughput speeds of 1.8 Gbps with a latency of about 1.5 milliseconds; a level that the brain can barely detect.<sup>[1]</sup>

5G will be the catalyst for advancing the Industry 4.0 revolution, the proliferation of Industrial Internet of Things (IIoT) applications, and enabling a variety of high-bandwidth, almost-real-time communications within enterprises across all industries and all business functions, from R&D to production to supply chain management.

New apps are being developed to take advantage of 5G’s very high bandwidth and very low latency. These include augmented and virtual reality (AR/VR), autonomous driving, 360-degree video streaming, remote surgery, and networks of robots communicating with each other to solve a problem, such as how to pick up an object. These applications require 5G to process massive amounts of data and operate at near-real-time speeds. Also, they require data analytics that is performed by processors at the edge of the network.

[1] The Truth about 5G: What’s coming (and what’s not) in 2019, December 10, 2018, Tom’s Guide, <https://www.tomsguide.com/us/5g-release-date,review-5063.html>

Given all the potential benefits of 5G, it is evident that businesses will be able to increase productivity, for example, of a production line by applying analytics to increase production, improve quality, reduce cost and provide a superior customer experience.

5G is more than a next-generation communication technology; it's a technology revolution. The question isn't if 5G will be transformational, but when.

As we enter 2019, there's a lot of activity across the 5G value chain, from chip makers to equipment makers to service providers that are expected to accelerate as the year progresses. (See Figure 1. The difference between 4G and 5G.) As with previous generations of mobile networks showed, the business advantage typically goes to the early adopters. There's no reason to doubt that 5G will be any different.

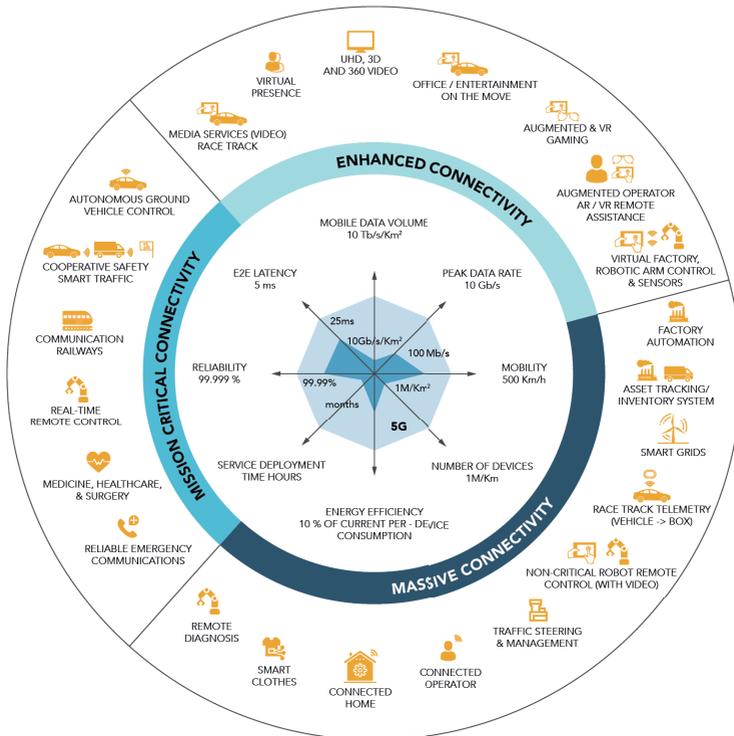


Figure 1: The difference between 4G and 5G

## BUILDING THE TECHNOLOGY

**4G was first introduced in 2010. Today, there are over three billion 4G (LTE) smartphone subscriptions worldwide. Just like previous generations of the wireless technologies, 5G will have its fair share of growing pains and is expected to take years—perhaps a decade or more—before it reaches ubiquitous coverage.<sup>[2]</sup>**

This creates a business challenge for 5G. Because high GHz signals don't carry as far as lower MHz frequency 4G signals, 5G networks require cells to be closer together, which means more cells need to be installed. This adds to infrastructure cost, which is ultimately passed down to the customer. How service providers structure the service fees for their customers will determine the speed of adoption of the new 5G service.

The good news is that 5G networks are under construction as CSPs ramp up deployment plans. While China and the US are leading the rollout, all major service providers around the world are planning to deploy 5G by 2020, some more rapidly than others.

Korea debuted 5G at the PyeongChang Winter Olympics in February 2018, before the 3GPP 5G standard had even been finalized. Later in the year, 5G pilot installations started to appear. In the US, Verizon has trials in 12 regions and is planning to launch two more. AT&T plans to deploy millimeter-wave 5G networks and T-Mobile US is deploying 600 MHz 5G networks. Service providers in France, Germany, the UK and elsewhere in Europe are ramping up 5G rollouts as well.

[2] Statista, <https://www.statista.com/chart/9604/5g-subscription-forecast/>

Some service providers are planning rollouts with 5G NSA (nonstandalone). This solution provides 5G access for high bandwidth data with a 4G Core network . Using this mode, 5G can be rolled out without having to rearchitect the core network. This enables application developers to take advantage of 5G technology without requiring service providers to make major investments now. Once there is a critical mass of 5G user and a viable market for new apps has been established, then service providers can roll out 5G SA (standalone) networks.

US and European service providers are planning 5G NSA rollouts in 2020 while South Korean and Chinese service providers are planning 5G SA rollouts. Fully functional 5G SA is likely to be available by the end of 2020 or early 2021.

Component and equipment companies are ramping up their 5G solutions too. In late 2018, Qualcomm announced details of its next-generation CPU, the Snapdragon 855, which includes a 5G modem that is expected to be the processor-of-choice for many smartphone companies. Apple has indicated it plans to wait until 2020 to release its 5G phone, while others including Samsung, will debut 5G-ready phones in 2019.

All the leading NEPs and CSPs, including Huawei, AT&T, Broadcom, Cisco, Ericsson, NEC, Nokia and others are introducing 5G equipment and services. Ericsson, for example, is delivering wireless access networks and core networks. The company has signed agreements with telecommunication operators in the US, Europe and Asia to trial its 5G-ready equipment. Similarly, Cisco is supplying CSPs with 5G infrastructure and is introducing a 5G security architecture using artificial intelligence to lower the time-to-detection of a security threat.<sup>[3]</sup>

[3] [https://www.greyb.com/companies-working-on-5g-technology/#Cisco\\_Systems\\_US](https://www.greyb.com/companies-working-on-5g-technology/#Cisco_Systems_US)

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## Monetizing 5G: the rollout may cost more than use cases will generate

5G is hands-down superior to 4G and over time will displace 4G. However, the speed of development depends in part on new use cases that will drive demand for 5G service. The explosive growth of IoT networks for industrial applications and autonomous vehicles is a powerful market trend that has the potential to accelerate the pace of the 5G build out.

Still, CSPs must continue to invest in maintaining and upgrading their existing 4G infrastructure even as the balance between 5G and 4G spending shift in the coming years. McKinsey & Co. projects that between 2020 and 2025, CSPs will spend an increasing percentage of their infrastructure budgets on 5G as they densify their networks through additional investments in macro sites, small cells and the 5G layer.<sup>[4]</sup>

- Low-band: Less than 1 GHz spectrum
- Mid-band: 1 to 6 GHz spectrum
- High-band also called millimeter wave: Greater than 24 GHz  
High-band also called millimeter wave: Greater than 24 GHz

Some operators are proposing 5G services in all three bands. However, China and India are proposing to offer services in mid-band as are some European operators. The US and Canada are offering services for 5G either in low-band or high-band. Typically, low-band is used for extending the coverage area and high-band is used for extending capacity.

High-band cannot penetrate buildings very easily, so an alternative is to offer 5G using small cells. In enterprises, 5G requires high bandwidth, so high-band is a good option. Consequently, operators are planning to install multiple small cells in high-band with massive MIMO antennas placed so there will be minimal interference between adjacent cells. This solution provides high bandwidth for enterprise users as well as better coverage.

[4] McKinsey & Co. <https://www.mckinsey.com/industries/telecommunications/our-insights/the-road-to-5g-the-inevitable-growth-of-infrastructure-cost>

In many enterprises, broadband connections are provided through Wi-Fi. Since Wi-Fi is unlicensed, there is the possibility of interference causing degradation of available bandwidth. To provide reliable, cost-effective broadband connectivity, enterprises are considering 5G over CBRS band.

5G can provide much higher uplink data throughput than 4G. In industrial enterprises, 5G can be used for use cases that require transferring high-quality images; for example, for monitoring a production line, where images are captured and sent via 5G to a private network for video analytics to verify the quality of the production line.

3GPP has defined the 5G architecture as a service-based architecture and all core network elements can be deployed as microservices. This allows for easy scaling, the addition of new services and network resource optimization, which delivers capex benefits to network operators. Network slicing provides the ability to define multiple slices for different resource requirements. For example, 5G networks can be deployed as slices in datacenters that allow auto-scaling based on capacity. Data can flow through software-defined networks to ensure they use network resources optimally.



## *Build the road, see the future; Altran offers end-to-end tactics to build the network needed to achieve your 5G goals*

5G advancements can be divided into two categories:

- Application-centric performance
  - a. Network slicing enables higher capacity and supports applications at the edge of the network via MEC
  - b. The C-RAN solution moves compute to the edge enabling low-latency applications
- Network agility
  - a. Improves the management and efficiency of network infrastructure and platform components
  - b. Leverages network function virtualization (NFV) based architectures, stateless solutions and software-defined networking (SDN) based routing resulting in an agile network that enables high bandwidth and elastic scaling

Getting the most out of new technology—especially a foundational technology like 5G—requires capabilities and skills to design, build and field the equipment, maintain and grow the network, and reap the benefits of the investment by developing innovative products and services.

Altran has the expertise to deliver cutting-edge 5G solutions and complementary MEC services that meet the needs of NEPs, CSPs and market-leading industrial companies. Our customers are looking to leverage the new wireless standard to grow their networks and increase market share with new use cases across multiple verticals—some not even yet imagined.

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## Delivering Value

Altran provides 5G services and capabilities that deliver value to our customers and address pain points by:

- Delivering high throughput for users requiring high capacity
- Revolutionizing the way, we use broadcast, including TV broadcast, which will shift to 5G as a communications platform for interactive TV
- Providing a common technology to support connectivity for various applications such as home automation, agriculture, industrial, healthcare, robotics and connected vehicles. For instance, in one agricultural application, drones could be used to collect analytics from the soil and use it to manage irrigation and fertilizer needs
- Delivering low latency and ultra-low latency AR/VR applications including advanced gaming, such as drone racing
- Enabling better healthcare solutions such as remote surgery performed by doctors hundreds of miles away from the operating room
- Improving the customer experience of sports events with 360-degree viewing that includes multiple views of critical plays

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## Scaling IoT

Altran ensures 5G will be an important factor for CSPs to scale the adoption of IoT by:

- Offering highly scalable virtualized core for creating large scale network
- Predicting resource usage of IoT devices that have very different resource requirements based on the type of service used by the devices
- Tuning the radio resource so IoT devices that require high uplink data transfer and lower downlink data transfer can upload video streams



# 5G FOR ENTERPRISES

Enterprises will benefit significantly from 5G to connect their devices. This enhanced capability applies especially to enterprises that rely on human labor to monitor equipment or collect data using sensors or smart meters in applications such as oil pipelines, mines and farms. By deploying 5G, upskilling their workforces and updating the technology used to collect, monitor and take action they can dramatically improve performance and lower costs.

To ensure network security and prevent data leaks, Altran can set up private 5G connections that leverage common 5G infrastructure and uses a slice of the network. Security of networks of connected cars will benefit from 5G's low latency. In the future, the adoption of entirely autonomous vehicles will be able to leverage 5G to decentralize processing.

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## Engineering next-generation infrastructure

The Altran 5G offering enables CSPs to fast-track their next-generation 5G product roadmaps.

We understand that 5G deployments vary widely, from sub-6 GHz band for mobility to the 20-plus GHz microwave bands for fixed usage outdoors; and from low-throughput applications, such as infrequent data transmitted from a network of IoT devices to very-high-throughput applications such as video surveillance cameras and streaming live audio and video.

Of course, one architecture does not fit all applications, which is why Altran created an offering that can be deployed for a variety of use cases with equal ease. By developing a 5G solution that enables the implementation of 5G-dependent business cases, CSPs can deploy new services rapidly and leapfrog competitors.

The Altran 5G-ready offering for 5G NR, 5G Core and Slice manager are designed to deliver next-generation 5G deployments based on a virtualized, scalable architecture. We can deliver multiple services that serve a variety of applications simultaneously. This approach leads to the optimal use of resources and accelerated deployments. Services can be offered in a phased approach in different geographies.

Altran solutions leverage MEC technology for low-latency in industrial IoT and autonomous driving applications. This allows operators to offer both data connectivity and 5G service to application vendors so that they can monetize both the applications and their usage.

Whether it is for 5G NR, 5G NGC, solutions to automate network-slice creation, mobile network edge, IoT edge, enterprise edge or device edge, Altran can help build the end-to-end 5G network including access, core, edge compute infrastructure, microservices that can be hosted by CSPs to let IoT application vendors bring next-generation apps and services to market.



Altran has the expertise and experience in many areas that complement 5G:

S. No	Area	Expertise and Experience
1	Cloud	<ul style="list-style-type: none"><li>• NFV Solution Design including VNF Development Integration and Testing</li><li>• SDN Controller Design and Deployment</li></ul>
2	Product Engineering	<ul style="list-style-type: none"><li>• HW and SW product engineering</li></ul>
3	Wireless Solutions	<ul style="list-style-type: none"><li>• Mobile Voice Core and IMS solutions</li><li>• Packet Core Networks</li><li>• Mobile Access and Core - including LTE (4G) and 5G Transition services: Enable transition 4G solution to 5G solution.</li></ul>
4	Networking Solutions	<ul style="list-style-type: none"><li>• L2/L3 Routing and Switching Solutions including MPLS</li><li>• Mobile Backhaul Solutions</li></ul>
5	Applications	<ul style="list-style-type: none"><li>• Application, Network and Operations Security Design and Implementation</li><li>• Advanced Operations Systems Development including Cognitive based Solutions leveraging our AIML expertise</li><li>• IoT Solutions including M2M integration, on-boarding and testing</li></ul>
6	Product Support and Sustenance	<ul style="list-style-type: none"><li>• Product deployment, support, and maintenance services.</li></ul>



# ALTRAN OFFERINGS

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## 5G RAN Offering

The Altran 4G RAN offering has Layer 2 and Layer 3 of eNodeB, which is pre-integrated on hardware offered by various vendors. Altran also offers professional services to create a field-deployable eNodeB for small cells and macro networks for NEMs. Recently, Altran observed an industry trend to move a part of eNodeB to virtual machines (VMs) or local datacenters to better utilize the network usage.

3GPP has devised multiple options to split the 5G NR for C-RAN solutions; each of these has some benefits. Some architectures are beneficial for highly dense areas, such as cities, and some for less dense areas, such as rural areas. Altran is exploring these solutions as there is value for carriers in different deployments to utilize split architectures.

Altran has various options for eNodeB C-RAN solutions and is transforming its eNodeB to comply with 5G NR for these architectures.

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## 5G NGC Offering

Altran has a 4G core offering that is being used by NEMs as a white-label solution and has been successfully deployed in a number of networks. At the same time, carriers are looking to optimize their core networks. In many countries, a common core network serves multiple carriers by slicing the network. This means the core network must be virtualized, so each carrier can scale up and scale down based on their traffic requirements. Both the control plane element and user plane elements need to scale.

The Altran Virtualized Next-generation Core (ViNGC) is highly scalable and enables operators to scale their networks. 3GPP has defined all core network elements to interface using a service-based interface. Altran ViNGC nodes interface with each other using a standard service-based interface. So, a carrier that plans to use the highly interoperable Altran ViNGC solution can use Altran services to interface with another vendor's core network services.

Altran ViNGC core network services are built as microservices that can be deployed on Kubernetes containers. Each microservice interfaces with other microservices using a service-based architecture. Interfacing with legacy network elements that are not using a service-based architecture can be supported using a special Altran inter-networking service that has the following benefits:

- Modular
- Service-based architecture that can be deployed in the cloud
- Available as microservices
- Deployable on containers
- Standard interfaces
- Deployable by carriers for network slicing



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## 5G Core for Network Slicing

Altran is developing a thought-leadership solution for dynamic network slicing based on predefined profiles, using analytics and dynamic feedback to understand the dynamic usage of the network. This allows operators to create multiple slices with the click of a button.

Network slicing enables CSPs to customize each slice to match varied functionality and performance requirements while ensuring a seamless user experience.

An autonomous vehicle relies on V2X (vehicle-to-anything) communication. Low latency is imperative to ensure security in such a system; however, high throughput is not a necessity. On the other hand, a live streaming service watched while the car is in motion requires high throughput and is susceptible to latency. Network slicing can help optimize resources in such a scenario, where both services can be delivered on different virtual network slices over the same common physical network.

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## 5G Core for MEC

The Altran virtualized next-generation core (ViNGC) solution can be used for MEC deployments by providing low-latency applications to offload data locally.

The Altran 5G Core offers all control plane nodes as microservice-based services and can be located in the central cloud. The user plane functions (UPFs) are implemented over the data plane development kit fast-path data plane which can be located at the edge of the cloud for local data offloads. UPFs are chosen based on the geography where the device is located.

Using a microservices architecture, the solution is scalable like any other web service application. This enhances performance and reduces the latency in processing requests from devices. The Altran solution can be used even in a multi-vendor deployment, which enhances time-to-market.

# CONCLUSION

It's time to begin building and monetizing 5G networks that will enable next-gen applications and use cases beyond even the current imagination. New technologies always take time to reach peak adoption, but with a strategic partner like Altran, we'll get you there fast. With end-to-end capabilities for building, maintaining and monetizing 5G, Altran is the partner of choice when it comes to creating tomorrow's low-latency, high capacity network, today.

## Contact us

[marketing@altran.com](mailto:marketing@altran.com)

## About Altran

### **Altran ranks as the undisputed global leader in Engineering and R&D services (ER&D), following its acquisition of Aricent.**

The company offers clients an unmatched value proposition to address their transformation and innovation needs. Altran works alongside its clients, from initial concept through industrialization, to invent the products and services of tomorrow. For over 30 years, the company has provided expertise in aerospace, automotive, defense, energy, finance, life sciences, railway and telecommunications. The Aricent acquisition extends this leadership to semiconductors, digital experience and design innovation. Combined, Altran and Aricent generated revenues of €2.9 billion in 2018, with some 47,000 employees in more than 30 countries.

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