RADCOM

Transitioning from 4G to 5G with RADCOM ACE

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Explosion of 5G

5G technology brings a dramatic change in the communication industry.

There are two main phases of 5G, Non-Standalone (NSA) and Standalone (SA). 5G NSA uses a 5G radio while relying on the same core network used for 4G (with minor updates). On the other hand, 5G SA introduces a new core network. Whilst 4G is NFV or hardware-based, the new Service-based Architecture (SBA) for 5G is fully containerized and cloud-native that comes with multiple benefits such as:

- Automated (such as self-scaling and healing capabilities)
- Dynamic (can launch network slices on-demand)
- Efficient and cost-effective

Today, at least 27 networks across eight territories[1] have fully functioning public 5G SA cloud-native core networks. The main pillars of 5G are:

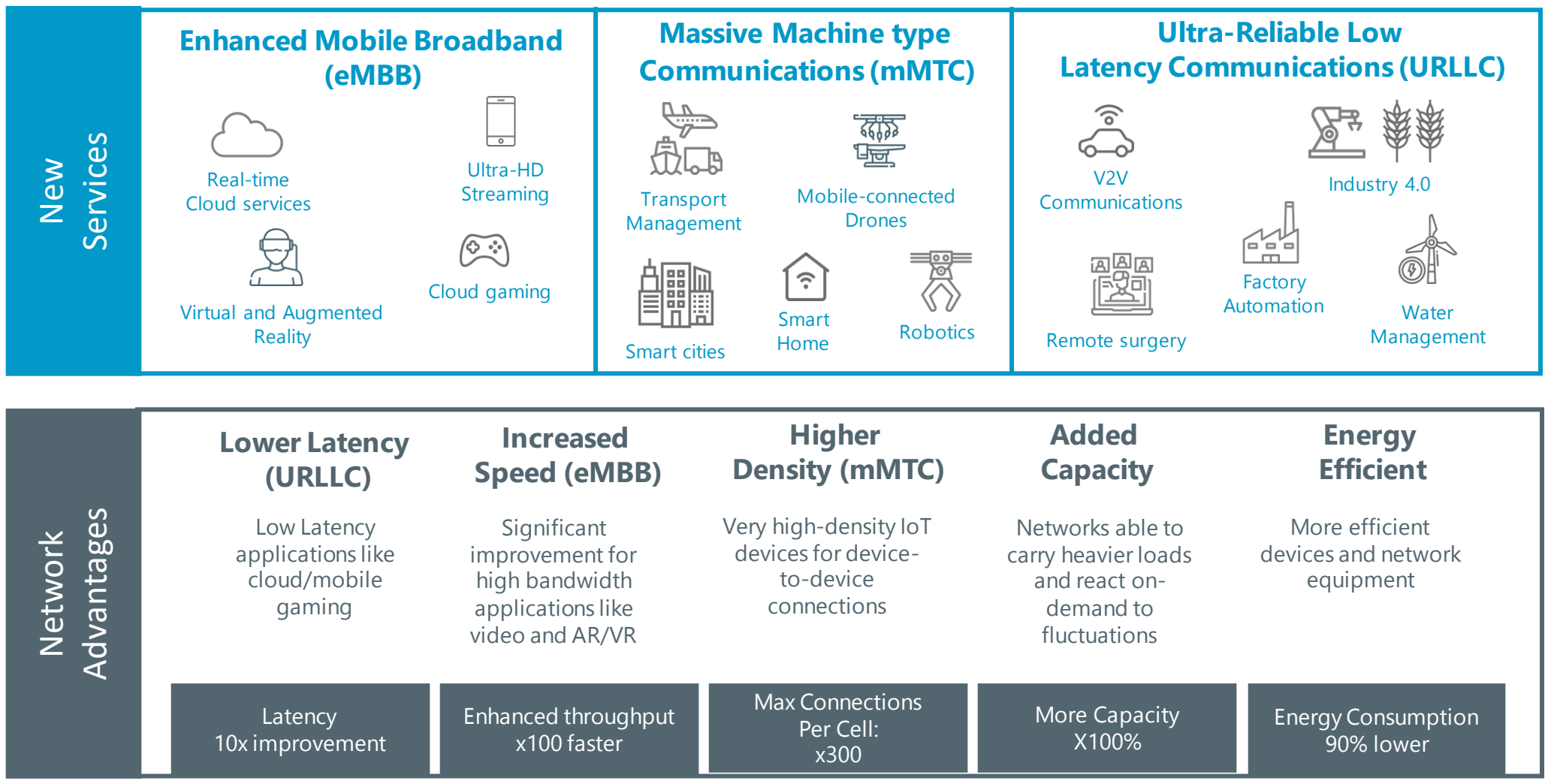


Figure 1 – 5G features and applications

[1] 5G Standalone, June 2022, GSA

Enhanced Mobile Broadband (eMBB)

Providing higher data rates and better coverage for devices that allow for video calling and virtual meetings, 5G networks will one day offer peak data rates of up to 10 Gbps. So far, Verizon 5G Home has demonstrated speeds of 600 to 800 Mbps downlink and 250 Mbps uplink in third-party testing. Regarding data volume, the 5G standard is designed to support up to 10 TB/s/km^2.

Massive Machine Type Communications (mMTC)

mMTC supports a vast number of IoT devices in a small area, therefore, (device density), creating bandwidth capabilities that can handle millions of devices to be connected to the network at any given time. For example, 5G should be able to carry over 1000 times the number of devices per meter as 4G. That is over one million devices per square kilometer.

This will include wearables such as watches, social networking (users having their videos and platforms work at expected speeds from the operators), smart homes, smart cities, health care monitoring, vehicle to infrastructure, and industrial automation.

Ultra-Reliable Low Latency Communications (URLLC)

URLLC enables real-time, mission-critical communications and services such public safety, remote surgery, Vehicle-to-Pedestrian (V2P), Vehicle-to-vehicle (V2V), and Vehicle-to-everything (V2X) communications. This requires operators to build their networks with increasingly lower latency to increase the reliability of communication and avoid accidents. Latency in the world of telecom is the time it takes for information or data to be sent from device A to the network and back from the network to the device. Currently, 4G has a latency of 200 milliseconds. While impressive, 5G comes in at a staggering one millisecond.

Transitioning to a cloud-native 5G core

To understand what makes the transition to a software-controlled network revolutionary, one needs to understand its core attributes. Given that it is a fully cloud-native architecture, it comes with the following advantages:

- Moves away from traditional telecom-style protocol interfaces to allow functions to communicate with one another and share data using a distributed web services model via RESTful-based APIs via HTTP/2. This will make it simpler for an operator to add, remove, or modify network functions from a network processing path (functional agility) and create new service-specific service paths on-demand (service agility).

- Multi-tenancy – being able to use the same computing resource for multiple tenants. This is not only more efficient but also much more cost-effective. Network slicing is such a use case, which is the logical partitioning of a physical network into independent virtual mobile networks.

- Control and User Plane Separation (CUPS) - first introduced in Release 14 and developed in 3GPP, Release 15 Control & User Plane Separation (CUPS) was added to support a more flexible, distributed architecture, with both centralized and edge deployments that will be essential for 5G. This creates a more efficient network but creates challenges for monitoring the customer experience.

- Scalability – Given that network functions are fully virtualized, you have a near-endless scale potential in terms of how much data, storage, or memory resources you can use for your network and services. Assurance needs to be part of this cloud-native environment to scale along with the network.

- Flexibility – Speed and agility are undoubtedly a massive benefit of cloud-native network infrastructure. Whether one needs to fix elements, create updates, or roll out new services, this now takes a few hours or days, as opposed to months or years.

- Efficiency – Not needing to construct and maintain physical transmission networks, the cost of implementing, running, and maintaining cloud-native software is much cheaper and can be performed by leaner engineering teams.

One of the challenges of deploying the 5G network is the O-RAN. It is important to note that the RAN infrastructure is also being virtualized with Open RAN (O-RAN) development. It provides an expanded ecosystem, lower equipment costs, and improved network performance. In order to give a good balance of coverage and speed, 5G RAN will use low, mid, and high-band frequencies.

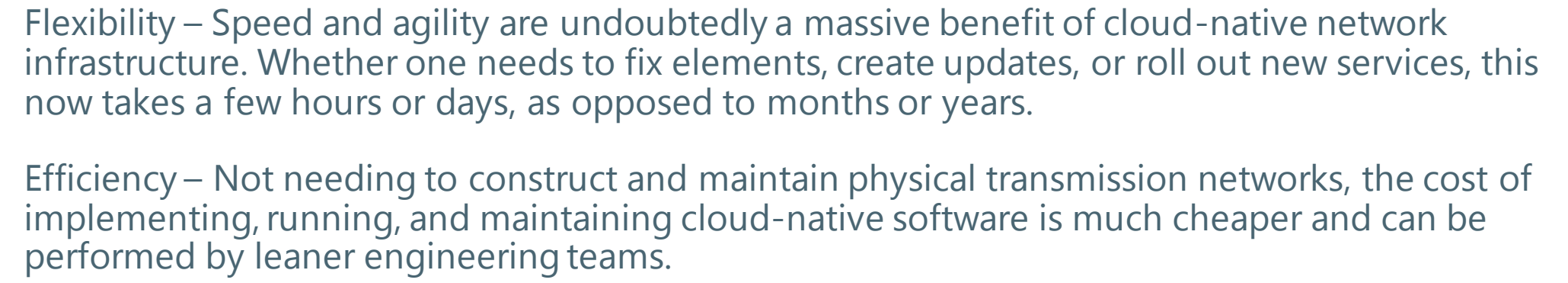


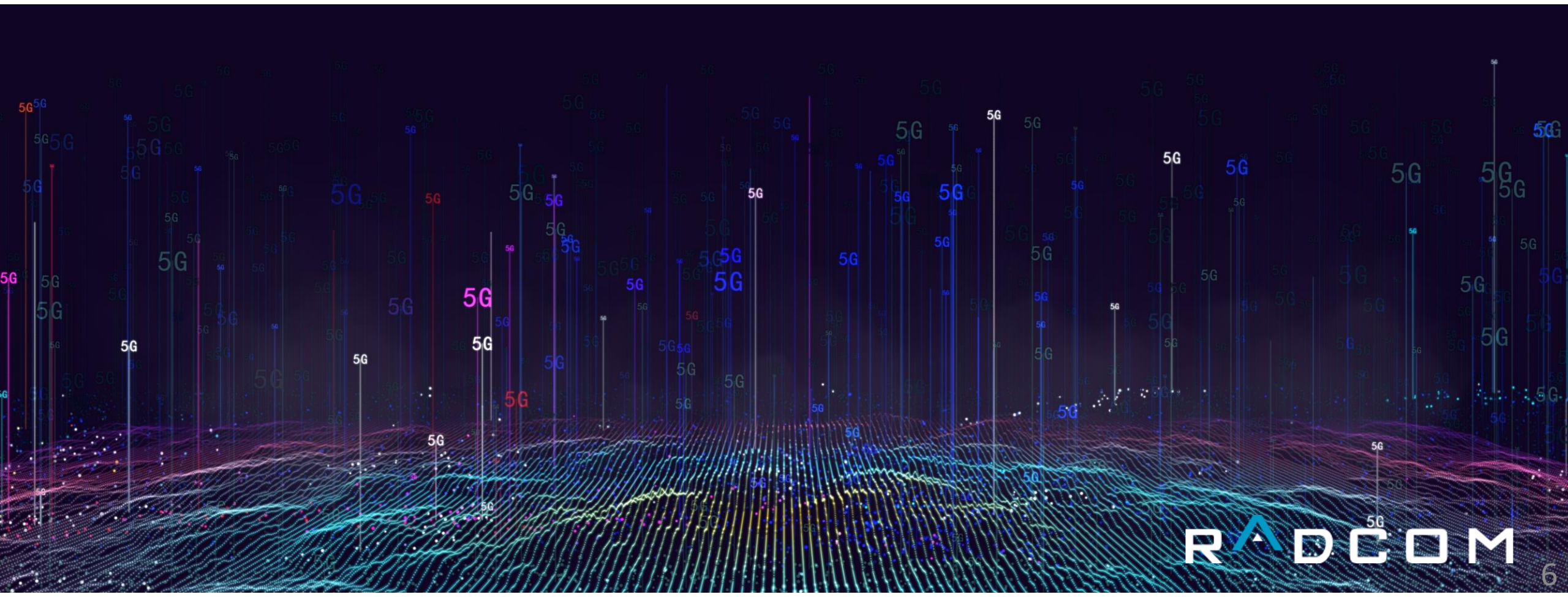
Figure 2 – 5G SA network capabilities

5G implementation challenges

The 5G network architecture is more complex than 4G, with more network functions, complex call flows and hundreds of different messages/packets. Initial data indicates that 5G troubleshooting is approximately 3-5 times more complex than in legacy 4G or 3G networks. However, standalone 5G networks being cloud-native are more dynamic than purely physical networks, making it possible for multiple virtualized functions to change on the fly, which can be a challenge.

Other challenges surrounding the transition to 5G include:

- Gaining visibility across multiple network domains and managing services such as VoLTE and EPS fallback that transverse both 4G NFV and/or physical and 5G (cloud-native networks)
- Deploying new technology, interfaces and protocols in the RAN and Core requires end-to-end visibility and advanced troubleshooting capabilities to ensure performance and service quality
- Previous generations of mobile networks were purpose-built for delivering communications, data services like messaging, or mobile broadband. 5G will enable a vast diversity of services that will need to be monitored in real-time
- The transition to new technology needs to be transparent to the operators' subscribers and deliver excellent customer experiences to guarantee success and build brand loyalty
- Control and User Plane Separation (CUPS) as well as Edge Computing, providing operators with challenges in understanding what is happening in their network at a subscriber level and being able to troubleshoot
- Many operators that are utilizing public cloud providers like Amazon, Google, and Microsoft, that need to manage multiple cloud domains
- Additional levels of encryption and header compression used in 5G protocols, mean that there are challenges in gaining visibility into the customer experience and service quality



The solution: Automated assurance for 5G

For 90% of operators, the 5G rollout is no longer a question of if but when. That is where assurance comes into play. A critical cornerstone of a successful transition to 5G is deploying an automated assurance solution. The solution needs to collect and correlate data from multiple sources (network events, event detail records (EDRs), and network packets) from the RAN to the core, and fully support monitoring 4G, 5G NSA and 5G SA, and have a cloud-native architecture.

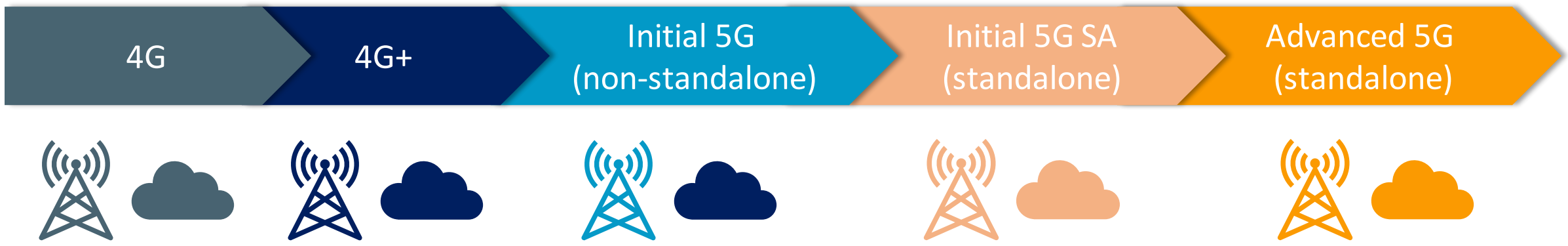


Figure 3 - RADCOM supports 4G, 5G NSA and 5G SA in the same unified solution

RADCOM ACE provides a future-proof assurance solution to help ensure 5G transformation success while offering a significant return on investment. Such a solution can also take data from legacy assurance solutions to extend their lifecycle and maximize past investments.

Operators can gain real-time subscriber analytics by including probe-based data as part of a comprehensive multi-data solution throughout the network. With strong deciphering, decompression, and correlation algorithms, RADCOM ACE correlates the data into user sessions, enabling advanced end-to-end subscriber and network troubleshooting.

Deploying RADCOM ACE at the beginning of the 5G transition is a critical foundation for an operator to ensure a smooth 5G rollout and guarantees that the migration is transparent to subscribers, providing end-to-end visibility into the network performance and customer experience from day one. In addition, RADCOM ACE can Assure the entire 5G network lifecycle from lab to commercial launch as an independent network vendor agnostic auditor that is not tied to specific hardware, to validate equipment deployed in the network and ensure service quality.

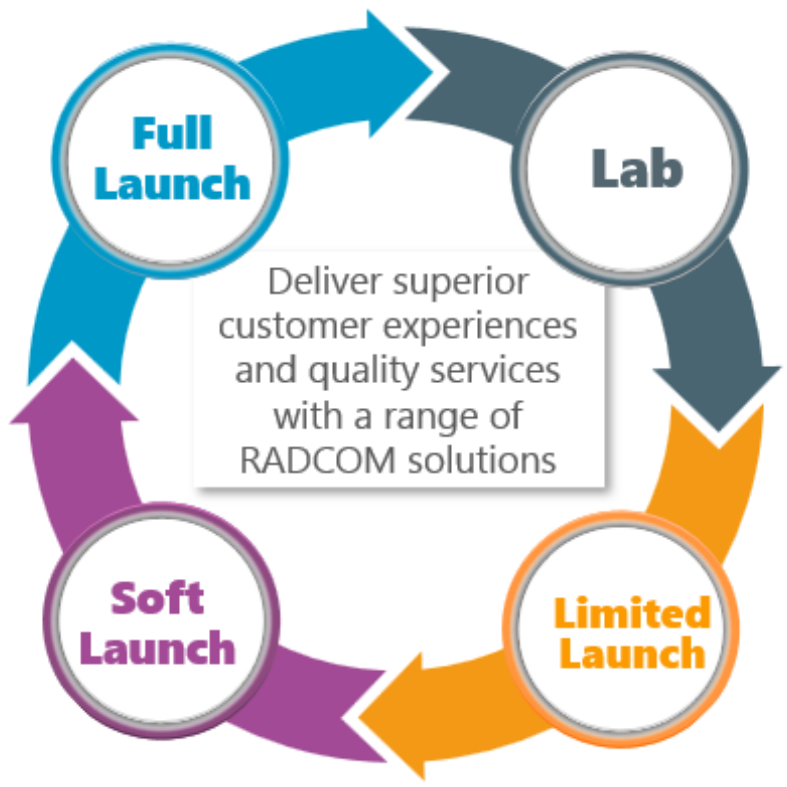


Figure 4 - RADCOM assures the entire 5G network lifecycle from lab to commercial launch

RADCOM ACE monitors the entire 5G network lifecycle from the lab to the full commercial launch and ongoing service rollout:

- Lab - From RAN, core, interoperability, and E2E testing to multi-vendor E2E validation
- Limited Launch – From network performance KPIs to troubleshooting workflows
- Soft Launch – From testing all onboarding of new subscribers, user experience verification, VIP user monitoring (C-Level manager, journalists, etc.) to identifying CEI impacting issues
- Full Commercial Launch – From executive dashboards, user experience KQIs (video streaming, etc.), and subscriber journey validation to automated AI/ML-driven anomaly detection and Predictive Analytics
- NWDAF for automated closed-loop network assurance and optimization

Figure 5 - RADCOM provides a wide range of solutions to ensure the customer experience.

As the operator moves forward in their transition, the same assurance solution must offer AI/ML-based insights to keep pace with all the moving parts and deliver automated network insights after the commercial launch as more traffic is generated and users join the network. RADCOM ACE provides operators with a comprehensive solution that ranges from KPIs, session and packet analysis with drill-down workflows and RADCOM AIM (AI Module) for AI/ML-based insights that include automated anomaly detection and predictive analytics built to automatically help engineers improve the network performance and deliver great experiences to customers.

RADCOM ACE is vendor-agnostic and open, so it can integrate with all 5G Core and RAN vendors while working with all known mirroring and tapping solutions. It can also be integrated with proprietary taps.

With vast amounts of data flying through networks and billions of devices being connected, knowing what is going on is crucial for operators to ensure a smooth customer experience. Whether it is keeping track of abnormal behavior, connections not working correctly, or looking to understand real-time trends in individual slices of your networks, having a cloud-native solution is critical. Today, AI/ML automated solutions can help solve these issues.

It is essential for operators transitioning to 5G to deploy cloud-native assurance solutions, gain visibility into these virtualized networks, and in the long-term, enable automation and take a closed-loop approach to network operations. Being fully containerized means that RADCOM ACE is also cloud-agnostic and can be deployed in private, public, and hybrid cloud environments. As operators roll out more advanced 5G services, this need for assurance will become even more apparent. For example, when dealing with network slicing, multiple virtual slices will co-exist on the same network, and operators will need to know precisely what is happening inside each virtual network to deliver on the committed SLAs. In addition, when dealing with vast amounts of data, it is simply not possible to manage it manually. So that leaves the question, what can be done?

RADCOM ACE is built to tackle these challenges and helps operators maintain a high quality of service for their customers. When looking for end-to-end assurance and an anomaly detection solution, RADCOM ACE provides operators with analytic capabilities and automated root-cause anomaly detection, which lets the operator know what needs fixing and provides a resolution before subscribers' SLAs are affected, essentially providing a closed-loop automated assurance solution.

Benefits of RADCOM ACE:

- Enables you to smartly monitor the journey from 4G to 5G across the entire network lifecycle from lab to full commercial launch
- Samples and filters traffic to smartly and efficiently manage and load balance massive traffic volumes across multiple clouds
- Automates the resolution of network degradation with AI/ML-driven anomaly detection using a closed-loop approach to assurance
- Delivers real-time subscriber analytics so you can understand the customer experience and utilize E2E troubleshooting to ensure service quality
- Provides insights into control and user plane traffic to monitor the entire customer experience from 5G connectivity to video streaming quality
- Extends network visibility to multiple use cases from 5G subscriber onboarding, working from home (for video call quality), Fixed Wireless Access (FWA), to VoNR
- Offers real network efficiency and improvements such as ~30% more efficient 5G SA deployment by proactively assuring the network
- A field-proven solution for 4G and 5G SA with successful deployments in Tier 1 operators like AT&T, DISH, Rakuten Mobile, and Telefónica

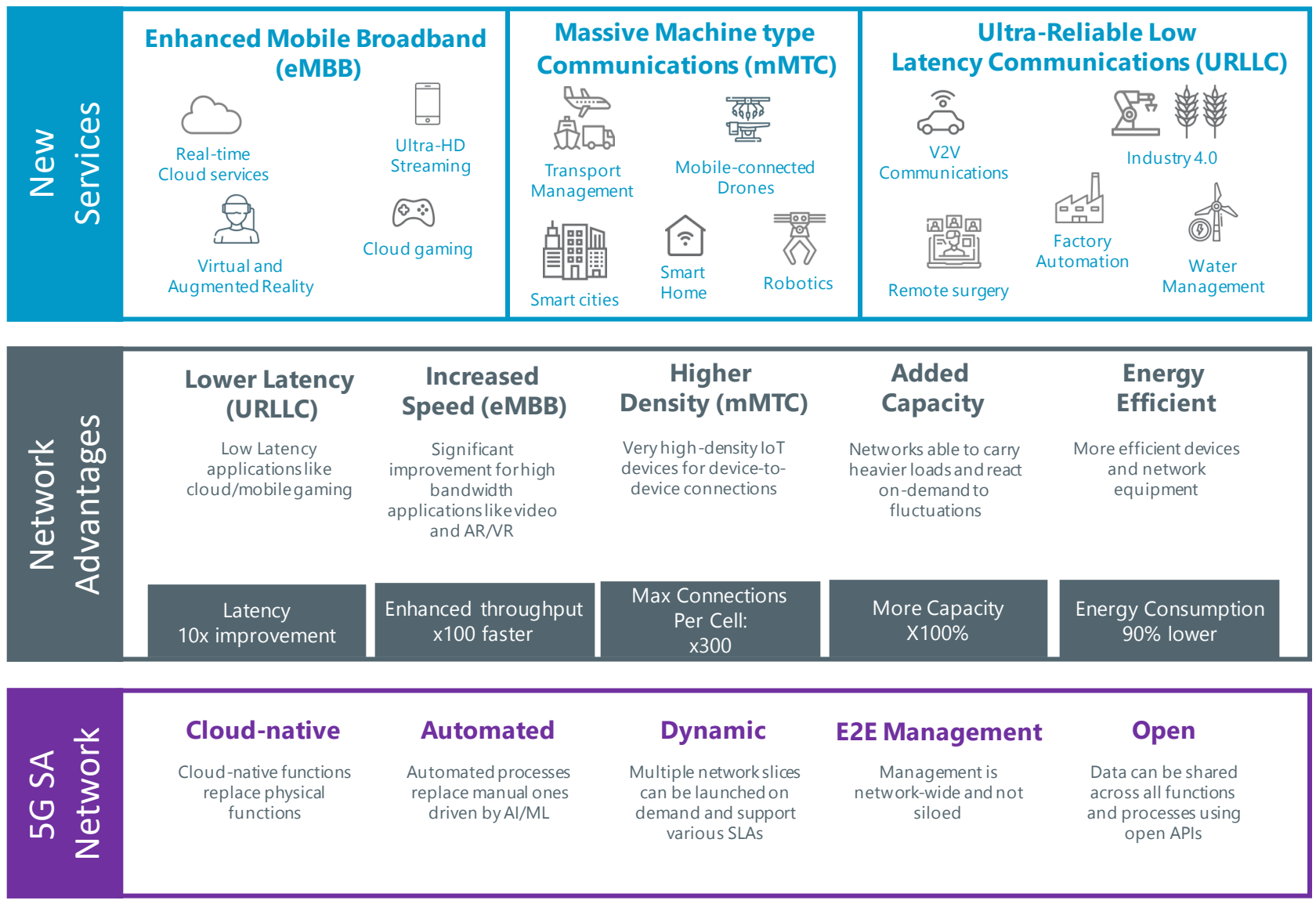


Figure 6 – 5G infrastructure and use cases

The solution: NWDAF for Closed-Loop Automation

Network Data Analytics Function (NWDAF) is a new Network Function (NF) introduced as part of the 3GPP standards for the 5G Core (5GC). It's a network analytics capability built into the general framework of the network architecture for enabling closed-loop use cases that automatically detect, predict and resolve network issues as well as improve network optimization.

RADCOM NWDAF:

RADCOM NWDAF introduces a new level of intelligence to the 5G network by combining end-to-end analytics, AI, and its seamless integration into the Operations, Administration, and Management (OAM) function to automate network operations. This closed-loop automation is essential for guaranteeing QoS and QoE while ensuring network performance, resource management, and operational savings.

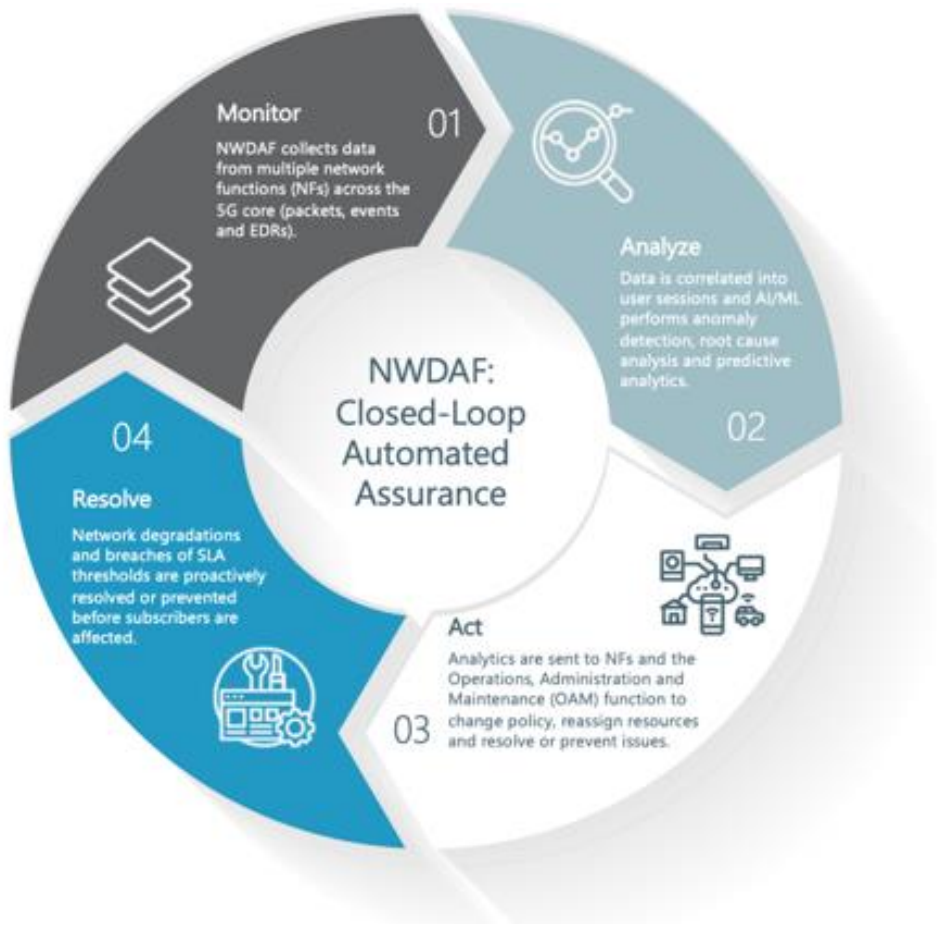


Figure 7 – Closed-loop automation using RADCOM NWDAF

RADCOM NWDAF acts as the conductor that ensures that all services and network functions work in unison to deliver a quality experience to the subscriber. In addition, with auto-discovery functions built-in to RADCOM NWDAF, new network functions and services can be tested and monitored as they roll out.

RADCOM can provide the following NWDAF options to operators:

1. A 3GPP-defined NWDAF that includes standard APIs and network interfaces. This option covers all the use cases defined in Rel. 15, 16, and 17.
2. An extended NWDAF solution beyond the standards that includes additional interfaces for closing the loop and optional probe data ingestion. This option adds proprietary use cases in addition to the 3GPP-defined ones.

For more information on NWDAF and its applicable use cases, please click here.

Summary

It is essential for operators transitioning to 5G to deploy cloud-native automated assurance solutions, in order to gain visibility into the network from the RAN to the Core, and gain insights that enable automation, so that operators can transition to a closed-loop approach to network operations.

By including probe-based data as part of their assurance deployment, operators gain real-time subscriber analytics that provides an understanding of their customers' real-life experience of the network, as well as advanced troubleshooting and optimization capabilities that are vital when deploying new network technologies. Furthermore, when deploying assurance at the beginning of the 5G transition, the operator can ensure a smooth network rollout and smartly monitor the entire network lifecycle from lab to commercial launch, ensuring service quality and deliver great 5G customer experiences from day one.

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