5G standalone: Lessons learned and the path forward

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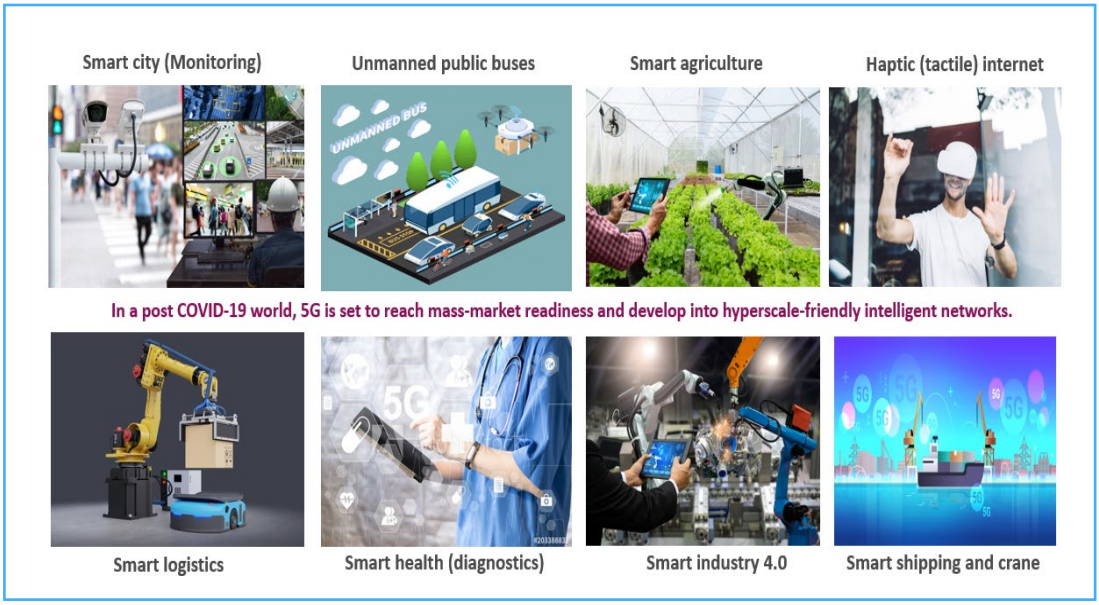
Introduction: CSPs must take advantage of the ever-expanding 5G ecosystem

"5G will be the miracle and game-changer" was the buzz phrase several years ago. CSPs, which were first out of the gate to deploy 5G for unique use cases and wanted to win the race, experienced only bitter lessons, and are still waiting for a return on their million-dollar investments in the so-called "5G-ready transport network." In the first phase of 5G, CSPs' focus was to win the competitive 5G regional race by powering on 5G services based on and leveraging on LTE (4G) RAN, transport, and core network capabilities.

5G standalone (SA) proves costly as compared to 5G non-standalone (NSA) implementations because it is no longer leveraging on CSPs' existing 4G network infrastructure and demands a lot of extensive effort in building dedicated and robust end-to-end network solution architecture. In a post-COVID-19 world, 5G is set to reach and penetrate deeply into mass-market readiness and develop into hyperscale -friendly, smart, and intelligent network. CSPs now must take advantage of the ever-expanding and growing 5G ecosystem. As shown in the exhibit below, smart, and intelligent revenue-generating use cases are gaining traction and faster market adoption as compared to old and conventional use cases. One converged unified and open network with end-to-end network slicing for low latency intelligent and smart services is the basic requirement. Haptic (Tactile) internet, smart logistics, smart crane, and smart hospitals are some good examples where stringent SLAs are required for delivering best user experience.

Exhibit 1: Cross-industry verticals are major drivers for 5G (SA) standalone adoption



After the release of 3GPP Rel.16 and 17, CSPs are now busy trying to take advantage of the developing and expanding 5G ecosystem. CSPs are targeting areas that are switching from massive deployments of consumer eMBB, and (FWA) fixed wireless access use cases to enterprise business vertical use cases and its implementations.

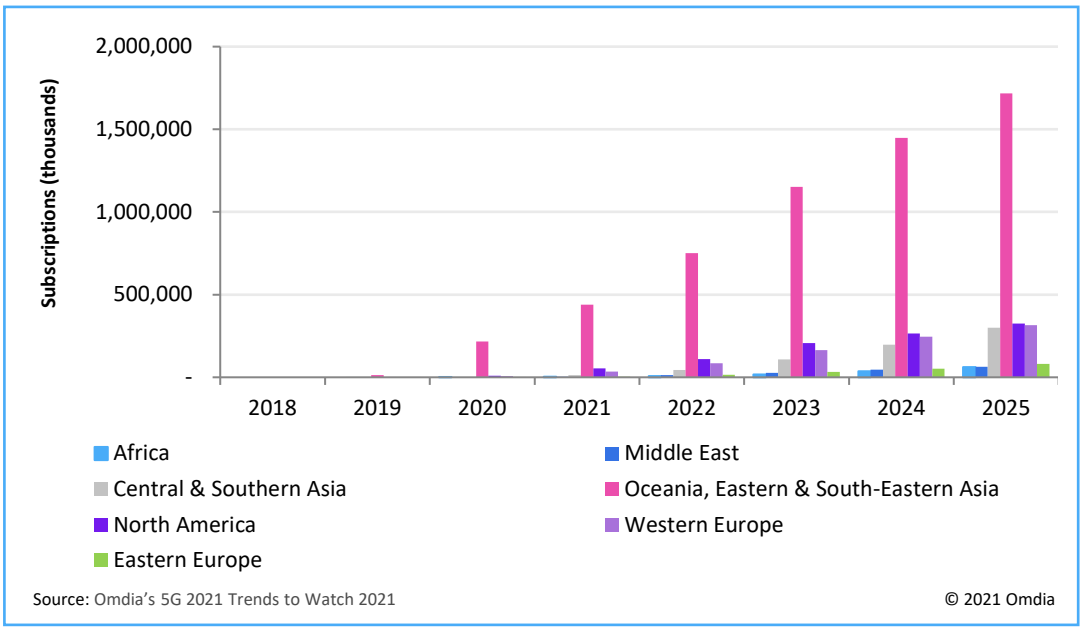
Major topics of discussion revolve around these important questions:

- How to do the network design transformation for 5G standalone architecture implementation?
- How will network orchestration and closed loop automation be unleashed through service assurance and data analytics?
- How to successfully meet the service requirements of future innovative and latency sensitive use cases?

Omdia's view: 5G (SA) is ready for mass-market adoption

According to Omdia's latest *5G 2021 Trends to Watch* report, globally 5G will reach 553m subscriptions in 2021. 5G networks will also facilitate the commercial adoption of 5G in B2B and B2B2x markets. Despite the COVID-19 pandemic, CSPs started initial discussions of massive 5G deployments in 2020, but the bulk of 5G (SA) deployments and 5G-driven edge deployments will be seen in 2021. New 5G core and network slicing will move from test beds to commercial deployments.

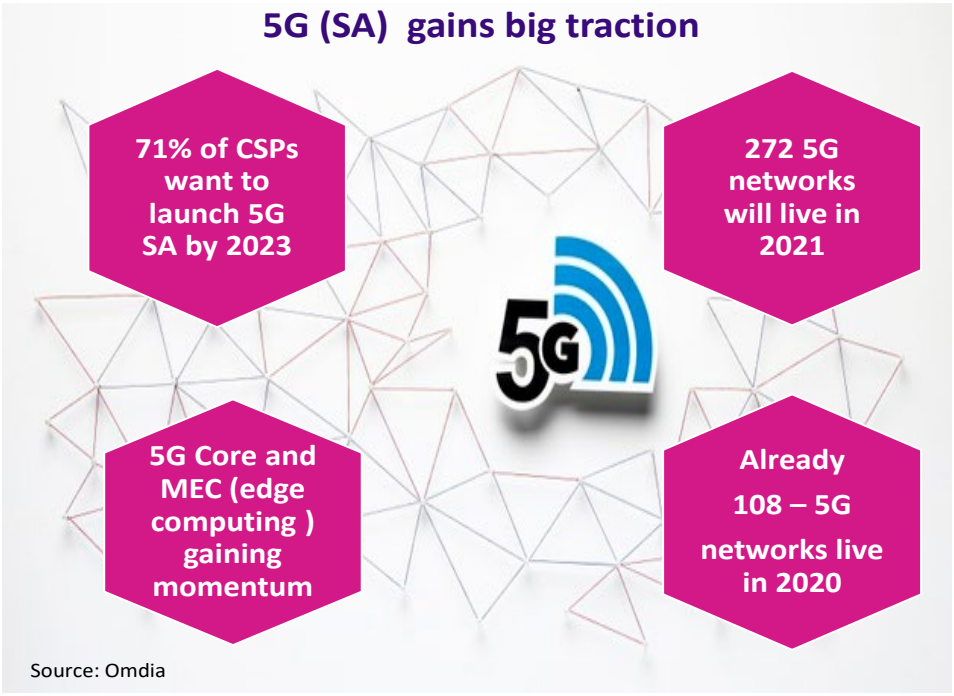
Exhibit 2: Cross – global and regional 5G connection forecast 2018–25



Source Omdia's 5G 2021 Trends to Watch 2021 report.

As shown in the exhibit below, 5G (SA) is ready for mass-market adoption with 71% of CSPs wanting to launch standalone architecture by 2023 and around 272 5G networks will be live by end of 2021.

Exhibit 3: 5G standalone architecture is ready for mass-market adoption.



Source: Omdia

Stringent service delivery requirements for 5G (SA) RAN, transport and core network with network analytics requires fundamental change in the network architecture and basis for monetizing the multitude of 5G backed opportunities.

Omdia's main observations and views for the 5G (SA) era:

- **5G commercialization in 2021 is a primary driver of 5G core demand**. To achieve the necessary scale and performance for 5G, operators need a programmable, agile, flexible cloud-native and service-based automated core architecture. This will reduce time to market 5G services and allow CSPs to monetize new services more quickly. So CSPs' choice of moving towards open networking will be an important determinant and trend setter.

- **Migration paths to 5G should be seamless.** In the choice between non-standalone and standalone architecture, most leading vendors know they need to be aware of operators' customers' cloud maturity curve and determine the options accordingly.

- **5G SA deployments and 5G-driven edge deployments** and partnerships started in 2020, but the bulk of the market will be ignited in 2021.

- **Network slicing** will break out of the trial-stage and start gearing up to commercial reality towards the end of 2021. This includes using end-to-end slicing across RAN, transport, and core networks. Incumbent CSPs can use slicing for wholesale purposes for sharing their network resources.

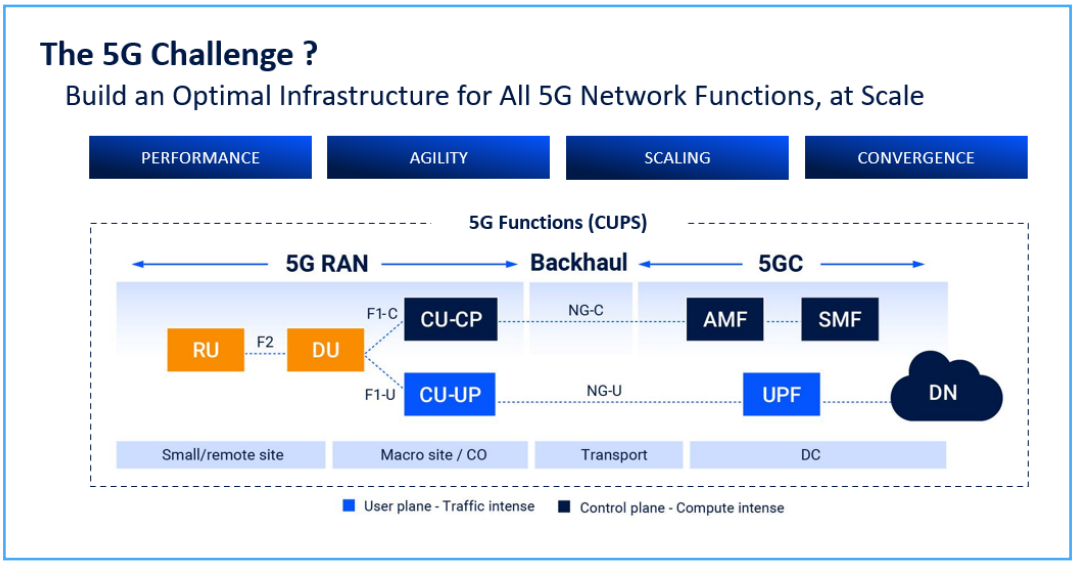
- **MEC (and edge compute in general)** is gaining traction because low latency tactile internet is gaining a lot of attraction and has around 5 to 10 ms latency requirements.

- **Service-based architecture, DevOps, and cloud-native virtual network functions** with closed loop network analytics and operations are the fundamental components of 5G integrating these technologies to help operators deliver new opportunities to build new applications or service offerings quickly.

Existing network – 5G (SA) challenges the legacy network Infrastructure

B2B vertical use cases with associated high revenue-oriented business models are the biggest drivers and motivators for CSPs to migrate toward 5G (SA) implementations. But this transition from non-standalone to standalone network infrastructures requires a lot of attention and is full of daunting challenges from end-to-end network readiness, monitoring, and closed-loop automation perspectives. Building an optimal network infrastructure from RAN to Core passing through one unified converged backhaul transport network is imperative for successfully delivering experience and enhance the efficiency of the network deployments. As shown in the exhibit below, CSPS need to brainstorm on how to solve existing network challenges and shortcomings to achieve best performance, service agility, network elasticity, and convergence.

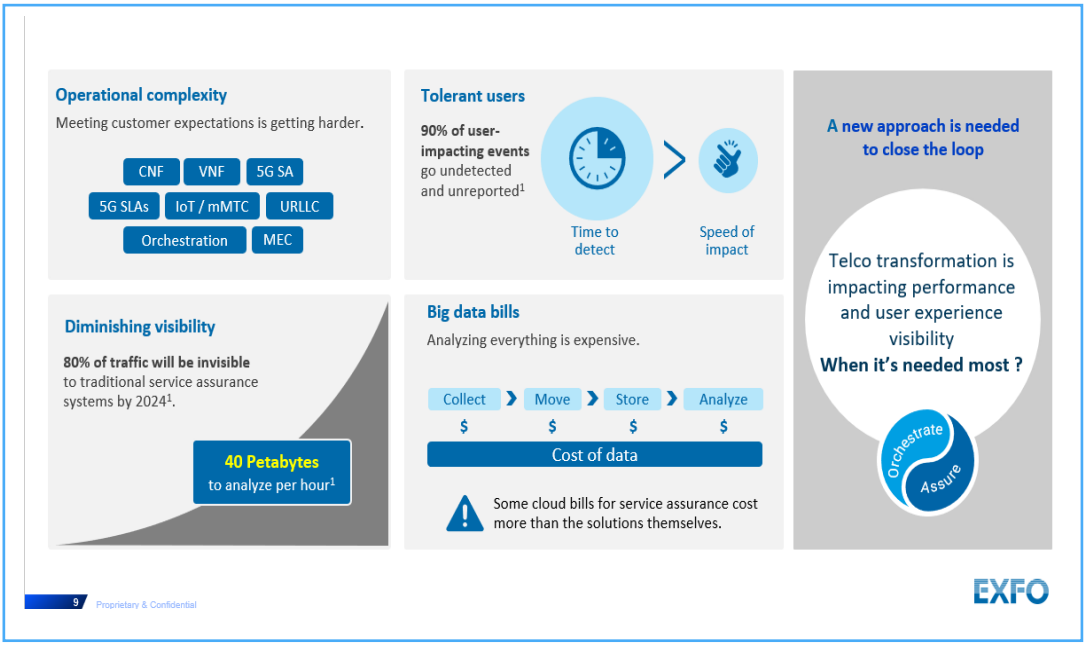
Exhibit 4: Challenge of building an optimal network infrastructure



Source: DriveNets, Addressing the 5G network challenges in 5G webinar, June 16, 2021

CSPs need to work closely with vendors on the integration of new network technologies to bring further agility into their existing network operations, with proactive monitoring and analytics in their RAN, transport, and 5G new core network. In fact, 5G standalone increases operational challenges. As EXFO highlighted in the webinar, virtualized networks and cloud native functions that are orchestrated in real time make it difficult to detect issues affecting the user experience. Service degradations, short-term service interruptions, and network failures occur faster than existing systems can detect, and users are reluctant to report them. At the same time, traditional monitoring techniques will become overwhelmed with the volume and diversity of data bursts, not only making visibility more difficult, but also significantly more expensive in handling big and shattered data. A new approach to service assurance is needed to ensure real-time orchestration and closed-loop network automation for 5G standalone implementations.

Exhibit 5: Obstacles to network monitoring and insights



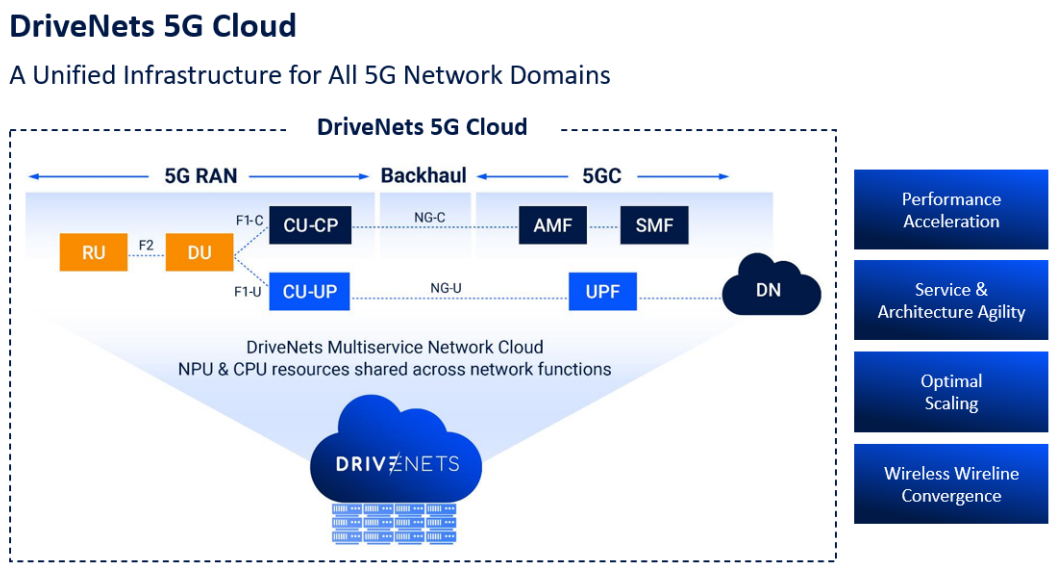
Source: Omdia Global CSP Survey, 2019 / EXFO Survey of CSPs, 2020; 2. Based on 5G probing requirements per Tier-1 North American MNOs

Architecture –new deployment solution with adaptive service assurance for orchestrated, automated 5G (SA)

5G new use cases present opportunities for CSPs to enhance their revenue streams from existing and new markets and can be introduced incrementally into existing networks for more of a transition than an instant upgrade. CSPs who have already implemented 5G NSA are now exploring different ways to do massive upgrades in their existing networks to support the 5G (SA) use case requirements. And more importantly, 5G core (5GC) virtual transformation is vital to support the new low latency requirements.

In fact, it is not wrong to believe that a true cloud-native open and unified network architecture with complete CUPS (control and user plane separations) from RAN to core is the way forward. This multiservice cloud-native architecture allows service providers to realize performance acceleration, service agility, optimal scaling, and fixed and wireless convergence over the same pool of cloud resources. Accelerated network performance and cost-efficient scaling with networking and compute optimized infrastructure is possible with 5G core. DriveNets highlights the importance of open and unified cloud infrastructure for all 5G network domains.

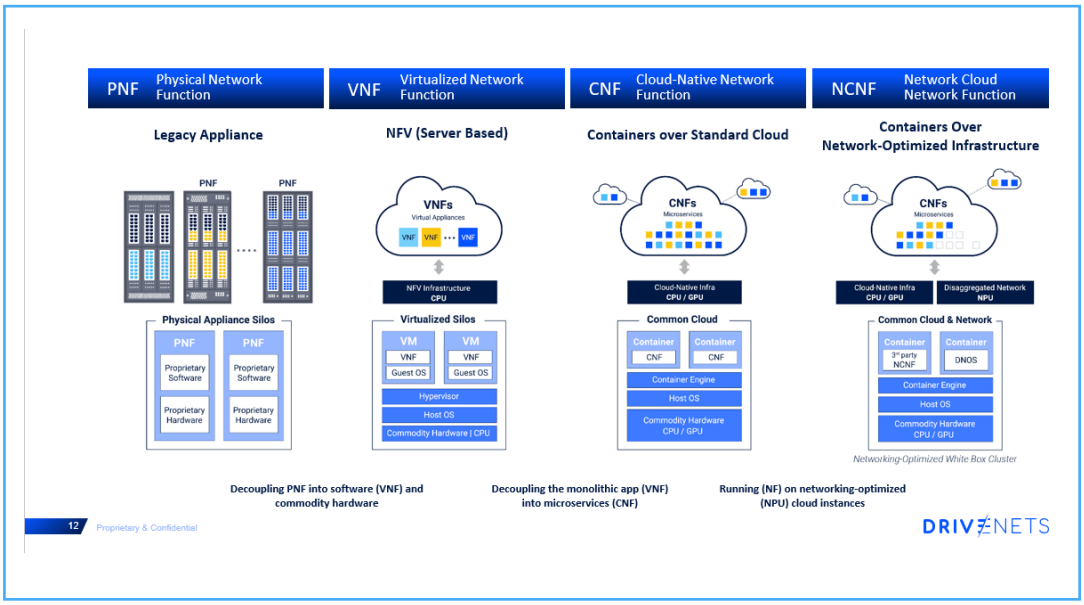
Exhibit 6: DriveNets unified cloud infrastructure for all 5G domains



Source: DriveNets, Addressing the 5G network challenges in 5G webinar, June 16, 2021

As shown in the exhibit below, three broad spectrum architectural transformation of network functions virtualization options are available for smooth and seamless evolution to the 5G (SA). First, continue to deploy 5GC with virtualized infrastructures for quick delivery of standalone services and do not wait for the containerized architectures. Secondly, CSPs wait and directly go for bare metal containerized architectures with dedicated virtualized microservices based functions for each service delivery. Thirdly, they can implement the best blend of containerized and virtualized deployments in bare metal and easily bridge from virtualized to containerized microservices with time and follow the moderate approach. The implementation and adoption style will vary as per the actual implementation requirements and network robustness of every CSP.

Exhibit 7: The evolution of network functions virtualization

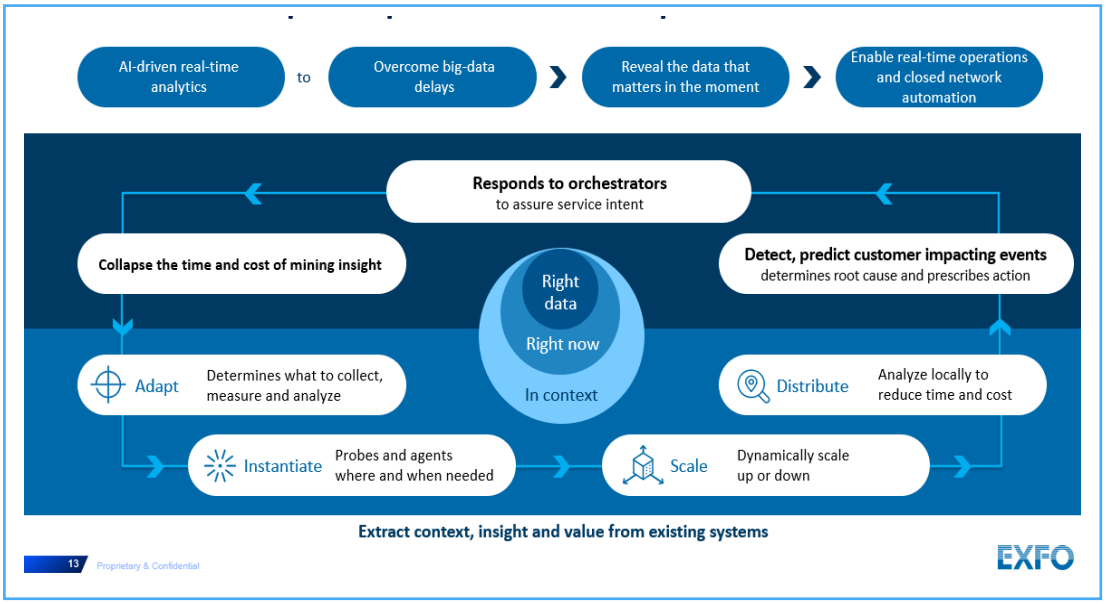


Source: DriveNets, The evolution of network functions in 5G webinar, June 16, 2021

On the other side, adaptive service assurance with predictive and proactive network monitoring and insights based on big data is extremely vital for best user experience. This adaptive network assurance system provides faster closed loop automation, extensive monitoring, and distributed adaptive data collection for orchestrated automated network until full network orchestration is achieved in 5G (SA). These real-time analytics to overcome big data delays and volume will reveal meaningful data that delivers insight, in context, as needed. Adaptive service assurance responds to orchestrators' requests for insight, then adapts data collection and probe location and scale, then analyzes data as close to the source as possible to further reduce resource consumption and proves efficient. AI-driven analytics provides direct feedback to ensure service intent and customer expectations are met and at the same time provides predictive and proactive troubleshooting. As automation is introduced, adaptive service assurance can reduce the amount of data collected and analyzed to a fraction of user plane traffic, ensuring cost-efficient scalability.

Procedural flows outlined in the figure below, show the potential of AI based network analytics on shattered big data and reveal the data that matters for network automation. In fact, there are many different layers to a real-time analytics and assurance system, each of which needs to be cloud-native and modular, so that components can be introduced as needed to complement existing, multi-vendor systems and in-house capabilities already deployed by the service provider. Open APIs and real-time streaming interfaces are critical to exchange requests and insights between orchestrators and assurance systems.

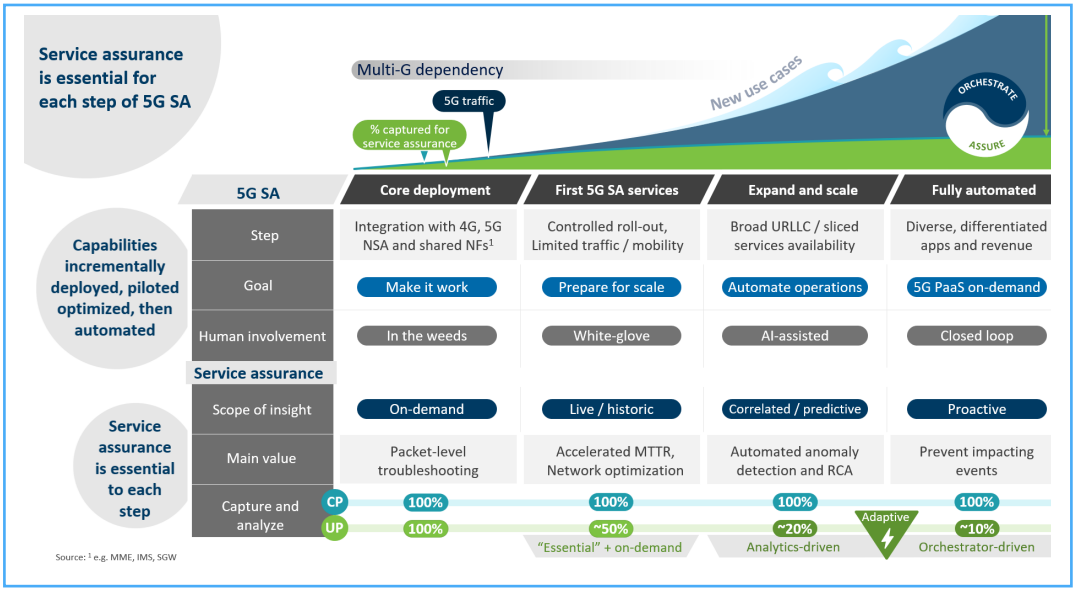
Exhibit 8: Procedural steps and flows for adaptive service assurance



Source: EXFO, Procedural steps and process flow of Adaptive Service Assurance in 5G webinar, June 16, 2021

CSPs agreed that adaptive data collection can reduce compute consumption at the edge by over 90%. Service assurance systems support this journey by providing detailed, trace level troubleshooting during core deployment, then progressively automate analytics until full orchestration is achieved. For many operators, this process needs to be repeated for each additional 5G (SA) capability introduced (for example slicing, or NR voice). As automation is introduced, the adaptive service assurance can reduce the amount of data collected and analyzed to a fraction of user plane traffic, ensuring cost-efficient scalability compared to traditional 'store and analyze' approaches.

Exhibit 6: Service assurance capabilities



Source: EXFO, modular service assurance capabilities at different level in 5G webinar, June 16, 2021

There are many different layers to a real-time assurance system, each of which needs to be cloud-native and modular, so that components can be introduced as needed to complement existing multi-vendor systems and in-house capabilities already deployed by the service provider. Open APIs and real-time streaming interfaces are critical to exchange requests and insights between orchestrators and assurance systems.

Bottom line – Conclusion and way forward

5G standalone is set to take-off at a fast pace and CSPs are in good position to migrate and ready their networks. And for CSPs to be successful in 5G (SA), it is important that new standalone architecture should be planned ahead in detail to keep future services SLA requirements especially in designing new dedicated 5G core. Open network with cloud native 5G core will be beneficial for operators that seek network agility, flexibility, and scalability while meeting low-latency service requirements. Last but not the least, AI-assisted future 5G network visibility and operations from RAN to core with advanced analytics and closed-loop automation is a way forward for orchestrated, automated networks.

To learn more

Watch this free webinar.

5G standalone: Lessons learned and the path forward

presented by Omdia and our partners:

The webinar can be accessed at: https://bit.ly/2SVtHr0

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