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Light Report

Network Data Analytics Function

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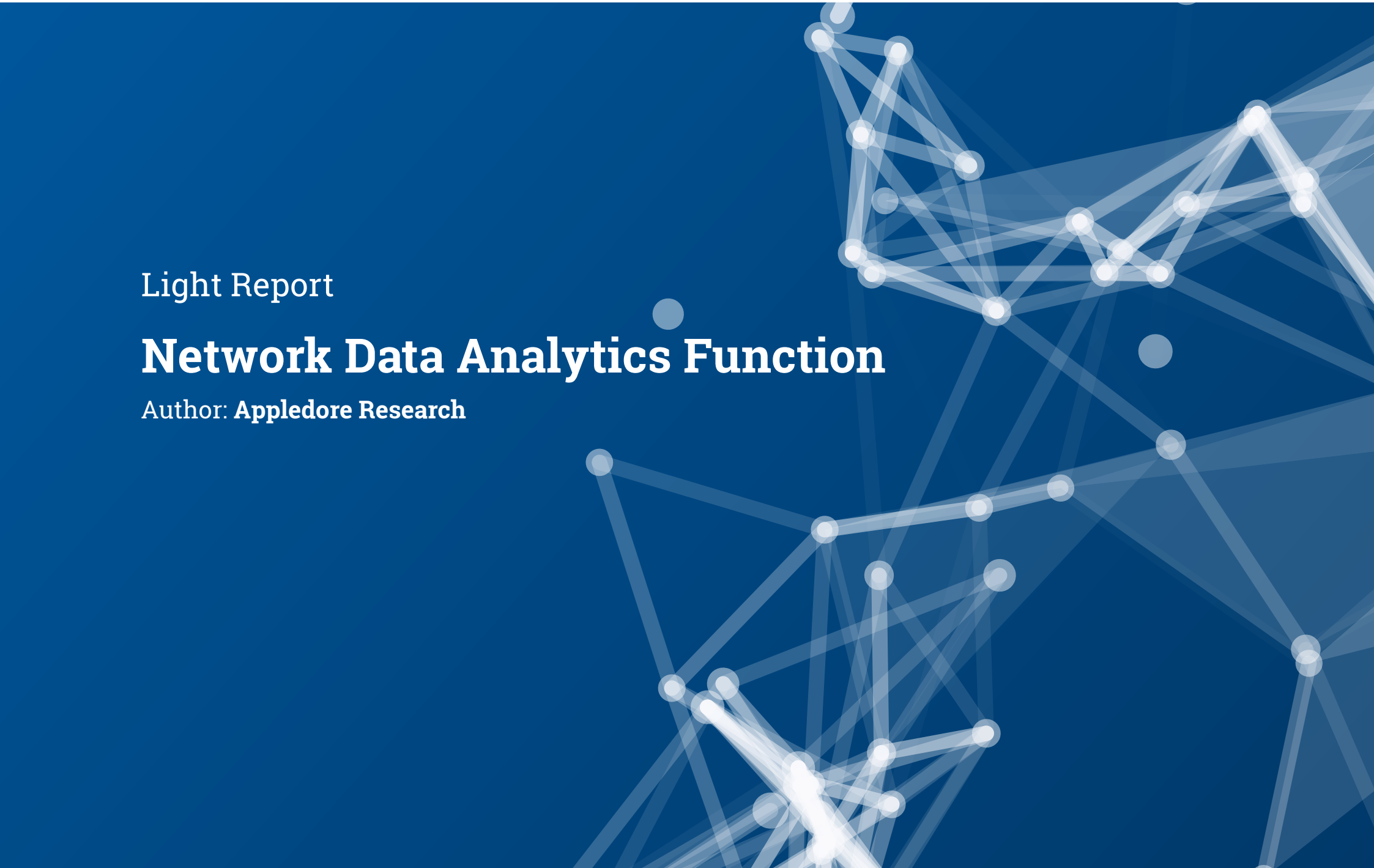

Telecom has one big, counterintuitive problem:

it works! It works incredibly well, almost all of the time, and in most situations where it has been relied upon. What telecom needs is new problems to solve – since it has solved so many basic challenges extremely well so far. And solving new problems means potential new revenue – vital for operators who are betting their future on 5G.

To an extent, the arrival of mobile usefully lowered the bar somewhat, as it introduced users to the idea of a tradeoff between mobility and service availability. The arrival of the mobile internet into our pockets further rolled back customer expectation for what constituted an acceptable experience. Now, users were encouraged to understand that the sorts of applications and websites they were using could also be a factor in the service experience – over and above their own location, speed of movement, device type and so on.

And things continue to change.

First, cloud (and cloud-based applications) that run seamlessly across desktops and handsets are highlighting any differences that the mobile context creates. A user on a Teams call expects to be able to seamlessly move from indoor (and Wi-Fi) to a 4G or 5G connection in a moving car. Streaming video viewers expect to see consistent streaming quality, switching between a phone and a connected tablet while catching a live game, concert or TV show. "The application works, so any problems must be to do with the network – right?" It's reasonable logic.

Second, the pervasiveness of Big Data and AI, in the widest sense, has led consumers and businesses to expect, well, simply smarter interactions. Privacy considerations notwithstanding, we now expect companies to make use of information that might improve their service to us: our location, our routines, our environmental conditions (send more taxis to the station when it's raining? No kidding!)

Third, the ability of mobile operators to actually make changes quickly enough to impact the user experience. Under the banner of "5G" (but in reality, the use of software-defined networks, fast analytics and cloud architectures), operators and their supplier partners do now have the capabilities required to create more automated, intelligent, responsive networks, and differentiating experiences.

Data is key to creating new experiences and value from all these changes. Not only what data is available, but where it is available, to whom it is available. Recognition of this led to the identification of the network data analytics function (NWDAF) as an industry standard. Though well-understood at a technical level, it remains a capability whose commercial potential is only starting to be fully explored. One particularly interesting market dynamic is growth in demand from enterprises, across multiple industry verticals, who are seeing the potential for greater speed, responsiveness, security and safety, based on greater insights from the networks that they rely on.

NWDAF Recap

Network Data Analytics Function (NWDAF) is a standard from the 3GPP group which defines a standard service interface for collecting performance data in the 5G core network.

As 5G deployments take hold, NWDAF brings us closer to realizing a new era of automation and insights that the industry has been foreshadowing for the past decade. At the same time NWDAF will disrupt the classic service assurance market. Operational systems used in traditional fault management, network performance, and testing of services will become less relevant. This shift will occur over a multi-year period beginning in 2023 as 5G standalone network deployments accelerate and with them, more NWDAF implementations.

The goal of NWDAF is to provide a framework using open communication protocols and APIs access high value data in a multi-vendor deployment. It is specific to 5G and should be used by CSPs and suppliers to gain additional data and insight on 5G core network performance. It provides additional value over existing tools in that it achieves economic scaling at a lower cost per device and per network interface. It promises to provide mobile operators with better prediction capability on service impacts, user experience and network capacity thresholds. It has limited potential outside of 5G technology domains giving the scope.

Mobile operators are actively engaged in proofs of concept and trials. Most of the suppliers that are making a bid to support NWDAF are currently responding to RFIs. Many mobile operators have indicated a strong desire to deploy NWDAF in their operations and network planning departments. The transition from RFI to RFP and deployment activity is expected to begin in 2023 as 3GPP NWDAF Release 17 becomes codified.

Most suppliers are keenly aware of the 5G market super cycle opportunity and have been actively adjusting their portfolios to participate in the growth of NWDAF but also AIOps more broadly. Nokia, Ericsson, Rakuten Symphony, Spirent, NEC, Samsung, InfoVista, Netscout, Huawei, Viavi, Guavus, Amdocs, and others have products under development based on 3GPP NWDAF standards. Ericsson and Nokia have productized NWDAF, and more commercial solutions will find their way into the market as we move from proof-of-concept trials towards live deployments which we expect in 2023.

Some gaps in the current NWDAF standard relate to security attacks on the 5G core network. The security and network operations functions cannot be divorced as two separate domains which is the case today in most mobile operators' businesses. NWDAF has overlooked troubleshooting functions once the prediction model has signalled a potential for service impact or in situations where service disruption has occurred.

Network Observability has moved to the forefront of many CTO and CIOs' thinking in designing a robust network that is increasingly becoming disaggregated. NWDAF is a very specific interpretation of observability in the 5G network. Implementers should recognize that NWDAF runs the risk of being another silo solution to a much larger problem. Instead, it should become a building block towards a wider network observability architecture.

Unlocking Value

To consider how a wider observability architecture can be monetized by telcos, we can consider how it might apply to a retailer. Imagine if a retailer's head office, instead of only having a list of transactions and spend amounts, had access to a much richer set of information:

- What time a visitor entered and left the store?
- How long they spend in different sections?
- Whether the duration of the latest trip was significantly longer or shorter than normal?
- Any patterns to the store visits or purchases – daily? Weekly? Monthly?
- Was the store busy or quiet while that visitor was there?

What could a retailer do with such information? Options range from internal (improving efficiency) to external (customer experience and spend levels). First the obvious ones:

- Assign extra checkout staff when high-spending customers were predicted to be in store.
- Reserve a parking space in an area closest to the front door.
- Incentivize some customers to visit at a less busy time, perhaps with a discount offer only valid on off-peak hours.
- Reward high-spending customers with a free snack in the café as a treat after those longer shops.

The retailer could be even smarter about it. They could monetize the data that told different food brands how long visitors lingered over their displays. And they could charge a premium for delivering data daily versus on a weekly or monthly basis.

Clearly, to realize any of these ideas requires access to much more detailed data. It also requires a way to analyze and use that data, and finally to join that analysis up with other systems. In the retailer's case, everything from a customer loyalty system to inventory and in-store environment management, car park management, customer database, supply chain management and point-of-sale terminals.

Equally clear, none of this is rocket science, and retailers are already expert in creating value from exactly this kind of data (and metadata). It helps them build customer loyalty, nudge revenue, smooth troughs, reduce waste (for example, on perishable products), and optimize their inventory and supply chain.

Given what retailers have been able to achieve from a relatively limited set of data, how much more could telecom operators achieve? NWDAF is how telecom operators open up new experiences and price points.

NWDAF defines a standard service interface for collecting a range of performance data from the 5G core network and making analysis based on it available to other functions. More specifically data can be collected on:

- Network Function loading.
- Device mobility.
- Subscriber user experience.
- Quality of service (end-to-end service quality data).
- Congestion level in the RAN (within and across network slices).

And with data collected, it can also be predicted.

A richer set of data is only one parameter that can be used to create new value. So far, operators are still largely browsing the initial set of use cases set out by 3GPP. These represent the first set of example applications, based on an extrapolation of what is available from existing OAM functions (operations and management).

But what gets operators excited are capabilities that can be (easily) monetized, or that offer a path to a strong experiential differentiator to customers. Especially in 5G, any outcome which makes an operator much more relevant to an industry vertical is worth looking at.

The question is where information from the network, or the applications running on it, could be used to improve the experience, speed, efficiency – or hard value – of a given process or service.

With new value parameters to work with, CSPs can create new points of value and differentiation.

Analytics based on network data – historical and predicted – can now be located at the network edge, allowing for intelligent, localized and autonomous control within a tight, closed loop.

There are several broad categories of value-creation opportunity:

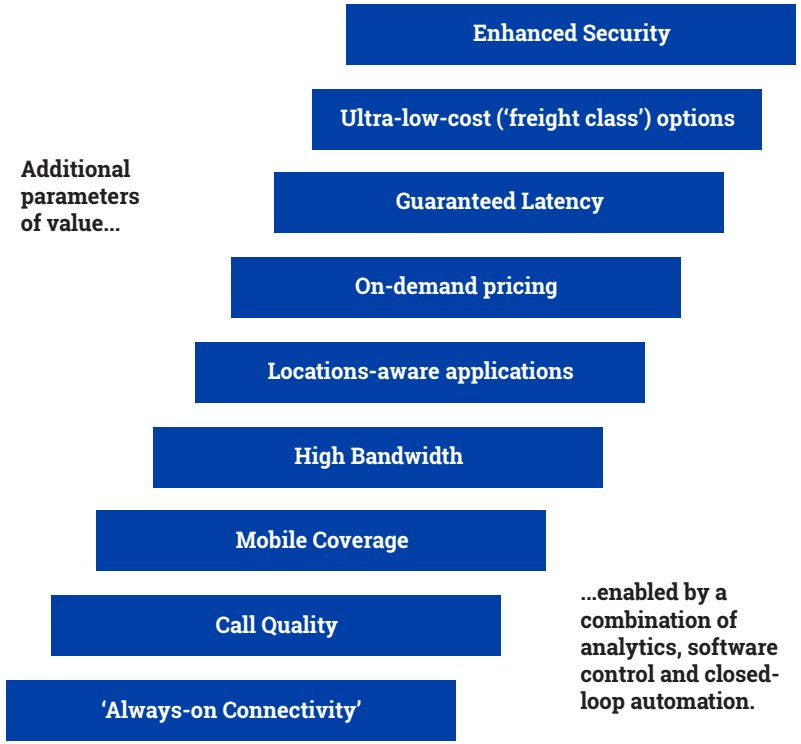

Figure 1: **Better analytics is key to enabling new value points**
(Source: Appledore Research)

Quality of Service

For a mobile operator, ubiquitous coverage (or the appearance of it), is the best foundation for retaining customers. Ensuring a consistently high-quality experience as customers move between cells, or between wifi and macro networks, is a constant goal. Overbuilding network to provide gold-plated experience is neither efficient, nor necessary. Armed with better, more detailed information about a customer (or device, or vehicle) position and trajectory, operators can spin up additional capacity where it is needed – and free it up when it is no longer required.

Enhanced Security

With more devices connected wirelessly – some moving (cars, trains) some not (environment sensors, security cameras) – there are reasonable questions about how to secure the network from cyber threats. One method is the early detection of anomalous behavior: a device that suddenly starts sending far more data than normal, or that connects to an unusual location. For enterprise customers, security is paramount. NWDAF can help enhance security by providing a mechanism for learning the normal behavior of devices and detecting anomalous behavior.

Intelligent Slices

NWDAF is how network slices get interesting. Without NWDAF (and automated control), a slice is just a static network. With NWDAF, a slice becomes capable of reacting to current (or predicted) conditions – both within the slice and considering adjacent slices. For example, the ability to reassign user sessions to alternate slices means that operators can create multiple levels of price points for traffic, ensuring that priority traffic always gets space, even if the network is congested.

Guaranteed Latency

Low latency connectivity is a pre-requisite for a range of applications. Gaming in general, immersive group experiences (training simulators), any form of machinery control. But only in some cases will all users need – or be willing to pay for – the lowest achievable latency. Instead, operators could use NWDAF to enforce the lowest latency for the customers willing to pay a price premium. This could enable a lower-cost price point for less latency-sensitive applications – such as point-of-sale backups, vehicle diagnostic uploads. NWDAF provides the critical intelligence required to guarantee performance within the SLA bounds.

Nokia

Nokia is among the first to offer a commercial NWDAF, launching an offering in early 2022, under the umbrella of its AVA (Analytics, Visualization, Automation) product line centered on AI and Machine Learning applications.

According to Nokia, 5G NWDAF can fulfil the analytics functions of a 3G and 4G network. But one key difference is in how the analytics is made accessible. The consume/publish model means that there is no need for probes, or for a separate data lake. Applications can simply subscribe to the data that is relevant to them – for example, prediction of a device's location in the next few seconds or minutes.

Nokia is alert to the niche application areas and situations where the special combination of capabilities around NWDAF will be critical. Monetization will come from giving enterprises the ability to see and act based on environmental and network conditions. And connected devices – from vehicles on a campus to robots to security systems – will create many more situations where speed and responsiveness are worth paying extra for.

Nokia has been running PoCs with several Tier1 mobile operators globally, and has already seen its first commercial wins, with live deployments expected in 2023. For example, Orange and Nokia are jointly exploring the feasibility and value of deploying NWDAF. So far, promising areas relate to improving Quality of Experience by predicting congestion; security related to IoT; and tuning network based on a user's predicted location. Significantly, Nokia reports interest in NWDAF not just from the usual network heads, but from the enterprise business owners at telecom operators, keen to respond to demand from their customers for everything from greater safety in mining operations to more agile production lines in manufacturing.

Nokia's offering can be deployed in a conventional on-premise model, though from launch, Nokia has been offering NWDAF on an as-a-Service basis – meaning as a scalable, cloud-native, hosted service, charged on a consumption basis. Nokia NWDAF is available on Google Cloud. The flexibility of its distributed architecture allows the same software to be used in both near-real time and non-real time applications.

Nokia sees NWDAF in the context of a fundamental change in telecom, towards two-sided business models, and the ease of experimentation. By exposing the capabilities, telcos could unlock a Twilio-style revenue stream, even without knowing today what the end-user applications might be.

In that sense Nokia sees NWDAF as a true investment for telcos, not simply part of the cost of being in the mobile business. For its own business, Nokia positions NWDAF in a much wider "Network as Code" vision, which seeks to make network capabilities accessible to third party developers – a new and untapped source of revenue partners for telcos.

APIs, Partnerships and Ecosystems

Some of the immediate use cases for a 5G Core network analytics function are internal to an operator – such as making it more efficient to simply monitor services. Things get interesting when the analytics (and analytics function) start getting exposed to third party applications.

There are plenty of examples of data that is not necessary operationally for operators, but might be valuable for others. For example, the distances travelled by commuters in a typical month. This could help plan transportation infrastructure or capacity. By tapping an NWDAF an application could be developed that reveals patterns in commuter routes and durations. CSPs could monetize this data to governments or regional authorities.

Similarly for connected cars – which types of vehicles cover the most miles? Could this aggregated data be useful to auto manufacturers?

The new software-based architecture for 5G is intended to enable innovative collaborations between vendors. In particular, by exposing published APIs that allow others to leverage previously unseen (or unknowable) information. This in turn means that CSPs can monetize their network data (assuming they also establish a mechanism to charge for API usage).

Conclusion

Rather than as just a new generation of analytics, NWDAF should be seen a sub-component in a larger AIOps architecture to facilitate open access to high quality data and leverage it in near real time for use in telecommunication operational domains. (For more analysis in this market see "AIOps in Telecom Operations".)

Arguably, the function provided by NWDAF is not new. What is new is the ability to incorporate intelligence and analysis more directly at more points within the service experience. Many mobile operators must be convinced of the risk and reward trade-offs. As with any new offer the business value must be proven. Risk factors include understanding the cost of integration and ongoing cost post deployment.

As 3GPP Release 17 reaches approval state we can expect a rush of commercial solutions available from many more suppliers. This will include not only traditional suppliers to the telecommunications industry but also hyperscale cloud providers such as Google Cloud, AWS, Microsoft Azure, IBM, and Oracle. Pricing and packaging offer that we see emerging will focus on UEs, slices, and machine learning prediction models. Delivery methods comprise both SaaS and on-premise, depending on the operator and the use cases supported.

Tight, fast control allows CSPs to offer a higher level of service quality guarantee for more demanding customers or applications – this not only makes more efficient use of the network but potentially allows for the creation of new, higher price points.

For now, operators and vendors are both just beginning to explore the possibilities of this relatively newly-created function. But the combination of greater insight with closed-loop automation and a wider range of reliable latency introduces a genuinely new set of parameters to work with.