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Service Assurance and Network APIs for 5G Monetization

A Heavy Reading white paper produced for RADCOM

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INTRODUCTION

Real-time service assurance is a capability that no service provider can be without. The right data, platform, and analytics are now essential to generating accurate insights and ensuring the performance of 5G networks. 5G standalone (SA) is the enabler for new services, providing a customer experience not possible in previous mobile network generations.

Service assurance must offer more than tooling for NetOps teams; it should also channel smart insights to drive service innovation for operators. Working in partnership with network APIs, end-to-end analytics can empower data-driven decisions to proactively change service characteristics for subscribers in real time.

This paper investigates how analytics and service assurance techniques can work in 5G networks to enable new service creation and monetization. It addresses how ecosystem partners can use network exposure-based API capabilities offered by operators within a secure governance framework.

To examine how real-time service assurance and APIs lead to business value, the paper considers potential service types that use network analytics and APIs to enable service providers and vertical industries to work together to create and launch new use cases rapidly.

NETWORK VISIBILITY ESSENTIAL TO 5G SERVICES

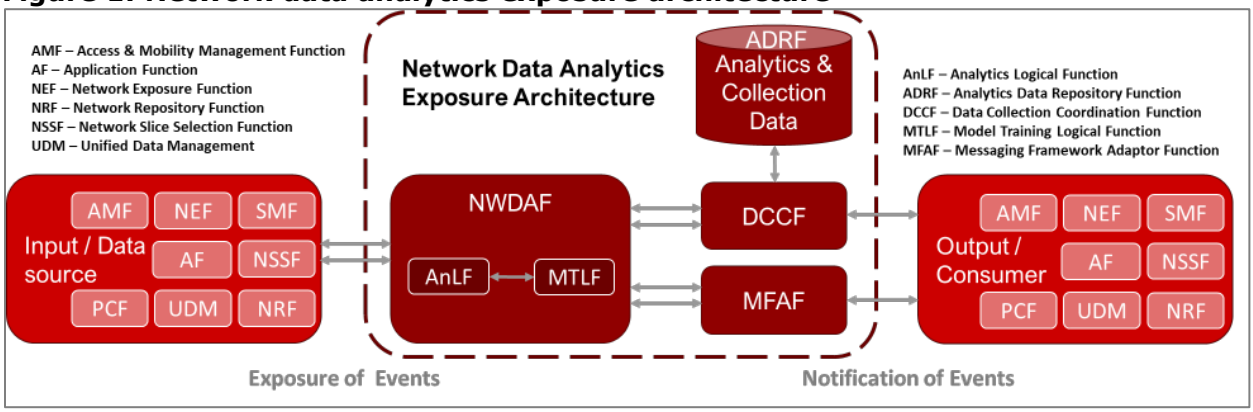
End-to-end network insights are an essential source of data for quality of service (QoS) monitoring, subscriber, and network troubleshooting and assurance. Numerous options allow operators to produce a holistic view of their network, capturing core-specific analytics and events. Some operators may deploy assurance only, while others will look at a combined approach incorporating a mix of assurance and the network data analytics function (NWDAF).

Analytics via a network function

The 5G architecture (defined by 3GPP) introduces analytics functionality via the NWDAF. The NWDAF provides a centralized collection and analytics function within the 5G core, gathering and correlating data from multiple network functions (NFs). From Release 17 onwards, 3GPP introduced additional capabilities within the NWDAF to allow device analytics, as well as model training, to support machine learning (ML) and inference for future network trend prediction. This extends the analytical information to include both future predictive events as well as past statistical events, which the NWDAF was already collecting.

The NWDAF can also expose events and share notifications with other NFs that have subscribed to receive this data. **Figure 1** below illustrates the network data analytics exposure architecture providing this functionality. Examples of event notifications typically exposed include location reports, the number of user equipment (UE) in a region, UE reachability, etc. In this way, the NWDAF increases the reach of service assurance data, allowing NFs from inside the network to use these insights and external application functions (AFs) to access it via the network exposure function (NEF), which also manages authorization and access to the data.

Figure 1: Network data analytics exposure architecture



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Assurance via probes

Network probing is a well-established way to derive entire network packet-based insights and monitoring. The methodology has evolved from physical probes to virtual probes (vprobes) and finally to a cloud native format, the containerized probe (cprobe), but essentially, they all collect packet-based data. Cprobes often form part of more sophisticated assurance systems, combining network events to gain a fuller picture.

Many telcos are choosing combined service assurance systems, integrating the NWDAF functionality and additional end-to-end service assurance capabilities. Integration allows full network visibility for troubleshooting while incorporating the NWDAF capabilities and architecture for network analytics (e.g., network slice load information).

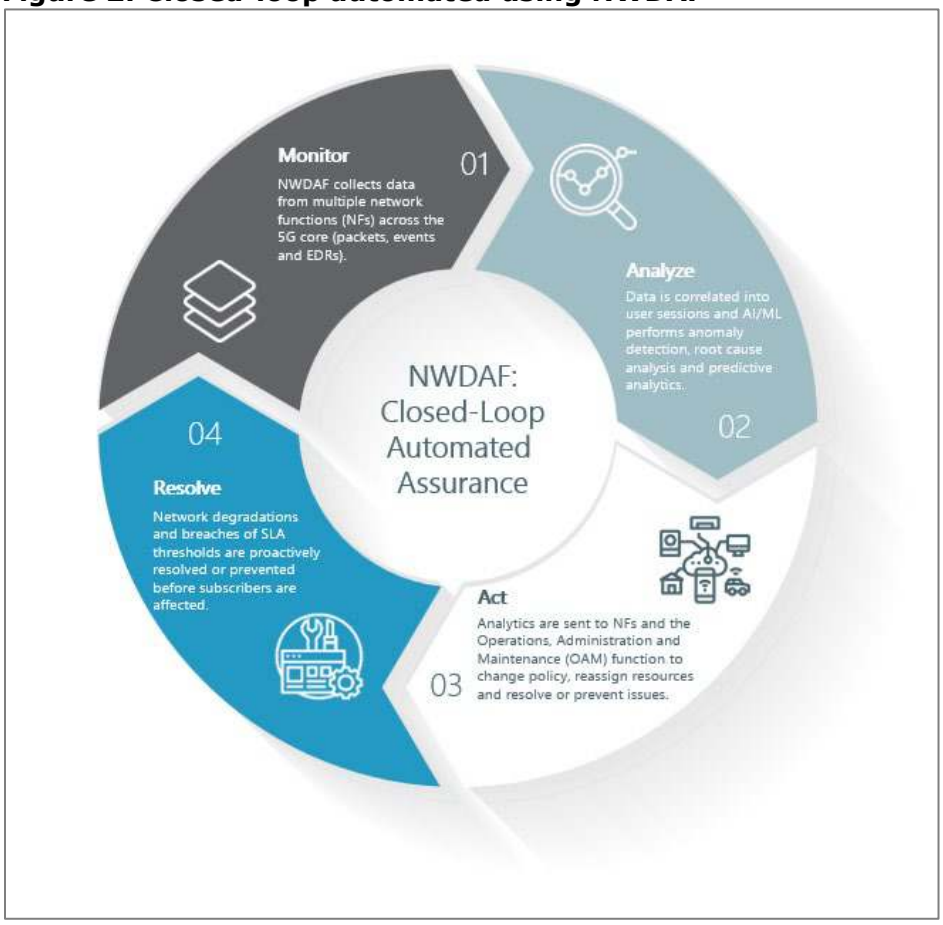
Extending the NWDAF could ultimately deliver a fully automated system, using network analysis and intelligent corrective recommendations end-to-end. This capability allows granular insights and real-time corrective actions in complex areas such as network slicing, where managing many slices becomes logistically difficult.

The basic steps for an analytical closed-loop-based system are as follows:

- **Monitor:** Collect and monitor network data and events across NFs within the 5G core. Includes packet capture, data flows, and key performance indicators (KPIs).
- **Analyze:** Correlation, root cause analysis, and insights based on the collected data.
- **Act:** Act on recommendations to change policy and resolve or prevent issues.
- **Resolve:** Automated resolution of the network problem, including proactively managing and orchestrating specific workflows or changing network parameters.

Figure 2 shows an example of a closed-loop automated issue and detection solution. Automated assurance introduces the potential for cost savings and new service creation.

Figure 2: Closed-loop automated using NWDAF



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5G ASSURANCE ENABLING NEW VALUE

5G service assurance has reached a new level of sophistication, with service optimization and resolution just forming part of the picture today. Assurance systems can now process analytical data in an efficient, real-time manner and provide fast insights, often assisted by artificial intelligence (AI) and ML techniques. Some key examples of data insights and their benefits are shown in **Figure 3**.

Figure 3: 5G assurance benefits

Operator savings	Operator new value
Fast identification and isolation of network issues to maximize customer experience	Distinguishing subscriber groups (e.g., device, location, profile, etc.) to offer new services
Proactive AI/ML assurance to improve network uptime and reduce engineering effort	Insight-driven offers (e.g., identification of roaming users to offer package add-ons)
Per subscriber service analysis allowing AI/ML-driven resolution, optimization, or QoS enhancement	Analyzing subscriber data usage, profile, and QoS insights to offer promotions (e.g., speed boost)
Automated network planning and optimization based on subscriber location/higher cell capacity detection	Selling anonymized user movement data to support other businesses or transport planning
Fraud protection analysis (e.g., bandwidth abuse, SMS spammers, etc.)	Data usage insights that enable offers (e.g., premium music or video upsell)

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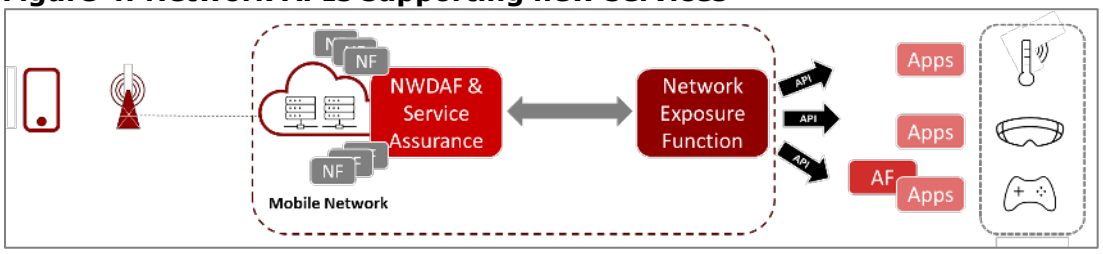
5G NETWORK APIS DRIVING NEW SERVICES

API exposure is not a new concept in the mobile industry; device manufacturers have been exposing capabilities inherent to the device (e.g., from sensors or the operating system) for many years, enabling an extensive mobile application ecosystem to form.

4G Internet of Things (IoT) initially used the secure exposure of services and capabilities to allow the tracking of non-IP data delivery devices. Telcos are now in the position of being able to adopt a similar but more sophisticated approach to expose capabilities from the 5G network easily and securely. There is a business value associated with the ability to expose real-time network capabilities, as well as feedback and alerts on the network status.

Figure 4 below illustrates NF capability exposure through APIs to applications via a direct relationship or an AF. The NEF, like the service capability exposure function (SCEF) in 4G, controls network exposure within the 5G network. As highlighted (and enlarged), the NWDAF and service assurance capabilities within the core are central for network exposure with other core NFs and the NEF.

Figure 4: Network APIs supporting new services



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5G network APIs

5G network APIs are a new mechanism by which operators can extend service creation opportunities across an ecosystem of partners. **Figure 5** explores the benefits of network exposure for each party within the ecosystem.

Figure 5: 5G network API benefits

Operator benefits	Developer benefits	Consumer benefits
New and sophisticated revenue opportunities (e.g., revenue sharing on services that utilize in-network capability information)	Shorter time to market for new use cases and applications	Availability of new services due to the additional network information available (e.g., low latency gaming)
APIs give more significant opportunities for network wholesaling (e.g., leveraging APIs could introduce slice leasing models)	APIs remove complexity around extracting network information for application developers	Smart planning of updates at a time convenient for the customer (e.g., overnight firmware updates if the device is in good coverage and bandwidth)
Ensures a secure and enforced security model and control is in place via the NEF authentication and authorization	Development of more sophisticated applications utilizing network capabilities such as QoS, current location, roaming status, etc.	A best effort, limited bandwidth service in a crowded location; could be upgraded to a superior experience by utilizing real-time exposed network information
Introduces possibilities for new and flexible charging options on premium services like gaming or toll-free network updates	Expands the portfolio of devices application developers can target services to (e.g., new services for lower cost IoT)	Allows new services for low cost or functionality devices (e.g., IoT sensors can be used across more scenarios)

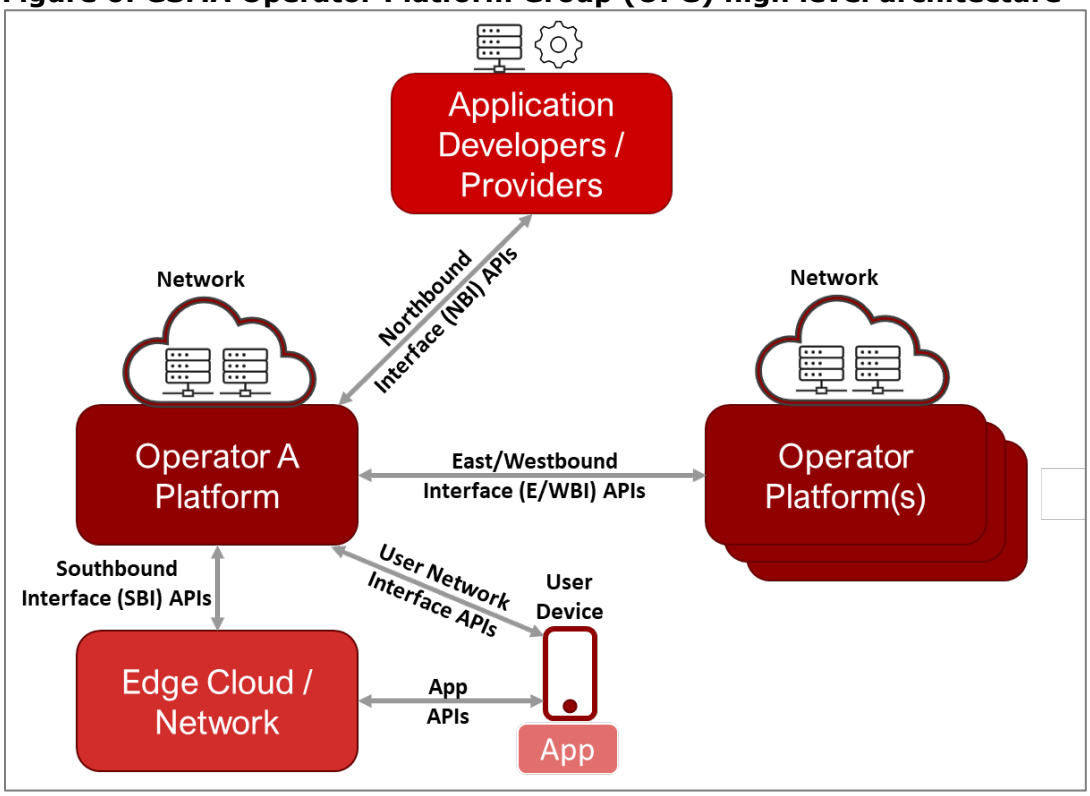
Source: Heavy Reading

Industry support of network APIs

APIs are an obvious choice for simplifying operations, improving network management, and offering a channel for innovation into telcos environments by third parties or by operators themselves. These initiatives provide direct opportunities to monetize the capabilities provided within operators' networks.

The industry is now focusing on the development of API capabilities with initiatives such as the Operator Platform Group (OPG) and open-source project CAMARA—the telco global API alliance. The OPG consists of developers, operators, platform providers, and those in the broader ecosystem that aim to drive a standard definition of exposing operator services and capabilities to developers. **Figure 6** illustrates the high level architecture of the OPG platform and highlights critical interfaces for API exposure. There is a close connection to 3GPP, especially around the NEF and SCEF interfaces, defining APIs in network events, mobility control and triggers, QoS management, traffic influence, user location, and application relocation. These are particularly relevant to many new service creation areas.

Figure 6: GSMA Operator Platform Group (OPG) high level architecture



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The CAMARA project is specifically working to define network capability APIs that are open and user-friendly. Sub-working groups within the project are developing "families" (or groups) of APIs. For example, API groups include edge cloud, device identifier, anonymized subscriber identifier, device location, etc.

Network APIs and real-time analytics information

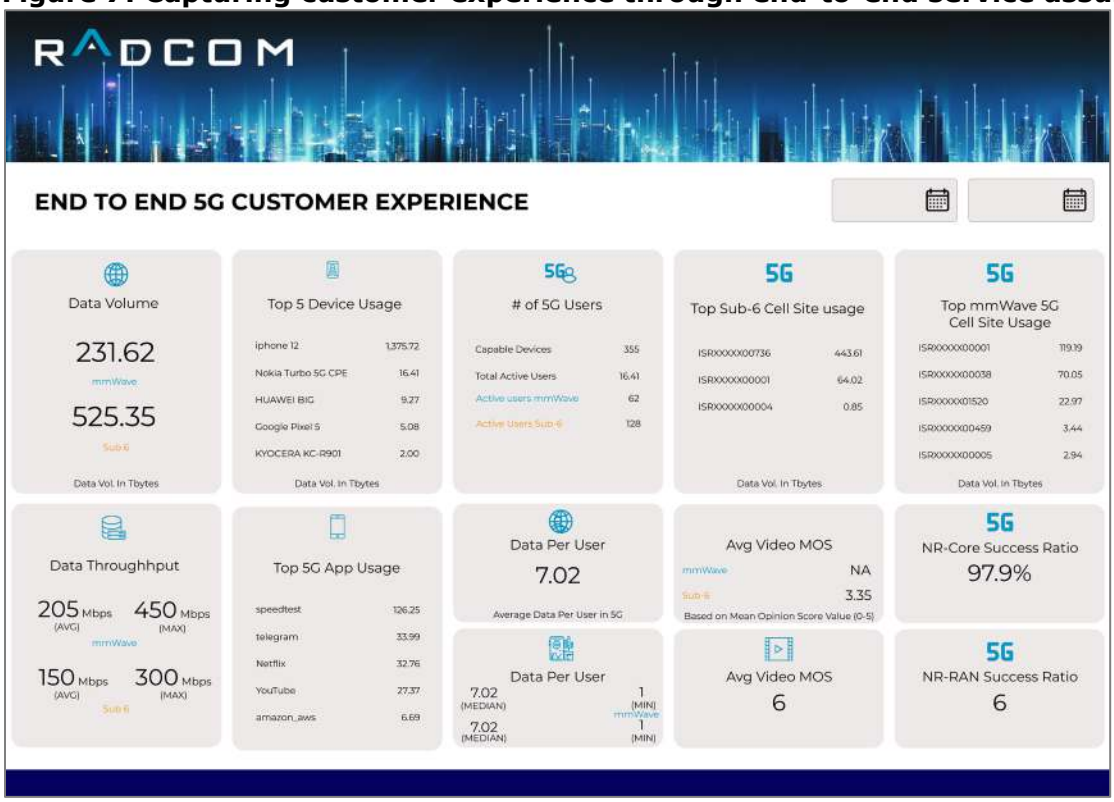
Applications have become more sophisticated, relying on many information feeds or events. Combining multiple network feeds into an application often introduces a reliance on analytical information to allow more intelligent feedback based on real-time events. For example, an application acting on current network load, bandwidth, or latency and combining it with location is essential in many new advanced 5G use cases targeted at remote operation, such as the smart industry.

Linking analytical information with location is an area of much interest for operators and study groups. For example, EU projects such as LOCUS heavily concentrate on analytics and location information within their scenarios and the concept of analytics as a service API.

NETWORK ANALYTICS AND APIS DRIVING COST SAVINGS AND REVENUE GROWTH

Together, analytics and other network capabilities exposed via APIs can drive new service creation or optimized functionality. These capabilities allow operators to make cost savings and improve customer service or develop new business value by enabling innovative services. Additionally, ecosystem partners can add value by utilizing the API framework, which opens new channels for consuming advanced network and service assurance capabilities. Assurance systems display just some of the information gathered within a 5G network. The example shown in **Figure 7** illustrates these systems make a clear case that insights can introduce cost savings and add new areas of monetization.

Figure 7: Capturing customer experience through end-to-end service assurance



Source: RADCOM

Use cases for operator cost savings and customer service

Operators today are under increasing cost constraints, and they are looking for new opportunities to streamline operations and optimize performance within their core networks. These have a direct link to cost savings and increased customer satisfaction, key benefits that also reduce churn. **Figure 8** below details some areas of increasing interest.

Figure 8: Operator cost savings and customer service use cases

Use case name	Description
Best network	Analytics insights directly benefit network capacity planning, future dimensioning, coverage, and user services, all key to customer satisfaction. For example, exposed analytical insights combined with location (present and historical) allow actions like proactive policy changes or faster time to repair.
Energy efficiency and power savings	Energy efficiency could allow the scaling back of network resources based on combined network analytical and other capability insights. Enables for compute cost efficiencies, RAN optimization, and power savings.
Group and cluster planning	Large groups of users within a certain cell or location can rapidly alter network performance and customer QoE. Using live analytical data and AI techniques allows the prediction of future hotspots within a network and problem avoidance.
Infrastructure sharing	Cost savings and optimization are possible by offloading certain services or users based on their requirements on either a temporary or permanent basis. Infrastructure sharing could include savings across RAN and core networks.

Source: Heavy Reading

New service use cases involving analytics and 5G APIs

Analytics and 5G APIs offer the ability to co-create new services that will generate business value for both the operator and the broader ecosystem. Most scenarios draw heavily on mobility- and event-based network API exposure, including analytics. There are many potential sectors to create new service types and use cases, improve on existing abilities, and drive monetization across the entire ecosystem. **Figure 9** explores the opportunities.

Figure 9: New service use cases driven by analytics and 5G APIs

Use case area	Description
Remote operations	Control and guarantee of user experience for a service (e.g., remote teleoperation) always requiring low latency. The service can use real-time network assurance data from the network to guarantee latency targets are always within the SLA levels. This could allow the application to trigger a reselection of network slices to support the service requirements or choose the best edge infrastructure based on all network exposure feedback.
Connected vehicle	Connected vehicle scenarios require strict service assurance feedback to provide the current network conditions, including latency, jitter, coverage, etc., within a location and for certain subscriber groups. Tracking groups of connected vehicles within a fleet or automated vehicle platoon is essential to logistics and fleet management companies. Automating this requires knowledge of user groups, location, feedback on the network's status, and sometimes prediction of future events. It may also include geofencing alerts if the vehicle(s) is to be kept within a particular geographic area or country.

Use case area	Description
Augmented reality	Awareness of real-time location allows augmented assistance for travel, maintenance, and tourist services like guided tours, walks, directions, etc. Network assurance is a crucial feed into this application area to ensure the network can deliver the SLA needed at the time of use and update user policy if the service requires it.
Guaranteed or secure downloads	Smart planning of large downloads or device updates at a convenient time for the customer (e.g., overnight firmware updates for a device in good coverage and bandwidth within the home network). Another option could be to trigger additional security services at specific locations (e.g., security VPN-style features).
Gaming	For mobile gaming to be successful, it requires a controlled user experience such as low latency, jitter, and high bandwidth. Using real-time network assurance data and predicted future trends would ensure targets (e.g., latency) are within the SLA levels. This could include the gaming application triggering the reselection of a user's network slice to support the requirements or moving users onto a common "gaming slice" for multiplayer games.
IoT and sensors	Using intelligence sourced from the network, real-time network capability exposure allows cheaper and less sophisticated IoT devices to do more. This is an added advantage for IoT size and footprint optimization. Additionally, this may allow sensors already in the field to add new capabilities (e.g., geofencing, location for non-IP data delivery IoT sensors like smart meters, etc.) Both are useful in asset tracking, fraud prevention, and service location zoning. This could also allow the scheduling of device updates or log uploads to the most optimal location.
Group-centric services	Sharing user mobility information (in an anonymized manner) is a valuable capability for future cities. It allows better transportation and intelligence physical event planning for businesses (e.g., utilizing anonymized figures on multiple subscribers in a specific location). For emergency services, network data exposure could also assist in route planning (clear routes), staffing in busy areas, and ensuring emergency group network capacity in busy locations. Another aspect could be offering services to groups over a specific size (using data on location, time of day, etc.) for areas such as stadium crowds. For example, premium services such as bandwidth boost based on network assurance feedback.

Source: Heavy Reading

CONCLUSION

Network analytics and APIs represent an essential partnership to drive revenue growth and network savings, as well as enhance customer satisfaction for service providers. These goals, in turn, are essential to defending against customer churn and increasing direct telco revenue.

5G SA network visibility techniques and assurance are maturing, supported by end-to-end service assurance tools and new analytics frameworks such as the NWDAF. These new sophisticated network insights present an era of automated assurance that can provide cost savings (e.g., enhanced radio coverage, hardware performance, and optimized networks), but they also introduce ways to monetize using anonymized analytical data.

This paper identifies the benefits of 5G network APIs for operators, developers, and consumers. Industry engagement and API standardized frameworks have highlighted network exposure capabilities, addressing how operators could capitalize by creating services and ensuring a common and standardized approach across the ecosystem. 5G APIs introduce opportunities to exploit and automate service assurance, allowing more ecosystem partners to co-create new sophisticated applications and services and gain new revenue.

When identifying future service types and use cases for network analytics and network APIs, operators should focus on developing these ecosystems to add new business value.

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