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Transforming through analytics

How the Network Data Analytics Function (NWDAF) enables carriers to succeed in the 5G era

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Introduction

Communications service providers (CSPs) are transforming in preparation for the 5G era. Competing in the 5G marketplace is requiring CSPs to move beyond consumers as their target audience and attract enterprise customers with increasingly enhanced experiences and tailored services for their industry segments. 5G has been a significant investment due to the upfront cost to design, deploy, and go to market. Once live, management and automation of the network are fundamental requirements – critical for CSP success. To achieve their desired return, service providers need to identify and develop new and differentiated services, as well as support new B2B2X business models.

With 5G networks operational, a myriad of new revenue opportunities will be available. To deliver these new opportunities, CSPs must continue to make decisions around what to optimize and how to differentiate themselves in the market. More now than ever before there has been a realization that data, both central and peripheral to the network, has tremendous value. The capability to identify the various data types, its origins and content, then through statistical and predictive analysis, take actions to decrease costs and increase revenue, truly makes data the "new global currency." Because of this, CSPs are employing network analytics to answer the most important business questions and identify insights critical to developing new 5G-enabled opportunities. Data can be mined to support any business objective.

"Data scientists spend around 70% of their time accessing and preparing data for analysis."

Linda Avery
Verizon's Chief Data Officer
and Senior Vice President

With data rapidly becoming a key component of success in the 5G era, it's critical that service providers understand what type of data they have, and how to monetize it. Service providers are challenged to make the most of the digital economy with the existing, rules-based analytics tools – many of which are siloed with non-standardized interfaces and data collection, long upgrade cycles, and poor data access and quality, including inconsistent data types and formats. To help CSPs gain clarity and insight into the business value of data analytics, 5G has introduced the Network Data Analytics Function (NWDAF), a 3rd Generation Partnership Project (3GPP)-defined function designed to provide analytics and drive insights all the way down to the 5G core network.

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2%

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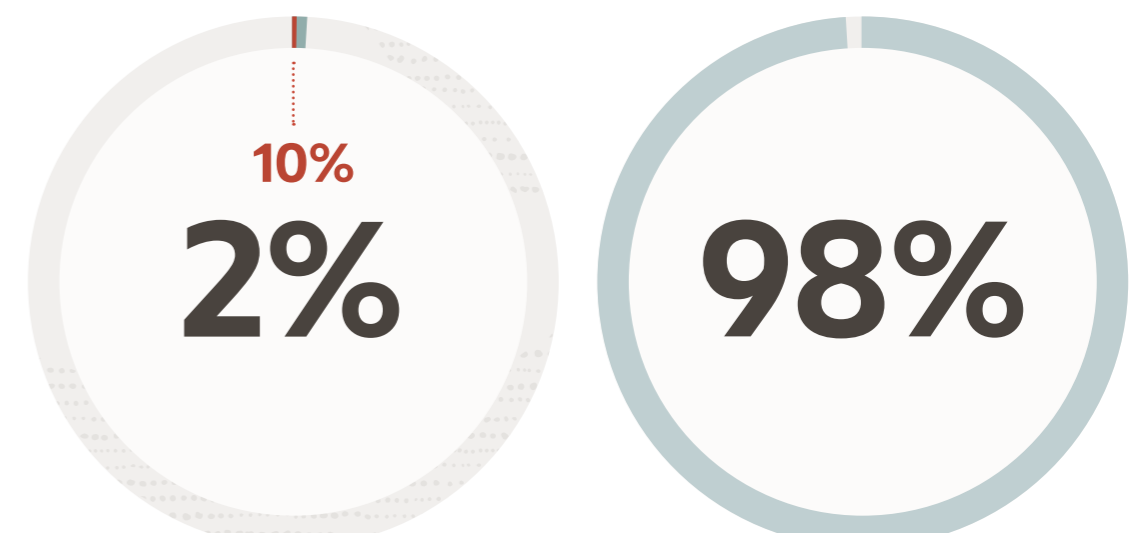
"At present, less than 2% of data generated have been stored. Within that, less than 10% have been analyzed, and applied. 98% of the means of production is not being used."

ABI Research*

Industry dynamics and challenges

Analytics can have a significant impact on the 5G return on investment. From the early stages of planning and design, analytics plays a role in understanding the performance of the network and identifying problem areas or gaps. Once a network is deployed and operational, data analytics built throughout the network can help carriers optimize business outcomes and improve customer experience.

Cohesion in analytics that spans the planning stage through operations equips the carrier to better react to the changes, challenges, and opportunities that inevitably present themselves. Potential benefits include a more personalized customer experience, a better managed supply chain, more informed financial decisions, and improved quality assurance.

Data analytics, automation and AI are foundational pillars in cloud native technologies and should be at the core of telco strategy.

Industry driver: Cloud native technology and the distributed nature of the 5G ecosystem.

5G and enterprise services are rapidly evolving from human to connected applications with significant impact on traffic patterns and need for automation.

Industry driver: Industry 4.0 scale and 5G business model diversity and guaranteed SLAs.

The massive increase in generated data from connected applications across all industries and the quest to gain more intelligence from this data means a need for real-time observability and monitoring.

Industry driver: Data extraction, management and synthesis.

Need for a complete picture of real-time service behavior requires access to the right data to generate meaningful insight at the right time.

Industry driver: Federation of connected applications insight and experience data.

The top five focus areas for CSPs seeking analytics tools

In order to contribute to current and future analytics use cases and allow CSPs to realize the full benefits that NWDAF can bring to their 5G strategies, it's imperative that the implementation is not considered a one-time event, but a platform-based approach.

Taking a platform-based approach provides CSPs with an opportunity to implement this network function as part of their broader analytics ecosystem. Implementing analytics as a platform-based solution enables the creation and operation of multiple analytics applications using a combination of technologies to meet company-wide needs.

Oracle Network Analytics Suite is a portfolio of statistical and predictive core network analytics solutions. It helps telcos to make strategic decisions using relevant trusted historical data and unbiased predictions about their network leveraging ML and AI. The suite consists of four components: NWDAF, Data Director, Insight Engine, and the Management Data Analytics Function (MDAF).

Greater service and network experience, improved efficiency, and security

Automated lifecycle management of network slices

Insight driven service assurance

Ability to turn insights into actions faster through autonomous networking

Responsible and sustainable data and AI

Oracle's analytics platform encompasses:

NWDAF

√ 3GPP defined 5G core Network Function for network analytics

√ Address analytics requirements across 3GPP Rel 16 and evolution to Rel 17

√ Provide statistical and predictive insights and actions for NF's consumption

Data Director

√ Provide centralized data aggregation for NF data feed (Non-3GPP APIs)

√ Offload the NF workload to distribute traffic across multiple tools

√ Selected traffic can be used for Insight Engine and MDAF

Insight Engine

√ Address non-3GPP analytics use cases (not addressable by the 3GPP analytics stated in NWDAF specs and MDAs)

√ Provide statistical and predictive insights/actions to orchestrator enabling the necessary actions

Management Data Analytics Function (MDAF)

√ 3GPP defined Network Function for Management Analytics

√ Collect data from all segments of NW (including NWDAF)

√ Process and analyze the data to provide analytics, insights, and inferences to orchestrator enabling the necessary actions for network and service operations

A solution for today, and a platform for tomorrow

Oracle's analytics solutions are designed to help operators make strategic decisions with machine learning (ML) and artificial intelligence (AI) using relevant historical data, predictions, and anomalies about their network. Aggregating data like control signaling measurements, the state of network functions, congestion, and quality of service can be accessed on an intuitive dashboard, thus enabling carriers to streamline operations and implement better network planning based on insights generated from current, predicted, and even simulated events.

Most solutions in the market today are only designed to achieve becoming data-driven because organizations are still in an early, report-driven stage. Thus, in their eyes becoming data-driven may be enough of a goal to achieve. However, simply becoming data-driven will not solve today's business or analytics challenges - looking at information is essential, but not enough.

The key is to move beyond a data-driven state into an analytics-driven one, where anyone in the organization can make strategic decisions based on all relevant and available data including historical data plus unbiased predictions about future scenarios. Only then can an organization embark on its journey to analytics-mastery. This implies using modern, immersive technologies, such as ML or natural language processing (NLP), that simplify obtaining and interpreting analytics, as well as projections. Vendors often need to partner with third parties to complete their analytics offerings, whereas Oracle addresses a wide spectrum of requirements, through proven technologies and a cloud-native analytics platform.

"Communications service providers are challenged by the levels of complexity that new technology brings to light. Building competitive advantage requires not only effective operations management, but advanced insight concerning network behavior. To access enterprise-driven business opportunities, and to create value within new industries that goes well beyond traditional connectivity services, network level analytics must play a heavy role in addressing customer-defined solution needs."

Karl Whitelock
Research Vice President, Communications Service Provider Operations and Monetization, IDC

What is the Oracle Communications Network Data Analytics Function?

A part of the Oracle Network Analytics Suite, Oracle Communications Network Data Analytics Function (Oracle Communications NWDAF) serves as a key data and analytics repository with standard interfaces to store and expose information that can support higher level analytics use cases. Therefore, service providers seeking a company-wide analytics strategy can implement the Oracle Communications NWDAF to reach beyond pre-defined 3GPP use cases and work with broader analytics solutions. This allows data practitioners to integrate network data with other data sets (data enrichment) to discover new use cases for the NWDAF.

Using machine learning (ML) and artificial intelligence (AI) Oracle Communications NWDAF enables CSPs to build automation into applications and includes observability tools for the monitoring and auditing of software components. Predictive analytics capabilities along with anomaly detection are also supported to avoid events such as network function failure.

Based on open standard interfaces, Oracle Communications NWDAF supports both private and public cloud environments and multicloud deployments. Further, Oracle Communications NWDAF can be combined with other 5G core network elements for network observability, and closed loop network automation.

The Oracle Communications NWDAF is disaggregated into two logical functions

The disaggregated architecture provides many benefits:

Ability to reuse preexisting data components
CSPs can reuse preexisting data components such as data lakes and message buses thereby reducing the time and cost of implementation.
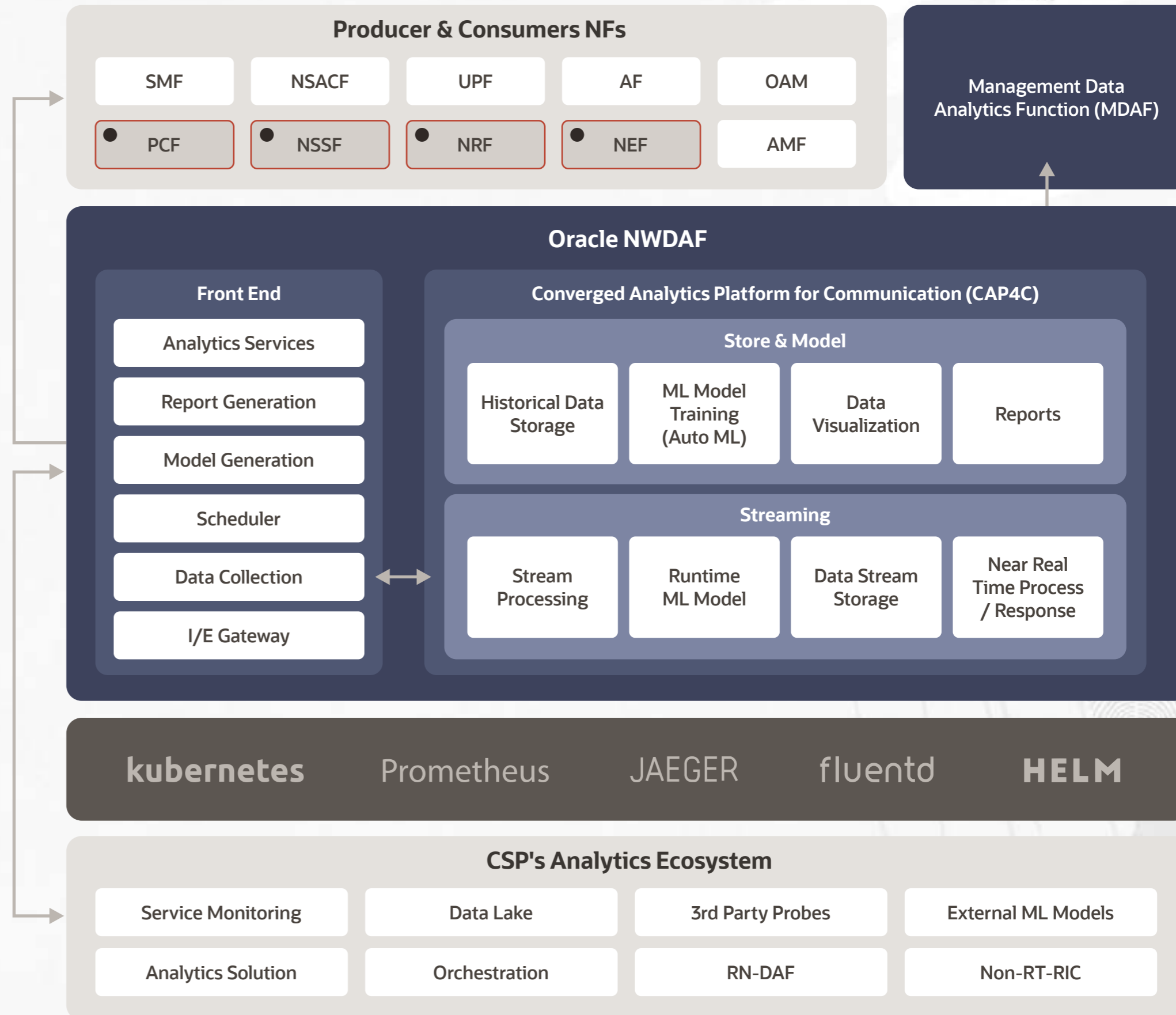
Coexistence with the analytics vision
Separation of the components creates opportunities for NWDAF to coexist with and contribute to CSPs' broader analytics strategies.

Reducing barriers
The standard interfaces of the NWDAF reduce the effort and time required by data practitioners regarding data access and preparation.

Driving network monetization
The NWDAF serves as a data and analytics repository which can be exposed to third-party developers to support in the creation of new services that create revenue and generate customer loyalty.

Producer & Consumers NFs

SMF	NSACF	UPF	AF	OAM
● PCF	● NSSF	● NRF	● NEF	AMF

Management Data Analytics Function (MDAF)

Oracle NWDAF

Front End
- Analytics Services
- Report Generation
- Model Generation
- Scheduler
- Data Collection
- I/E Gateway

Converged Analytics Platform for Communication (CAP4C)

Store & Model

Historical Data Storage	ML Model Training (Auto ML)	Data Visualization	Reports

Streaming

Stream Processing	Runtime ML Model	Data Stream Storage	Near Real Time Process / Response

kubernetes   **Prometheus**   **JAEGER**   **fluentd**   **HELM**

CSP's Analytics Ecosystem

Service Monitoring	Data Lake	3rd Party Probes	External ML Models
Analytics Solution	Orchestration	RN-DAF	Non-RT-RIC

● Oracle 5G core network functions

Use cases

The implementation of the NWDAF should be viewed in a broader analytics context rather than simply deploying it as a silo to fulfill the 3GPP specification. The NWDAF should complement the building blocks of a CSP's broader, end-to-end analytics journey. CSPs should look beyond 3GPP's pre-defined NWDAF use cases to discover others that the NWDAF might support, in the areas of customer experience, network security, and optimization.

The NWDAF's disaggregated architecture is key to realizing these additional use cases because individual NWDAF components can coexist with, and contribute to, CSPs' broader analytics architecture. The NWDAF can also become a key data source within such architecture and can consolidate 5G core network data so that it can be easily accessed using standard interfaces. This will reduce the time and effort required by data practitioners to access and integrate network data with other data sets to drive company-wide analytics objectives. In addition to supporting 3GPP Rel 16 and 17 use cases, Oracle Communications NWDAF supports a comprehensive set of use cases currently not defined under 3GPP.

Optimize network orchestration

NWDAF can assist in orchestration for network function load, resource utilization, and slice load optimization. Utilizing orchestration and NWDAF Analytics IDs will trigger scaling and predictions can be requested to automate future network expansion plans.

NF load information Initially, Oracle Communications NWDAF will provide the Network Function (NF) load based on the Network Repository Function (NRF). Resource utilization is available via OAM sourcing once the industry has settled on an implementation.

Optimize network slicing

Slice specific analytics IDs can track user equipment (UEs) and PDU sessions. Analytics IDs and PCF can identify network function, network performance, data network performance, and user data congestion.

Slice load information Slice load provides a load value that is based on the user equipment and sessions registered for a slice.

Observed Service Experience The Observed Service Experience use case delivers Application Function (AF)-based service experience per slice, application, MEC, and RAN.

- **Application service experience** The average of observed QoE and/or variance of observed QoE for a UE or a group of UEs in an application or in a set of applications.

- **Network slice service experience** The average of observed QoE and/or variance of observed QoE for a UE or a group of UEs in a network slice

Avoid congestion

Employing the policy control function (PCF) and NWDAF Analytics IDs categories of Network Performance, DN Performance, User Data Congestion and Dispersion, NWDAF can assist in congestion detection. Relevant action can be taken to mitigate or avoid congestion, which enables CSPs to not only improve customer experience, but also provide service differentiation.

User data congestion Network performance provides load and performance information for the RAN, including statistical and predictive analytics.

Dispersion Delivers data or transaction usage for a UE or a group of UEs.

Geo-fence for user experience mobility

Using a combination of the NWDAF Analytics IDs, Access and Mobility Management Function (AMF), and Application Function (AF) CSPs can use analytics-assisted geo-fencing for UE mobility and unexpected UE location. This includes UE location predictions – giving CSPs the opportunity to run location-based advertising, reach audiences with push notifications, and derive insights from real-time events. The Oracle Communications NWDAF consumer may request for these analytics separately, or in a combined manner.

UE mobility UE mobility provides access to UE location based on the location of the cell tower (the cell tower location is not the actual UE location so it is not considered an invasion of privacy).

Abnormal UE Oracle Communications NWDAF provides UE abnormal behavior analytics that allow consumers to identify a specific UE or a group of UEs with abnormal behavior, for example misused or hijacked UEs (including the UEs in which there are malicious applications running or the UEs that are stolen). When Oracle Communications NWDAF detects UEs that have deviated from the expected behavior, for example, unexpected UE location, abnormal traffic pattern, or wrong destination address, Oracle Communications NWDAF notifies the result of the analytics.

Additional 3GPP-defined use cases

QoS sustainability Delivers UE throughput in RAN and abnormally released flows per 5QI and slice

WLAN performance delivers WLAN load and performance

Session management congestion control delivers SMCC experience of high, medium, and low to estimate fairness

Redundant transmission delivers a "redundant transmission experience" value

DN performance delivers User Plane performance

UE communication delivers communication characteristics of a UE or group of UEs

The top five benefits of using Oracle analytics solutions

Cloud native disaggregated architecture with multivendor support

The disaggregation of the NWDAF means flexibility, increased pace of innovation, and the avoidance of vendor lock-ins. The Oracle Communications NWDAF can be combined with other 5G core network elements for network observability and closed network automation.

Generate revenues

Network insights provided by the Oracle solution enable the creation of new services to increase revenue and reduce customer churn.

Improve customer experience

The Oracle Communications NWDAF is key to achieving the analytics-driven, closed loop automation of network functions and network lifecycle management that is required to assure a high quality of experience (QoE), and meet the service-level agreements.

Improve operational efficiency

The Oracle platform approach towards the implementation of 5G network analytics will reduce the time and effort required by CSPs to access and integrate network data with other data sets to drive company-wide analytics objectives.

Analytics-driven closed loop automation

The Oracle Communications NWDAF can also be used for preventive network maintenance and proactive operations in order to facilitate advanced technologies such as machine learning (ML). The 5G core network data can be used to train ML models to predict network anomalies, identify root causes and recommend corrective actions to resolve network issues.

Oracle Communications NWDAF empowers CSPs to utilize analytics to future-proof their business and proves an integral source to a cloud native 5G core product portfolio, supporting carriers as they transform from purveyors of connectivity to providers of digital services.

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