MAVENIR™

SOLUTION BRIEF
MAVENIR'S NETWORK DATA ANALYTICS FUNCTION (NWDAF)

Mavenir's Network Data Analytics Function (NWDAF) offers Artificial Intelligence/Machine Learning (AI/ML) powered analytics services to enable closed-loop network automation. It is compliant with 3GPP Technical Specification (TS) 23.288 and 29.520 for data collection, analytics output, and procedures for providing analytics services as part of 5G core (5GC) architecture. These Analytics services can be used by other network functions (NF) for intelligent decision making to achieve various business goals such as efficient resource utilization, enhanced service experience, autoscaling, slice service assurance, and offer differentiated services. Mavenir's NWDAF supports additionally various southbound and northbound connectors to support pre-5G integration for converged network analytics.

Mavenir's NWDAF architecture is microservices-based and supports various modular data lake integration options. It can be deployed over bare metal, virtual machines, private cloud, and public cloud infrastructure. In addition to 3GPP compliance, it has a visualization component and a Machine Learning (ML) model training workbench supporting the CI/CD mode of operations.
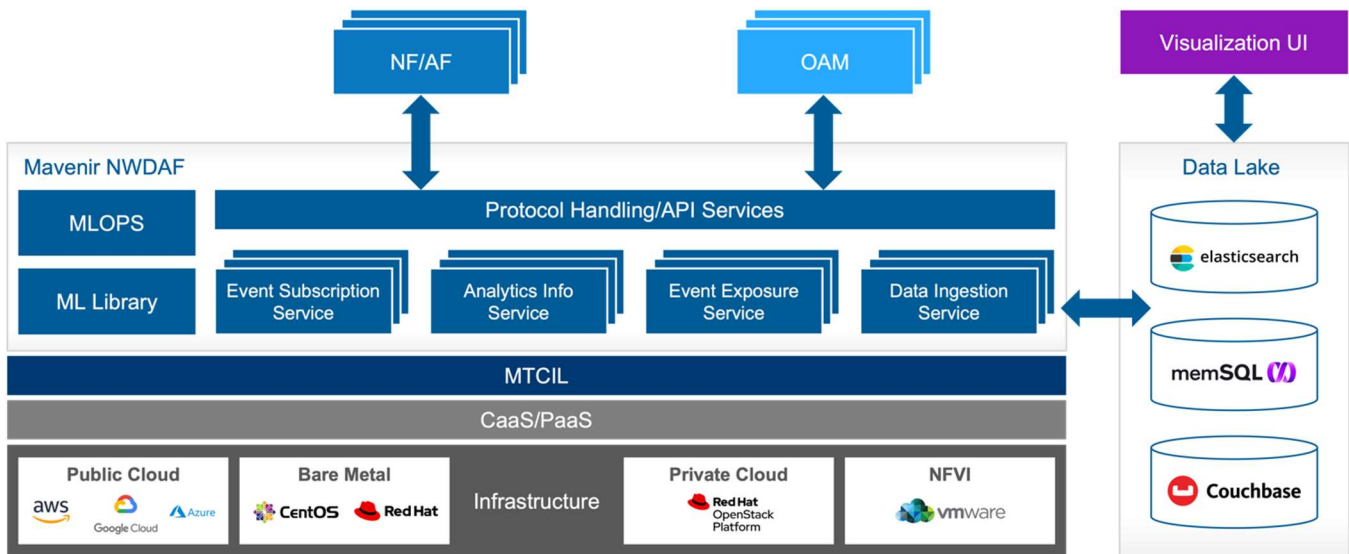

Figure 1: Mavenir's NWDAF Architecture

It supports various custom integrations such as BI tools and orchestrators and feeds into other systems such as Fraud Management System (FMS), Customer Relationship Management (CRM) through open APIs along with streaming north-bound data e.g., Kafka.

Mavenir's NWDAF solution consists of the below components at high-level for providing analytics services:

> **Data Lake and ML Platform services** provide management components and infrastructure needed for analytics and application services such as kafka, zookeeper, kubeflow, logstash, singlestore.

> **UI Rendering services** These services constitute the UI component needed for insights, MLOps, and management. They also provide APIs needed for third-party integration, such as BI tools.
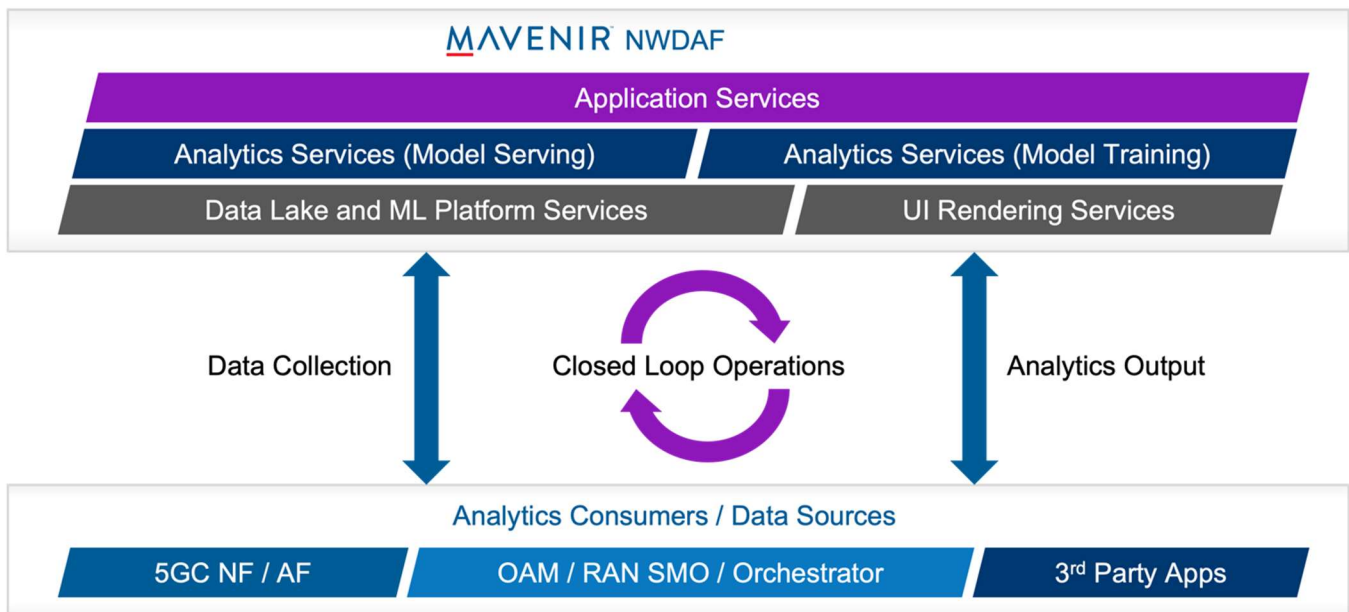

Figure 2: Mavenir's NWDAF enabled automated, closed-loop network operations

> **Analytics services** These are a set of microservices that perform statistical computation and prediction for each of the analytics use-cases served by NWDAF. Further, they function as two different set of blocks – one providing analytics services and another set of microservices does model training in the background for improving the accuracy of the ML prediction models.

> **Application services** These cloud-native services handle data collection and analytics services related tasks, such as
>   - Event exposure subscription and request to other NFs, Notify handling, Data Ingestion, ETL pipelines for the various data sources and data formats.
>   - Analytics services: Subscription-based data fetching handling, threshold-based or periodic notification for subscriptions, active subscriptions management.

Any 3GPP compliant NF or AF or OAM can utilize the NWDAF enabled Analytics services as 'Analytics Consumer' for making analytics-enabled decisions as part of their Network procedures.

Mavenir's NWDAF is 3GPP TS 29.520 release16 compliant and supports TS 23.288 defined exemplar analytics services as below.

- Network slice load analytics
- Service experience analytics
- NF load analytics
- Network performance analytics
- UE abnormal/expected behavior analytics.
- UE mobility analytics
- UE communication analytics
- User data congestion analytics
- QoS sustainability analytics

These analytics services enable closed-loop, end-to-end 5G network procedures enhancement as defined in 3GPP Release 16 TS 23.501, 23.502, 23.503 specifications:

- NSSF selection of Network Slice based on Slice Load Analytics information.
- PCF utilizing Slice Load Analytics provided load threshold values to modify the RAT Frequency Selection Priority (RFSP) policy associated with a Subscription Permanent Identity (SUPI) which has an associated Access Management (AM) policy.
- PCF using Observed Service Experience Analytics for session management and update service flow template's authorized QoS for affected users by comparing the 5QI values assigned to Application.
- AMF and SCP using the SMF Load Analytics information for SMF selection.
- SMF using UPF load analytics information to select/reselect UPF for subscriber's PDU session.
- PCF utilizing Network Performance Analytics provided load information for a given area and UE group to derive Background Data Transfer (BDT) transfer policies and negotiate with AF if required.
- PCF utilizing abnormal UE Analytics to perform UE QoS or Service Area restrictions based on Unexpected long-live/large-rate flows or Unexpected UE Location exceptions, respectively. Also, PCF utilizing "too frequent service access" and Suspicion of DDoS attack exceptions to terminate UE PDU session. And, utilizing the "wrong exception address" exception to perform service data flow gating.
- AF utilizing Expected UE Behavior Analytics for Service Operations information flow procedures.
- AMF utilizing UE Mobility Analytics for smart paging.
- AMF deciding on Mobile Initiated Connection Only (MICO) mode using UE mobility and UE communication Analytics.
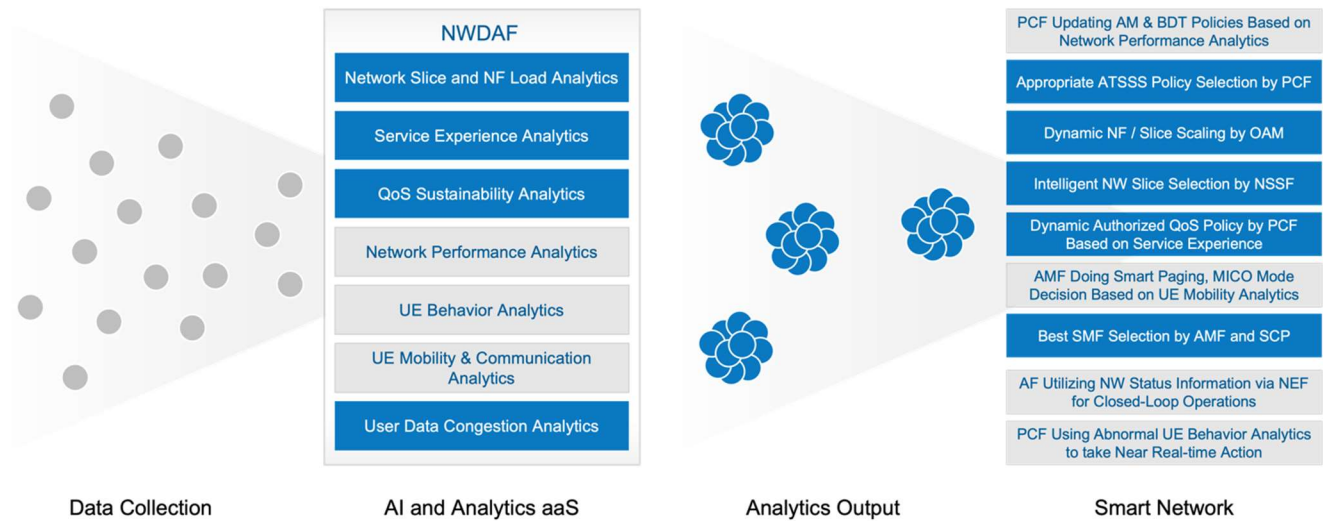- NEF deriving Network status information for AFs based on User Data congestion Analytics.

Figure 3: Mavenir's NWDAF powered Network Automation use-cases

Mavenir's NWDAF being standards compliant helps CSPs with faster Return on Investment (ROI), the quick launch of new services, offer custom differentiated solutions and more cost savings in the following ways:

> **Standard Compliant and Less CapEx:** It uses standard data sources and formats which makes Extract, Transform and Load (ETL) function lightweight ensuring lower Capex. This also helps CSPs reduce spend on probes, custom data source licenses and also accelerate integration in the multi-vendor environment using modular data lake and data bus integrations options available.

> **On-Demand Data Collection and Less OpEx:** It does on-demand data collection based on analytics services subscriptions and requests. This avoids unnecessary processing and storage of data, helping CSP to have lower Opex compared to always-on data collection mode by non-standard functions.
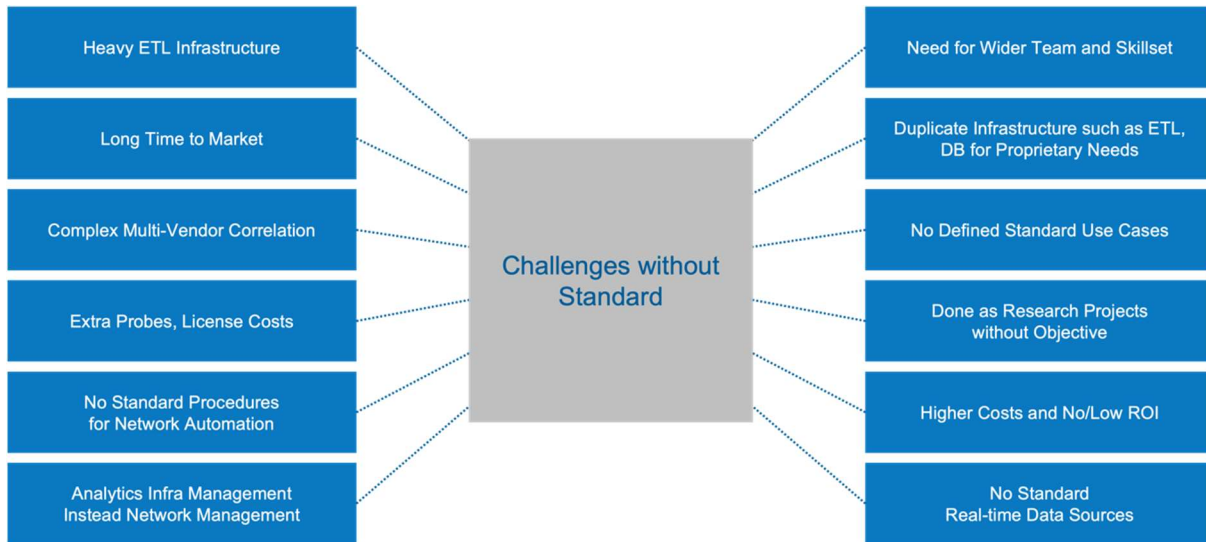
Figure 4: Driving factors for Standarization of Network Analytics - NWDAF

> **Open APIs and Easy Integration:** Mavenir's NWDAF supports open APIs which makes custom use-cases development and integrations easier for the CSP.

> **Granular Network Control:** It enables granular per-UE and application-level dynamic network control and network policies.

> **ML models and Innovation:** Mavenir's NWDAF solution provides efficient AI/ML libraries for custom use case development by CSPs to provide differentiated new services with the agile mode of operations. It also provides custom algorithm creation and tuning capability with an ML workbench for MLOps.

> **Converged network analytics:** Mavenir offers O-RAN alliance defined RIC for RAN control along with NWDAF to enable efficient end-to-end closed-loop network automation and control architecture across the RAN and packet core.

> **Distributed, scalable solution:** Mavenir's NWDAF can be deployed as multiple instances per analytics services and region with standard registration and routing support provided by network repository function (NRF) as part of 5G core.
This architecture makes it scalable from small to large deployments.

> **Efficient database design:** Mavenir's NWDAF uses an optimized database and schema design along with low latency queries.

About Mavenir

Mavenir is building the future of networks and pioneering advanced technology, focusing on the vision of a single, software-based automated network that runs on any cloud. As the industry's only end-to-end, cloud-native network software provider, Mavenir is transforming the way the world connects, accelerating software network transformation for 250+ Communications Service Providers in over 120 countries, which serve more than 50% of the world's subscribers.

For more on Mavenir solutions please visit our website at www.mavenir.com