Network Exposure Function (NEF):
Exposing the power of 5G-network to external entities

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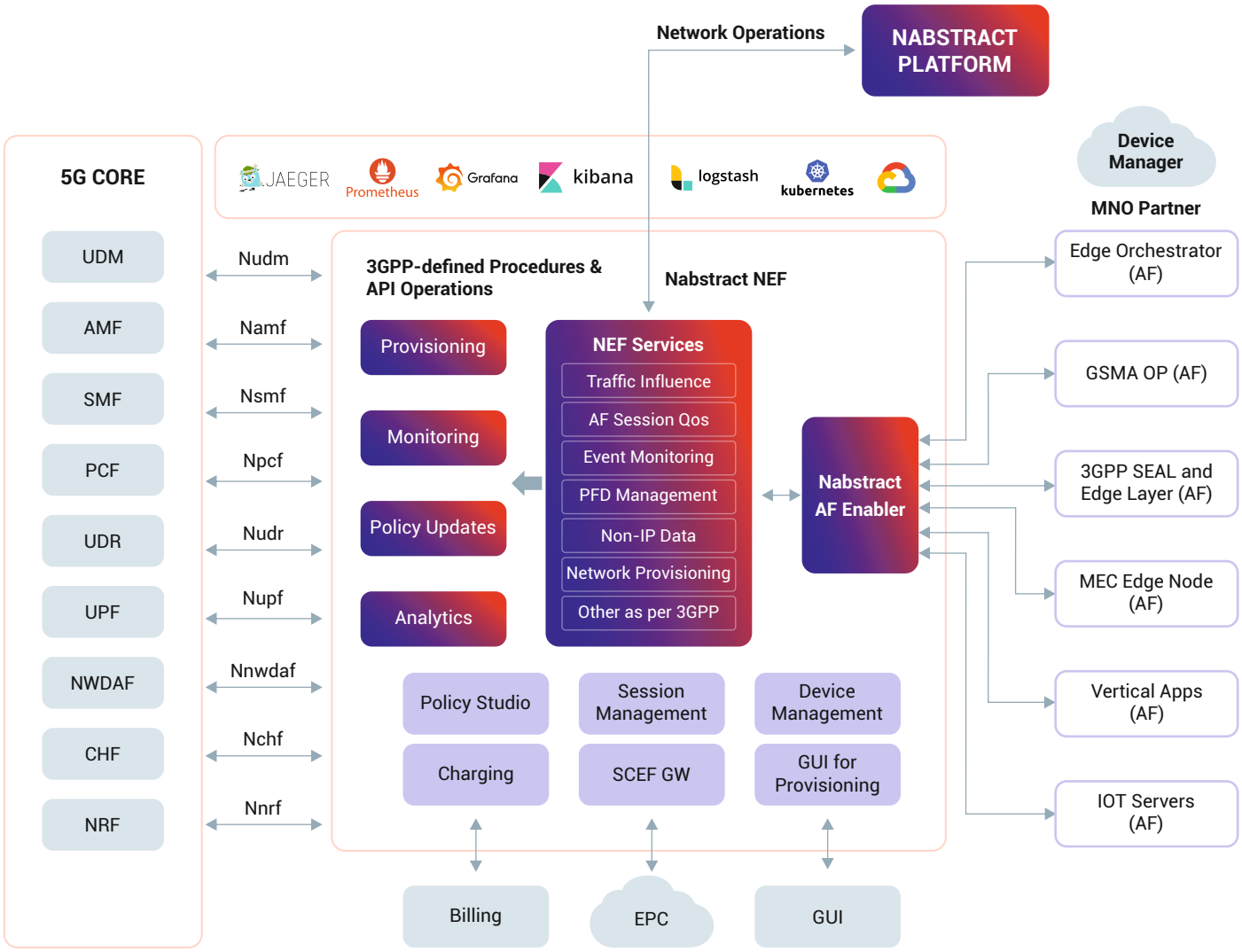
5G-networks, conceived fundamentally as multi-service networks, meet the connectivity-requirements of virtually any application with greater flexibility than previous technology-generations. Virtualization, Network Slicing, Edge-computing capabilities and a range of features can be capitalized on by telco networks to realize those connectivity-requirements and manage them efficiently for Vertical Applications and Enterprises. The features, exposed by the functions and the programmability of 5G-networks, are the most critical, wherein Network Exposure Function (NEF) signifies exposing the power of 5G-networks to any external entity. As one of the capabilities, natively built into the 5G-network and a gateway to a telecom-network, NEF is extremely critical in terms of security of access. The function has to scale with the growth of the network-usage by enterprises and verticals, which is why its features have been evolving with more and more requirements, as envisaged by the telco-community and specified in the global 5G-specifications by 3GPP. The criticality of the function lies in a telco operator's stretch of direct control on services, in terms of functionality and deployment.



Nabstract NEF
A versatile and scalable Network Exposure Platform

Nabstract NEF is a versatile, secure and standards-compliant scalable NEF product, that enables abstraction or exposure of the network-services and resources and empowers the next-generation applications to consume these services from telcos through APIs, to meet the increasing demands of Business Enterprises.

Nabstract NEF provides 5G-network services to the external applications and entities through well-defined APIs. It contains the intelligence to transform a service-request from the external Application Function (AF) to the appropriate service-request towards the 5G Core. The function manages the sessions for the service-subscription responses and the required notifications between the AF and the 5G Core functions. The network-services, provided by Nabstract NEF, can be used for monitoring and provisioning of the network, making policy updates and reporting analytics. A Policy Studio and a GUI are also provided to configure the function with the data and policies, required to manage the services. When required, SCEF (Service Capability Exposure Function) Gateway is used by Nabstract NEF to connect to 4G-networks.

Nabstract NEF Features

Nabstract NEF's features enable the applications to leverage on the three fundamental 5G-based services, i.e. eMBB (enhanced Mobile Broadband), mMTC (massive Machine Type Communications) and URLLC (Ultra Reliable Low Latency Communications), with the Vertical Use-cases like V2X, UAS and 5GMS (5G Media Streaming). Nabstract follows the service-based architecture of 5G Core and the service-implementations are fully compliant with the 3GPP-standards.

CAPIF
Nabstract NEF follows the CAPIF (Common API Framework) standards, introduced by 3GPP for exposing APIs securely to the third-party applications.

Diverse Deployment Options
Nabstract NEF is a cloud-native component which can be deployed as a container in a cloud, VM or Bare Metal, as per the topology required by the Telco, Cloud or Edge Provider. Multiple instances of NEF can be deployed, taking up roles as provisioned for each instance.

Policy Studio
A user-friendly Policy and Rule Engine is in place to configure Nabstract NEF and its behaviour for each service. This helps the operators to tune the functionalities, based on individual partners and 5G-network-providers.

Charging
Nabstract NEF can generate charging data-records and send to 5G Core for charging and monetization.

IoT Data-transfer
Nabstract NEF can act as the Session Anchor for non-IP IoT-sessions and connect the external IoT-servers to 5G Core. For mission-critical IoT-sessions, it can help the verticals manage the latency and other key-performance requirements of the applications.

Logging and Diagnostics
Application Logs are generated to monitor all the functions and diagnose issues with unique System Reference details.

Compliance with Standards
Nabstract NEF supports standard interfaces towards the 5G Core network-functions. The product is fully compliant with 3GPP Rel 16 and for selected services with 3GPP Rel 17. It supports the service-based interface towards all the key NFs of 5G Core – PCF, AMF, SMF, UDR, UDM, CHF, NRF, UPF and NWDAF.

3GPP TS 29.522 (along with 29.122 for 5G)	Network Exposure Function Northbound APIs
3GPP TS 23.501	System Architecture for the 5G System
3GPP TS 23.502	Procedures for the 5G System

The product complies with the CAPIF-services, enabling authentication and authorization of access from API-invokers of an untrusted or external domain.

Nabstract NEF Key Features

- **Exposes the capabilities of 5G Networks to the External Applications**
- **Standard interfaces for each function**
- **Service-based Architecture – REST API Interfaces**
- **Complies with 3GPP Release 15 and 16 and selected features of R17**
- **Security framework based on 3GPP CAPIF**
- **Multiple NEF instances can be run**
- **NEF for central and edge implementations**
- **Interfaces with all the major NFs of 5G Core**
- **Policy and Rule engine for individual services**
- **Inputs for Charging**

Network Exposure Function (NEF)

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Nabstract NEF Services

Event Monitoring
Nabstract NEF enables monitoring of device-status and network-events. For example, the AF can be informed by the NEF when a device moves into a specified Area of Interest. Nabstract NEF can expose more than 30 such data-points from the 5G-network.

Traffic Routing
One of the most important features enabling Multi-access Edge Computing (MEC) is the 'Traffic Influence'. Nabstract NEF uses Traffic Influence as a key currency, through which an external application can control the traffic-routing from the device to the data-network.

PFD Management
The Applications can modify the Packet Flow Descriptions (PFDs), sets of information enabling the detection of application traffic, through Nabstract NEF which can change various policies, applied on the Application Flows and provides required services to the SMF.

QoS on Demand
Nabstract NEF helps in selecting a set of AF-requested QoS-profiles, which can then be applied by the 5G-network, as required by the network-conditions.

Non-IP Data Delivery
Nabstract NEF acts as a Session Manager to deliver non-IP data between AF and the devices.

Background Data Transfer
This enables the applications to set the policies to send traffic, which is no time-critical, to a set of devices during non-busy periods.

Provisioning
Nabstract NEF provides services to AF for provisioning the 5G Core like 5G LAN, Communication Patterns, IPTV, Edge Servers etc. External applications can control the behaviour of the network by changing the configuration, based on the business-requirements.

Analytics Data
Nabstract NEF can interact with 5G NWDAF (Network Data Analytics Function) and bring forth up-to-date and real-time data-collection and consumption, the analytics data, for other Application Functions.

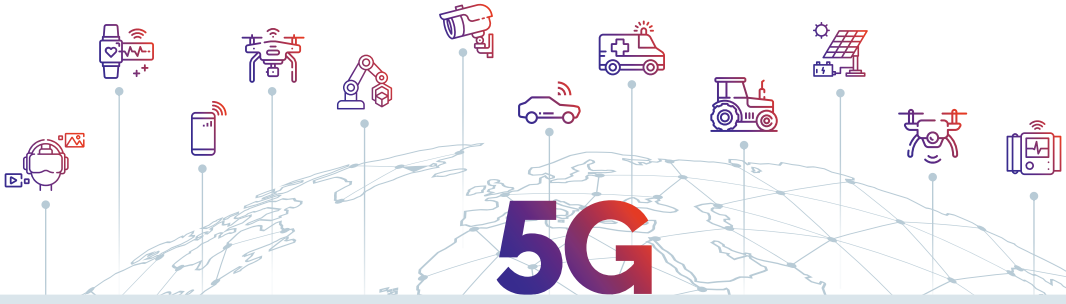
Services Supported

- **Traffic Influence**
- **AF Requested QoS**
- **Monitoring Services covering Location, Loss of connectivity, Reachability. Session Status, Roaming Status etc.**
- **PFD Management**
- **Non-IP Data Delivery**
- **Resource Management of Background Data Transfer**
- **Device Triggering**
- **Analytics Information Exposure**
- **5G LAN Parameter Provisioning**
- **Communication Pattern Parameter Provision**

Event Monitoring

Nabstract NEF can gather the data from AMF, SMF, UPF, UDM and PCF. Major ones are listed below:

- **Device Location**
- **Device Status – Connectivity, Reachability**
- **PLMN Changes**
- **Access Type**
- **UP Path Change**
- **PDU Session Status and Info**
- **UE IP Address Changes**
- **RAT Type**
- **Communication Failure**
- **QoS Monitoring**
- **Service Area Coverage Changes**
- **Satellite Backhaul Category Changes**



Nabstract, a B2B2X enabler Platform Overview

Nabstract NEF is a critical building block for the Nabstract Platform. Nabstract (Network+ Abstract) provides a platform, based on device, network & services, that converts complex network APIs into simple intent-based service APIs for Enterprises and Vertical Platform Developers. As an enabler for 5G B2B2X value-chain, Nabstract is engaged in the development of network exposure capabilities of 5G & Edge Cloud platform to build new differentiated services. Working with a B-2-B focus, the platform enables Telcos to get a leading edge by selling 5G-connectivity and cross-industry digital products to enterprises, realizing faster monetization from the networks. Reducing the complexity of the network infrastructure, the platform's simple APIs streamline and accelerate application development, quickening deployment and ROI-timelines for them. With Nabstract APIs, they can integrate all the data-sources, both on-premises and on the cloud, facilitating enterprises to build, manage and scale applications across distributed environments. Nabstract employs Open API methods by using different programming languages. The platform enables different vertical platforms related to healthcare, manufacturing, retail, transportation, smart cities, content delivery, gaming, drone applications, IoT-based applications and AR and VR applications to have vertical-specific APIs, in order to abstract relevant information from the networks.

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