

Oracle Communications Cloud Native Core Solution

The latest network evolution, 5G, offers more efficiency, security, and flexibility than any “G” that has come before. It will allow for new, highly customized, innovative services across many industries – and smart ecosystems whether it is a smart home, a smart workplace or a smart city – where participants and ‘things’ can engage, transact, and share information using a common digital platform. However, 5G introduces a number of innovative and disruptive networking paradigms, many of which had not been applied to mobile networks in the past. Operators will need the right partner to enable them in building a robust and scalable core which can deploy multitudes of network functions independent of the underlying frameworks.

Not all 5G core solutions are built the same...

Oracle Communications helps service providers navigate through the challenges of the new 5G core SBA architecture by leveraging decades of experience and heritage in 3G, 4G core network solutions combined with Oracle’s in-depth expertise in cloud native environments. Oracle Communications Cloud Native Core 5G network functions help service providers to cost effectively evolve their core network to 5G

THE NEW 5G CORE INNOVATIONS AND CHALLENGES

The fifth generation of mobile networks radically changed the way components in the core communicate with each other. The core network in 5G follows a Service Based Architecture (SBA) where network elements advertise and provide services which can be consumed by other elements in the core via APIs. This allows for the adoption of web scale technologies and software into telecom networks. Web scale technologies rely primarily on open source software and bring in significant automation. SBA is one of the cornerstones of the new 5G core: it applies IT network technologies to mobile services, enabling greater service innovation and offering sizeable benefits to operators. However, the Service Based Architecture is a major departure from previous generations of mobile networks. Operators need to look deeper and

consider how to leverage and possibly improve the IT-based SBA tools to support the needed attributes for telecom services. Service mesh is an emergent technology proposed to address challenges related to congestion control, traffic prioritization, overload control and optimized routing, within a cloud native environment.

A cloud-native service mesh is a dedicated common service for handling communication between services in a microservices architecture. It makes inter-service communication safe, fast, secure, and reliable. A service mesh simplifies applications by decoupling the network and provides end-to-end security, load balancing, traffic splitting, and more. However, an off-the shelf service mesh solution is not 5G aware, which deprives it from critical capabilities required to meet the 5G SBA needs. Experience of building and operating cloud native environments, and delivering signaling, routing, and policy solutions, has allowed Oracle to add 5G awareness to the service mesh foundation. This awareness is essential for helping CSPs overcome the many challenges the new service-based architecture presents, particularly related to traffic routing, prioritization, overload control, load balancing, and interworking. Oracle's cloud native microservices-based 5G Core solution supports multiple deployment options with a distributed architecture for resiliency, scalability and security, providing operators with choice and peace-of-mind.

WHAT DOES A CLOUD NATIVE, MICROSERVICES-BASED 5G CORE ENABLE?

Building a telecom network using authentic cloud native solutions deployed on private or public cloud platforms empowers CSPs to replicate the success of IT webscale models which have proven to be considerably more agile, cost-effective and customer-oriented. Furthermore, this enables CSPs to better leverage IT cloud based technologies such as Big Data Analytics, Artificial Intelligence (AI), and Machine Learning (ML), to optimize the network resources, understand customer behavior and anticipate needs to offer personalized and tailored services more efficiently and rapidly. From an operational perspective, CSPs can start to benefit from increased automation and more efficiency gains through adoption of agile processes. This includes: continuous delivery of software, continuous deployment enabled by automated testing, methods to enable canary releases and blue/green deployments, end-to-end service orchestration, dynamic slice management and, eventually, one-click procurement of slices deployed as a service for specific use cases and market segments.

ORACLE COMMUNICATIONS CLOUD NATIVE 5G CORE SOLUTION

Oracle Communications is focused on providing cloud native microservices-based 5G Core solutions designed on the following fundamental pillars.

40+ Years Telecom Heritage

Leveraging proven product innovation skills, session & signaling market leadership together with core network expertise to build the next generation of highly reliable and highly scalable core network foundational elements. This is summarized in an Intelligent Cloud Native Core Platform including cloud native 5G core network functions, all running in an Oracle or CSP provided cloud native environment (containers running on bare metal or containers running on Virtual Machines (VMs)). This solution can be deployed in the CSP's cloud or any other cloud. In addition, the solution can be enhanced with cloud based services from Oracle's SaaS Smart Ecosystem, including security, analytics/AI, monetization, etc.

Oracle Communications Cloud Native Core, Network Function Cloud Native Environment is based on the foundational concepts of Cloud Native Computing Foundation (CNCF) to help customers truly leverage the automation, scalability, agility, security and flexibility of cloud

Key Business Benefits:

- Significantly speeds-up service delivery time. With full automation from test to deployment (CI/CD) and independent lifecycle management of microservices
- Enable CSPs to go beyond traditional service offerings with easy integration to other cloud Services
- Leverage the proven operational efficiencies of the cloud with simplified container lifecycle management
- Curated and integrated set of tools picked by Oracle as well as 3rd party cloud native and industry experts to enable rapid and reliable cloud native application development
- Deployment flexibility built on the concept to build once, run anywhere. Enables moving between private cloud and public cloud, including Oracle
- Runs on a bare metal or VM based infrastructure, enabling CSPs to leverage current infrastructure/investment

ORACLE'S CLOUD DNA

An established cloud player offering a complete cloud portfolio including IaaS, PaaS, and SaaS solutions. Most of Oracle's on-premise enterprise software solutions have been re-written from the ground up into full SaaS solutions. As such, Oracle has integrated "Cloud" into its core DNA as evidenced by its deep expertise in not only building cloud-native applications but also operating them in a DevOps model.

ORACLE'S ADVANCED CLOUD TECHNOLOGIES

A wide portfolio of advanced cloud technologies including Big Data Analytics, Machine Learning, Artificial Intelligence, Blockchain and other technologies that are offered as PaaS and SaaS. Many of these technologies will play a key role in 5G. For example, the new 5G Network Data Analytics Function will require advanced analytics technologies, which are at the core of Oracle's Cloud offerings. Oracle Communications solutions leverage these advanced technologies to make the 5G core network functions smarter in areas such as slice selection, policy, binding and routing with unmatched scale and resiliency.

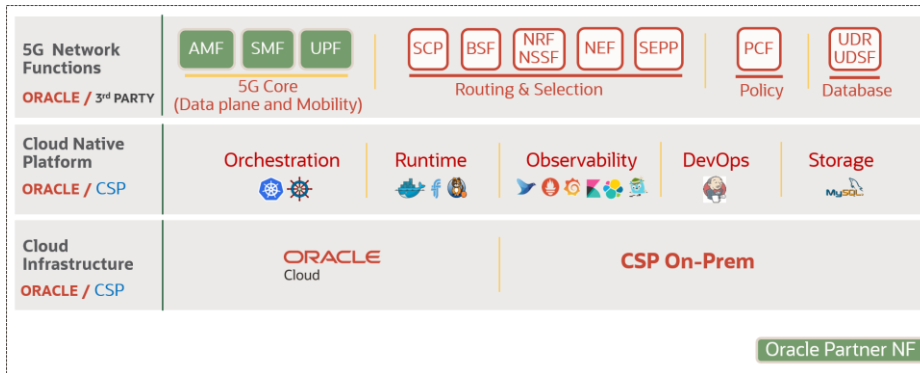


Figure 1. Oracle Communication Cloud Native Core 5G Network Functions

ORACLE COMMUNICATIONS GOING BEYOND STANDARDS

3GPP adoption of Service Based Architecture (SBA) and the desire to adopt cloud native concepts make the 5G standard specifications flexible and open to adopting new features and capabilities. Oracle is actively engaged with industry standards bodies bringing ideas beyond the standards to accelerate innovation and provide CSPs with competitive edge.

ORACLE COMMUNICATIONS CLOUD NATIVE CORE, NETWORK FUNCTION CLOUD NATIVE ENVIRONMENT

The Cloud Native Computing Foundation (CNCF) is an open source software foundation dedicated to making cloud native computing universal and sustainable. Oracle is a platinum member of the CNCF in the realization that its vision of an open, cloud native and standards approach is well aligned. With a rich heritage in telecommunications, Oracle Communications has a deep understanding of service reliability. Developing applications in this space has placed an emphasis on creating foundational platform services whereby applications could be built consistently to these expectations.

Oracle Communications Cloud Native Core, Network Function Cloud Native Environment (NF CNE) is based on leading industry open source services and tools, and it enables operation and management of 5G Network Functions (NFs) in a production grade environment. Oracle Communications NF CNE provides a holistic

Oracle Communications Solutions

- Oracle Communications Cloud Native Core, Policy and Charging Rules Function (CNPCRF)
- Oracle Communications Cloud Native Core, Policy Control Function (PCF)
- Oracle Communications Cloud Native Core, Service Communication Proxy (SCP)
- Oracle Communications Cloud Native Core, NF Repository Function (NRF)
- Oracle Communications Cloud Native Core, Unified Data Repository (UDR)
- Oracle Communications Cloud Native Core, Unstructured Data Storage Function (UDSF)
- Oracle Communications Cloud Native Core, Binding Support Function (BSF)
- Oracle Communications Cloud Native Core, Network Function Cloud Native Environment (NF CNE)
- Oracle Communications Cloud Native Core, Interworking and Mediation Function (IWF)
- Oracle Communications Cloud Native Core, Network Exposure Function (NEF)
- Oracle Communications Cloud Native Core, Network Slice Selection Function (NSSF)
- Oracle Communications Cloud Native Core, Security and Edge Protection Proxy (SEPP)

set of services to efficiently manage the 5G NFs. The flagship services of NF CNE includes:

- Runtime services (virtualization and networking)
- Orchestration and management services
- Storage services
- Security services
- Observability services (logging, tracing, and metrics)

Oracle Communications Cloud Native Core Service Communication Proxy (SCP)

Early in the 5G standardization process, Oracle identified SBA gaps related to the lack of a service framework to support common functions such as routing, addressing, load balancing, overload control etc. Oracle not only led the way in defining the Service Communications Proxy requirements and solution for Operators, it is still leading the way today in defining it in 3GPP R16 Service Communications Proxy (SCP) which is now part of 3GPP R16 as per the conclusion of the eSBA study (3GPP TS 23.742). It is also worth noting that Oracle Communications SCP is backward compatible with 3GPP R15, giving the option to build in network security and resilience from the start.

Web scale technologies rely primarily on open source software and bring in significant amount of automation especially in the deployment and operational aspects. As part of web scale technologies, to resolve issues such as congestion control, traffic prioritization, overload control, optimized routing, etc. several software solutions, referred to as service mesh, have been and are continuing to be developed. However, these solutions are based on informational elements present in messages below the telecom layer and hence not telecom aware. Oracle Communications' Cloud Native Core Service Communication Proxy brings telecom awareness to the service mesh. It not only resolves the challenges introduced by the 5G Service Based Architecture but also optimizes signaling controls. It enables service provider to get a better visibility into the core network; SCP also boosts the network performance by continuously coordinating with other network functions

Why Oracle Communications

- 40+ years of heritage in network experience meets cloud innovation to deliver highly secure, robust, and flexible cloud native 4G/5G core network solutions
- Dominance in 4G control plane category inventor for Session Border Controller & Diameter Signaling Router
- Cloud native environment based on Oracle's Cloud leadership and expertise
- Continued innovation in Cloud Native 5G Core control plane network functions
- Trusted partner ecosystem to deliver end-to-end 5G Core solution
- Network Slice-as-a-service for reduced OPEX/CAPEX & faster time to market with a rich SaaS ecosystem including IoT Cloud services
- Smart Monetization Solutions

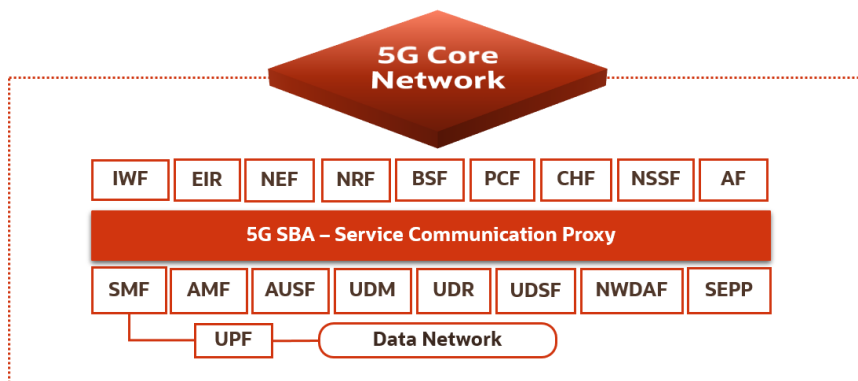


Figure 2. Oracle Communication Cloud Native Core SCP

The policy framework is one of the key components of the 5G network, empowering CSPs to better differentiate and customize tailored offerings for a wide range of use cases. At the core of Oracle Communications policy solution lies a flexible and intuitive policy design experience leveraging new tools and architecture for design, run-time, debugging and testing. This enables CSPs to generate and test operator policies from scratch and deploy them into their production environment in matter of minutes. The **Oracle Communications Cloud Native Core Policy Control Function** is built as a cloud native application composed of a collection of micro-services running in a cloud native environment. It separates processing/business logic and state concerns following the corresponding logical grouping of microservices/components:

- *Connectivity*: Components interfacing with external entities. This is where an API gateway is utilized to interface with external traffic to the PCF. These are stateless sets of components.
- *Business logic*: Application layer running the PCRF/PCF business logic, policy engine and various services that can be enabled based on deployment needs. These are stateless sets of components.
- *Data Management*: Data layer responsible for storing various types of persistent data. The PCF is built to be able to plug in different types of backend data layers that could be internal or external.

Oracle Communications Cloud Native Core, Policy Control Function (PCF) enables service providers to control 5G network by implementing complex policies decisions based on: network, subscriber and service information. At the core of Oracle Communications PCF lies a flexible and intuitive policy design experience enabling CSPs to generate and test operator policies from scratch and deploy them into their production environment in matter of minutes. Oracle Communications PCF empowers CSPs to customize tailored offerings for a wide range of use cases ranging from Enhanced Mobile Broadband, Ultra-Reliable and Low Latency Communication, and Massive IoT.

Oracle Communications Cloud Native Core, Network Repository Function (NRF), is a key component of the 5G SBA Core and serves as the registrar for other elements defined in the 5G core such as the Access and Mobility Management Function (AMF), Session Management Function (SMF), etc. The elements in the 5G core are expected to be instantiated, scaled and terminated with little or no manual intervention; the NRF maintains an up to date repository of the 5G elements available in the Operator's network along with the services provided by each of these elements. Given its role in the 5G core, the Oracle Communications NRF interacts with every other element in the 5G core of the Home Public Land Mobile Network (HPLMN) and provides management and discovery services as well as authorization and authentication. Oracle Communications NRF functions in stand-alone mode as defined in 3GPP Rel. 15. However there are significant benefits in integrating NRF with SCP for better selection results.

Oracle Communications Cloud Native Core, Binding Support Function (BSF) supports the interface to the 5G Policy Control Function (PCF) and Application Function (AF). It also supports the Diameter Rx interface for compatibility with IP Multimedia Subsystem (IMS) Proxy Call Session Control Function (P-CSCF).

Oracle Communications Cloud Native Core, Network Slice Selection Function leverages analytics inputs and a powerful policy engine for dynamic slice selection and adjustment based on flexible rules and real time information. **Oracle Communications Cloud Native Core, Network Data Analytics Function (NWDAF)** leverages Oracle suite of analytics solution to provide flexible platform for 5G Core analytics that can be easily extended to support new use cases and requirements.

The **Oracle Communication Cloud Native Core, Security Edge Protection Proxy (SEPP)** is a non-transparent proxy sitting at the edge of the PLMN network enabling secured inter-PLMN NF communication. Oracle Communications SEPP supports both standard and non-standard security frameworks.

Oracle Communications Cloud Native Core Network Exposure Function (NEF) and Service Capability Exposure Function (SCEF) securely expose the 3GPP network capabilities of 5G and 4G network respectively to Application Functions. Exposure functions act as a centralized point for service exposure and play a key role in authorizing all access requests originating from outside 3GPP network to enable Cellular IoT, non-IoT, edge computing and API gateway use cases for Operators.

The **Oracle Communications Cloud Native Core, Unified Data Repository (UDR)** is a data repository which hosts the structured data for the Unified Data Management

(UDM), PCF, and NEF as defined by 3GPP. The UDR architecture provides a highly available, distributed, flexible data storage platform using service-based, cloud native design principles. The flexible architecture of the Oracle Communications UDR is extensible to allow other data repositories, such as the Unstructured Data Storage Function (UDSF), to be hosted in addition to the UDR. Oracle UDR and UDSF use Oracle MySQL cluster technology which supports both SQL and NoSQL database access and leverages Oracle expertise in delivering carrier grade database solutions optimized for real time critical requirements.

The planned **Oracle Communications Cloud Native Core 5G Charging function** solution is based on Oracle Communications Billing and Revenue Management (BRM) acting as an Account Balance Management Function (ABMF) and the BRM Elastic Charging Engine (ECE) as a Converged Charging Server, which is a well-integrated and proven solution in mobile broadband deployments.

ORACLE COMMUNICATIONS: A STRATEGIC 5G PARTNER

The 5G core brings exciting new possibilities for communication service providers. It offers agility, efficiency, resiliency, faster iterations, deployment options, and decreased downtime for greater profitability. But 5G also presents some challenges. Addressing these challenges proactively and efficiently is essential to prevent costly delays or gaps in service. Oracle's history of 2G, 3G, and 4G innovation is alive and well in 5G. 5G is so much more than a faster mobile phone network. It has the potential to be a catalyst for a fourth industrial revolution! As 5G adopts IT WebScale cloud models, CSPs need a 5G partner with in-depth expertise and experience in telecommunications and core network technologies. But they also need a partner with foresight – that sees and can work toward the enormous potential of 5G. Oracle's telecom expertise, cloud DNA, and in-depth enterprise knowledge uniquely position it to be your most strategic 5G partner.

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