metaswitch

Metaswitch Fusion Core™

Cloud Native 5G for Network Operators

Meeting 5G objectives demands a fierce commitment to rapidly deploying a complete cloud native core. Establishing a plan which facilitates a smooth migration to this next generation infrastructure is critical for achieving optimal performance and realizing 5G's primary business goals of delivering innovative low-cost services. Only Metaswitch can provide the powerful, efficient, programmable and highly automated control and user plane functions required to make 5G a reality.

- **A complete cloud native 5G core solution**
- **Runs on any public, private or hybrid cloud**
- **Built using microservices methodologies**
- **The highest performance UPF data plane**
- **Exclusive support for 4G and Broadband**
- **Powerful orchestration using Kubernetes**

The evolution of mobile network infrastructures made a significant advancement with the introduction of 5G standards. Starting with a vision of communications in the year 2020 and beyond, 5G embodies the potential for a totally connected world which can enhance the lives of individuals while propelling industries and communities into a new era of innovation.

With the promise of meeting the insatiable demand for mobile bandwidth and providing an alternative to costly fixed line broadband, 5G New Radio (5GNR) deployments have already commenced, straining the existing core components to provide the required capacity. Upgrading the EPC user plane to support 5GNR prolongs the life of legacy network functions but early 5G Core (5GC) alternatives have lacked critical cloud native design principals or the packet processing throughput, programmability and flexibility required to be widely deployed. Without a clear path to addressing these issues, operators are left to continue 4G investments while contemplating the possibility of operating a highly-inefficient dual-core network.

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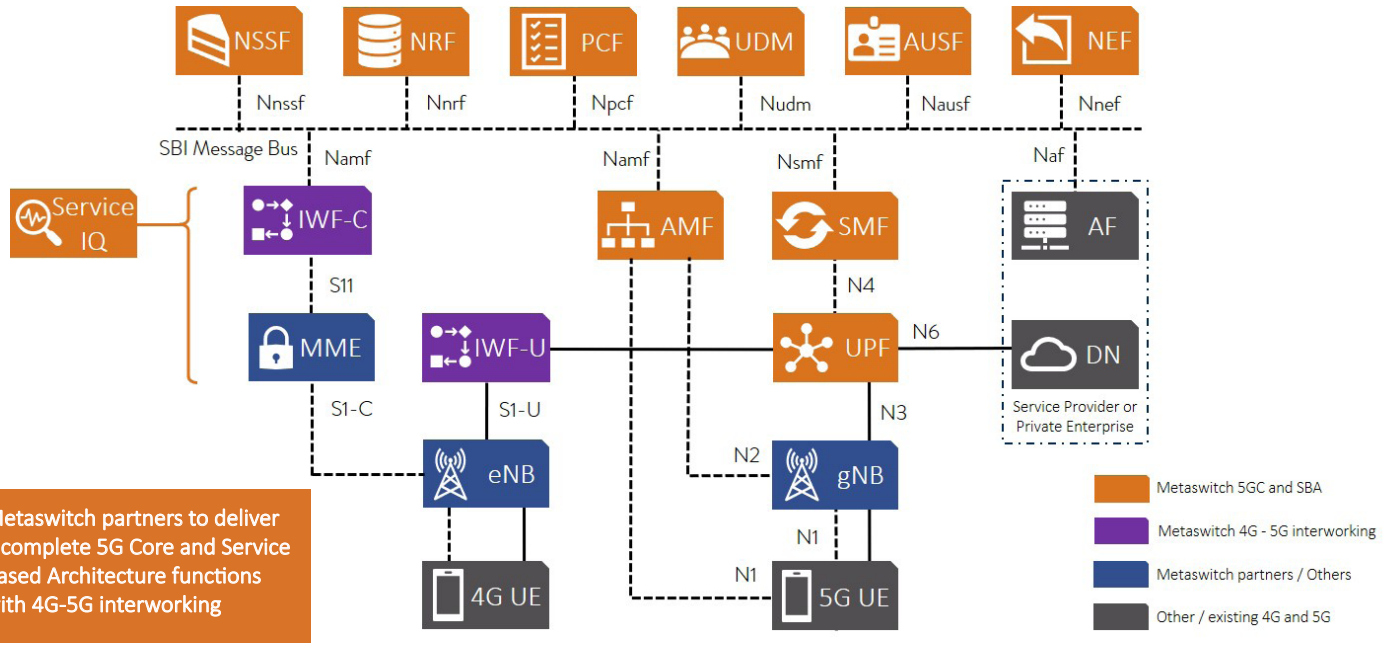
Without a primary 5GC supporting the backbone for all traffic, the inherent cost savings derived from the ability to deploy highly automated, distributed, cloud native network functions cannot be realized. Furthermore, the inability to efficiently deliver new services and network slices negates the opportunity for deriving new revenue streams from the implementation of expensive radio access technologies. This includes the expectations of the ITU-T's IMT-2020 vision for 5G, which covers support for enhanced mobile broadband (eMBB), ultra-reliable low latency communications (URLLC) and massive machine type communications (mMTC) in support of applications ranging from personal augmented reality to industrial automation and smart cities.

As recognized pioneers in cloudification, Metaswitch has a deep understanding of what it takes to deliver cloud network functions (CNFs) with superior performance, scalability and resiliency. This requires expertise in the areas of microservices development platforms and design patterns, highly distributed state maintenance, advanced data plane acceleration plus modern orchestration models. This is particularly critical when developing 5G core components, which will be some of the first network elements to be exclusively deployed in public, private or hybrid multiservice edge compute (MEC) clouds.



Metaswitch partners to deliver a complete 5G Core and Service Based Architecture functions with 4G-5G interworking

Metaswitch Fusion Core enables:

- The fastest path to 5G: With a unique interworking function, Metaswitch brings multi-access support on a single 5G Core architecture instead of a complex and costly dual core approach.
- The lowest cost per bit: Fusion Core delivers disruptive 5G core user plane performance with industry-leading compute resource utilization on both control and user plane functions.
- Massive scale/any cloud: Complete containerization of our core while leveraging Kubernetes Orchestration enables you to deploy and dynamically scale the core on any cloud infrastructure.
- Rapid service innovation: We strive to make the Fusion core developer friendly, with on-demand instantiation, open network interfaces and a highly programmable data plane.
- The network effect: Infrastructure-first initiatives ensure your network can meet all future service demands, thereby attracting new partners, users and applications to your business.

Metaswitch Fusion Core comprises four key 5G technical areas: The user plane, control plane, service-based architecture and management. Each individual function has been carefully architected to exceed the stringent demands that will be placed on them and can be instantiated within compute clouds with diverse virtual machine, container and serverless architectures that span from large centralized data centers to small edge application delivery locations.

The User Plane Functions

Subscriber packets, within a 5G's separated control and data plane architecture, are processed by the User Plane Function (UPF). The UPF is the protocol data unit session anchor enabling mobility between multiple radio access technologies and provides the interface between the 5G Core and other data networks. This includes not only the operator's Gi-LAN, where mobile applications and service platforms are hosted, but the carrier's private wide area infrastructure, interconnect peering partners and the Internet. As such, the UPF performs packet classification, routing and forwarding, a set of functions typically performed by proprietary platforms with completely custom silicon. However, these legacy hardware platforms lack the flexibility required to meet the business and technical demands of 5G.

Totally cloud native, instantly deployable, granularly scalable and uniquely resilient, the Metaswitch Fusion Core UPF features the first packet processing engine capable of deriving the cost/performance required to deliver a viable alternative to classic, physical, switch/routers. This is made possible by our exclusive composable network application processor (CNAP) technology. CNAP avoids the pitfalls of a typical data-driven switch's upfront packet parser by performing that function at each stage. Plus, unlike a classic code-driven system, CNAP significantly reduces the time it takes to load the code required to process packets each stage.

CNAP dramatically improves on current switch pipeline batching and interleaving techniques by first implementing a unique optimization approach which groups packets into superframes as vectors.

As the initial packet in the vector warms-up the, cache the number of cache misses is dramatically reduced, which significantly enhances performance. The pipelines themselves are completely programmable via application-specific graphs that are configured through an open application programming interface (API) and a just-in-time parser collects the fields required for each classifier only as they are required. The graphs are constructed automatically by the UPF's Software Development Kit (SDK) and expressed in a definition document that uses a custom YAML (Yet Another Markup Language) schema. External network automation applications can therefore program the graph without having to operate directly on the packet processing or classifying stages of an individual switch pipeline. A cross-compiler enables the P4 programming language to be used when defining UPF pipelines.

Whether employed as a UPF or fixed mobile convergence (FMC) Access Gateway Function (AGF), Metaswitch Fusion Core's programmability affords the ability to quickly and easily build innovative service function chains (SFCs) that enable a rich portfolio of service enhancements to be applied directly to the traffic flow.

Control Plane Functions

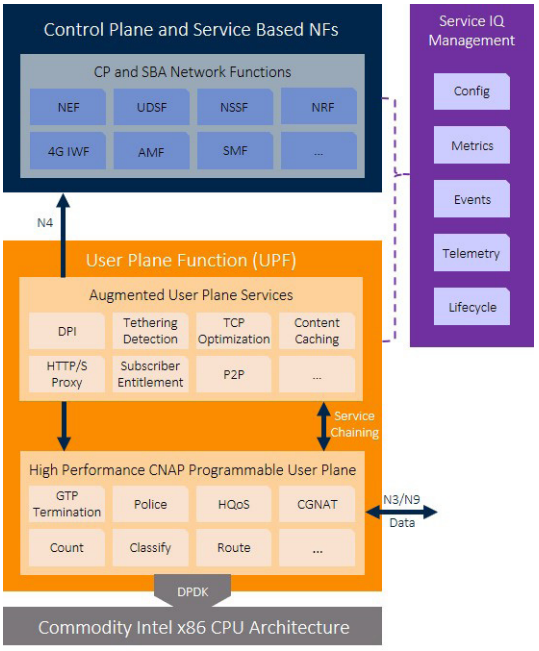
The Access and Mobility Management Function (AMF) and Session Management Function (SMF) are responsible for handling all control traffic within the 5G mobile infrastructure. This requires interfacing with the user equipment (UE), the UPF and supporting functions within the SBA. To meet the architectural requirements of 5G, the control plane elements must be entirely designed as a cloud-native network functions, dynamically deployed and scaled-up on-demand in a completely automated manner. This is a particularly complex proposition when it comes to high-availability control components with asynchronous call flows across geo-diverse infrastructures as they require long and short-lived state maintenance for sessions traversing elements that might quiesce without notice. These functions must therefore employ established design patterns for building and deploying massively scalable web applications while adapting to fit the constraints of real-time communications networks.

Employing our Unstructured Data Storage Function (UDSF), all Metaswitch Fusion Core components are implemented as decomposed stateless microservices. This critical new 5G service based architecture (SBA) element is architected for scalability and resiliency, providing the ability for other network functions such as the AMF and SMF to remain almost entirely stateless. Like the cloud native UPF, these control plane components are deployed in containers as N+k redundant systems which fully orchestrated by Kubernetes. This approach makes for a very robust and fault-tolerant architecture but, more importantly, greatly simplifies the automation of life-cycle management, especially for healing and software upgrades. This lays the foundation for transitioning to modern continuous integration and continuous delivery (CI/CD) operational approaches.

4G/5G Interworking

Recognizing that current migration options are convoluted or incomplete, the Metaswitch Fusion Core solution includes unique control and user plane interworking functionality designed to ease the transition from 4G to 5G while eliminating the huge costs associated with operating dual-core networks.

Early 5G has focused on the RAN, supporting limited use cases such as fixed wireless access (FWA). To implement a standalone 5G network, however, a complete 5G core implementation is required. Meanwhile, early mobile 5G UE's operate strictly in non-standalone mode, following the 3GPP's migration option 3x which continues to employ 4G signaling and an Evolved Packet Core (EPC). This direction still requires a significant CAPEX investment in and upgrade of practically all EPC components while resulting in a significant, ongoing, OPEX burden for the carrier. With this approach, a network operator faces the prospect of operating a dual-core network almost indefinitely.



Inside Metaswitch Fusion Core

For greenfield and incumbent network operators, the Metaswitch Fusion Core control and user plane interworking functions (IWF-C and IWF-U) provide an immediate path to 5G without continuing investments in maintaining a 4G core. The IWF-C exposes an S11 interface to 4G Mobility Management Entities (MMEs) and provides protocol translations for supporting functions, such as the Policy and Charging Rules Function (PCRF) by way of an N7 to Gx proxy interface. Commensurately, an IWF-U provides the necessary interworking required on the data plane to handle the possible disparities between how sessions and implemented and handled within the 5GC verses an EPC.

Service Based Architecture Elements

The 5G Service-Based Architecture (SBA) provides a modular framework from which common applications and services can be deployed to support control plane functionality while providing common data repositories. Assuming the role of either service consumer or service producer, the result is a set of interconnected but independent reusable Network Functions (NFs), each with authorization to access each other's services. Each network function exposes its functionality through a service based interface (SBI), which employs a well-defined, stateless, REST interface using HTTP/2.

Our success stems from a unique combination of our deep experience in software engineering with agile development capabilities and a very highly regarded support team.

There are numerous SBA network functions which are required to deliver a feature-rich and dynamic 5G core infrastructure that meets the technical requirements and business goals established by the 3GPP and ITU. Metaswitch partners with suppliers of best-in-breed SBA network functions, while delivering those integral to the operation of our Fusion Core components using our deep expertise in developing cloud native solutions.

Service IQ Management

Metaswitch Fusion Core's Service IQ delivers the management, analytics, orchestration, lifecycle and automation required to enable Metaswitch Fusion Core cloud native network functions to be rapidly deployed in distributed hybrid cloud infrastructures. Service IQ elements intelligently provision new service slices, dynamically scaling network functions on-demand. Meanwhile, our analytics platforms leverage network telemetry to monitor and manage the health and performance of these individual elements on an ongoing basis. Built on open source frameworks such as GitOps, Grafana, Prometheus and Kubernetes, our Service IQ solution aligns your 5G core network with industry-recognized best practices for IT Devops, dramatically simplifying and reducing the cost of managing this complex network while simultaneously accelerating the rate of innovation.

The Faster Way Forward

Facing continuous technological and competitive change, communications service providers are now entering the 5G era that demands a new perspective on how networks should be built, the roles that operators will play and the battlefronts on which they will compete. These networks need to be flexible and scalable enough to support a wide variety of new applications and devices, while cost effective enough to support an exponential increase in customer data traffic. 5G also offers the chance for truly practical network convergence, where a 5G packet core can handle traffic for both fixed wireless and mobile networks.

Seeking the many benefits promised by network functions virtualization (NFV), 5G standards are mandating software that is built on cloud native architectural design principles. And as the cloudification of digital services simultaneously becomes the norm, operators are looking at where best to deploy these cloud native elements: In public, private or hybrid clouds, in the core, or at the edge.

Metaswitch combines the best attributes of a nimble start-up and a seasoned market leader. We have a long history of providing high-performance, hardware-independent software to the communications industry. We're a proven and trusted partner for small and large network operators across the globe, thanks to our ability to support them on complex network and business transformation projects, while also remaining agile enough to react quickly to market changes and technology transitions.

Our success stems from a unique combination of our deep experience in software engineering with agile development capabilities and a very highly regarded support team. By deploying our cloud native software solutions, the world's most forward-thinking operators are building on Metaswitch to deliver innovative business, consumer and Internet of Things (IoT) communication services over the mobile connections of today and tomorrow. When looking to enter new markets, increase revenue, reduce costs and constantly leverage the benefits of modern technology innovations, those in the know, know Metaswitch - the faster way forward.

Metaswitch Core Fusion Features

Control Plane Network Functions

- Session Management Function (SMF)
- Access and Mobility Management Function (AMF)
- 4G Interworking Function (IWF)
- Network Repository Function (NRF)
- Network Slice Selection Function (NSSF)
- Security Edge Protection Proxy (SEPP)
- Policy Control Function (PCF)
- Unified Data Management (UDM)

User Plane Network Functions

- User Plane Function (UPF) for N3 and S1-U
- N3 Interworking Function (N3IWF)
- Access Gateway Function (AGF)

Access Technologies Supported

- 5G Standalone (SA) options 2 and 4
- 4G/5G Non Standalone (NSA) options 1 and 3 (via IWF)
- Wi-Fi Access (via N3IWF)
- Broadband Access (via AGF)

Minimum Base Hardware Requirements

- Standard x86 Intel Xeon (Skylake) CPU

Container Application Platform Supported

- Dockers with Kubernetes on Bare Metal or within VMs on Openstack/VMWare
- RedHat OpenShift
- VMware Essentials PKS (Tanzu)
- Azure Public Cloud (AKS)

Performance

- User plane
  - 40 Gbps per core (Intel Xeon Gold)
  - 500 Gbps (35 Skylake Cores & Mellanox 100Gbps NICs)
- Control Plane
  - 20,000 sessions per pod

Carrier Grade Capabilities

- N+k Cloud Native Redundancy
  - Per Site and Cross Site Support
  - Control plane: Stateless Design
  - User plane: Shard Based Design
  - Modular UDSF Implementation
- Automation Framework
  - Helm Based Automation
  - CI/CD Delivery with Canary Testing
  - Git/Artifactory Mechanisms for Upgrades
  - Kubernetes Lifecycle Management and Scaling
- Service Mesh Integration
  - Security framework
  - Advanced Load Balancing
  - Overload Protection
- Operational Tools
  - Integrated Performance Validation Tool
  - SAS Control Plane Tracing
  - Prometheus/Grafana, ElasticSearch/Kibana

Service IQ Management Components

- Telemetry: SAS (Control Plane)
- Config: GitOps
- Metrics: Grafana
- Events: Prometheus

Open Source

- CNCF Foundation Projects
  - Kubernetes, Prometheus, Fluentd
  - Multus CNI, Linkerd, Helm, etc
- Others
  - Intel DPDK, SR-IOV, Memcached, Grafana, Kibana

Features and specifications are subject to change without notice.