Zeetta NETWORKS

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WHITE PAPER

NETOS®: THE FIRST END-TO-END 5G PLATFORM SUPPORTING CONVERGENCE AND SLICING

What is 5G?

We believe that 5G will be a collection of multiple hardware and software technologies, based around wireless and wired communication network technologies, that combine in systems to deliver the ambitious 5G features of ultra-high-bandwidth, ultra-low-latency ubiquitous communications networks.

These 5G features will facilitate new and better ways of delivering value by connecting people and things to services that will increase quality of life and productivity.

5G is a collection of ambitious technology features, including ultra-low latency and ultra-high bandwidth, that will vastly improve connectivity of people and things.

What is the value add of 5G?

- 100 times higher data rate - A farmer in a video conference with a remote vet, caring for cows in the middle of a field in Somerset
- 1000 times higher data volume - Everyone in the stadium can see the instant replay of the goal, in high definition
- 100 times more connected devices - Tracking every rented bicycle in London, wherever they are
- End-to-End latency of < 1ms - Instantaneous response with interactive augmented reality
- 10 times lower energy consumption - Low cost connectivity everywhere

All of this enables the creation of new services and businesses that can deliver value to people wherever they are.

What are the 5G technological challenges?

5G, above and beyond the wireless focus of 4G, will drive innovation in all parts of the end-to-end systems that enable connectivity and services. This includes new capabilities in devices, integration of different radio technologies, optical backhaul, network service provisioning, cloud computing, virtualisation and so on.

In short, the 5G architecture vision encompasses all aspects of the communications and IT services systems that are combined to deliver services from the cloud to the edge.

5G is a "whole of system" approach to communications that encompasses innovation in wireless technology, wired technology (and specifically optical fibre connectivity) and cloud computing. This vision extends far beyond just improving wireless technologies, which was the focus of 3G and 4G.

5G will be a platform for the emergence of new applications and services. To enable this, close integration between heterogeneous access and transport networks and compute capabilities is required. This close integration leads to 5G convergence. 5G convergence requires a uniform architecture, encompassing a wide range of communications and compute models, that will make it easier and cheaper to deploy new services at scale in multiple different environments.

5G convergence is the outcome of a uniform architecture that closely integrates wireless and wired technology, especially with optical fibre connectivity, and cloud computing.

The scope of the 5G architecture also requires deterministic control over latency, bandwidth and reliability. This enables applications and services ranging from Autonomous Vehicles, AR/VR, Internet of skills (e.g. remote surgery) to fully connected smart homes, where the 5G network systems can provide guarantees that 3G and 4G systems cannot.

The requirements for heterogeneity of these emerging applications and services is creating a major challenge for network operators with the current 4G architecture. With the current 4G model, operators often have to build a dedicated network, with specific properties, for each application or service. This is not technologically, or economically, scalable.

What is required is a means to be able to use the same infrastructure for multiple services that are deployed alongside each other. In the compute space, server virtualisation and container technologies support the efficient utilisation of server hardware, upon which multiple services may be deployed. The logical accompaniment in the network space is network slicing.

Network slicing is about composing and operating multiple co-existing and isolated network slices (also known as virtual networks), each with its own topology, quality of service, and other properties, all sharing the same physical infrastructure. The major challenge here is to slice specific network segments, and splice those slices end-to-end, across wireless, switched and optical networks, connected to on-demand services on computing infrastructure.

From MVNO to 5GAVNO: 5G slicing will be an important technology enabler that allows operators to evolve the concept of Mobile Virtual Network Operator (MVNO) to a new level of application-specific virtual networks. 5G slicing will support the creation of multiple, coexisting and isolated virtual 5G networks, each with its own quality of service, serving a specific type of service or application. This is the concept of a 5G Application-Specific Virtual Network Operator (5GAVNO).

What is Zeetta Networks doing about it?

Zeetta Networks has developed NetOS®, a multi-technology, multi-tenant dynamic network slicing platform. NetOS® provides an open platform for programmable network infrastructure that is used to create flexible and cost-effective network and service virtualisation-based solutions. These allow versatile, scalable and on-demand transport networks to be created and managed for network operators

NetOS® differentiators and the core value propositions include:

- Vendor agnostic control, management and provisioning of services with multiple network device technologies, across multiple network domains
- Network virtualisation, or “network slicing”, where a common physical infrastructure can be sliced into multiple application/service specific logical or virtual networks for specific business and end-user applications, decoupled from the physical resources
- Utilisation of underlying physical network resources for multiple services in a multi-tenant environment
- Open APIs to allow 3rd parties to create network services via web-apps, scripts or integration with OSS/BSS
- An extensible and open framework to allow rapid support for new device plugins and drivers

NetOS® simplifies the provisioning and management of network services as slices, integrated with the expanding range of network management capabilities of open platforms widely adopted by industry. Being based on open platforms, NetOS® benefits from the rapidly increasing robustness of such platforms, the growing size of the open community, and the many options for support and development partnerships that the open platform communities offer.

NetOS® uses multiple layers of topology abstractions to represent baseline underlay networks, over which multiple virtual network overlay slices may be provisioned and managed. These topologies are exposed, using standard interfaces, as sliced networks (virtual networks) to higher layers. This delivers a heterogenous network abstraction, integrated with a slicing engine and platform services.

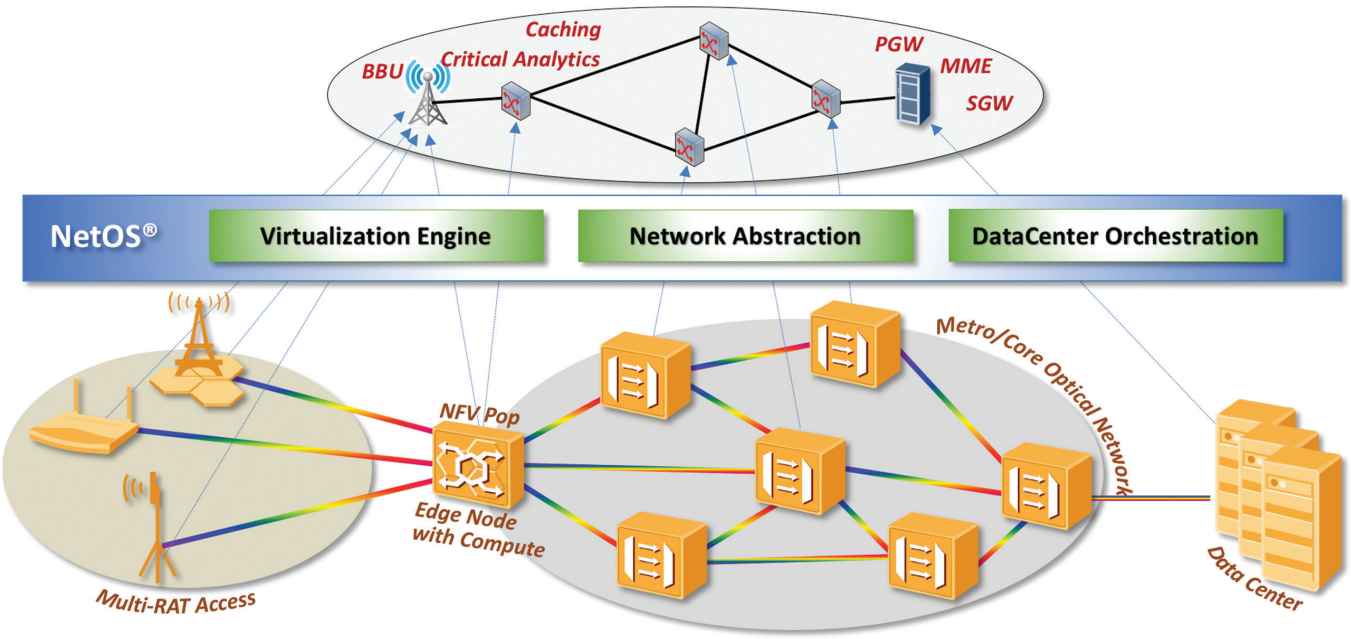

Figure 1 – NetOS® Topology Abstractions – Virtual overlay over infrastructure underlay

How NetOS® addresses 5G technological challenges

NetOS® for convergence of wireless, optical and packet transport networks.

The core service functions and abstractions offered by NetOS® support heterogeneous device integration into a common topology abstraction, as described above. Zeetta Networks has developed a patented, SDN-based, abstraction mechanism that supports heterogeneous wireless, optical and packet transport technologies.

NetOS® enables operators to achieve seamless convergence across wireless, optical and packet domains. The topology abstraction mechanism, and services that act upon it, are exposed through northbound (NB) APIs based on industry standards, such as the IETF Topology YANG models, and the ONF T-API as part of the MEF LSO PRESTO. Other NB APIs can also be supported, integrated with the same common abstractions, for application specific integration scenarios.

NetOS® implements unique and patented network abstraction techniques to enable vendor agnostic convergence of wireless, optical and packet transport into a single aggregated and abstracted topology with rich standardised interfaces for technology-independent control and operation.

NetOS® for convergence of cloud computing with heterogeneous transport network and 5G network function virtualisation (5G NFV).

NetOS® is seamlessly integrated with ETSI MANO, via the NetOS® NB APIs. NetOS® functions as a network control platform providing connectivity services with programmable bandwidth and delay for virtualised network services hosted in a data centre. The combination of NetOS® and ETSI MANO allows operators to meet their delay and bandwidth target for 5G virtualised network services at the edge (mobile edge computing - MEC) and core (virtualised evolved mobile packet core - vEPC).

NetOS® is seamlessly integrated with an ETSI MANO NFV platform serving connectivity for 5G services. It provides guaranteed delay and bandwidth for 5G network function virtualisations, including virtualised MEC and EPC.

NetOS® for 5G end-to-end slicing

The patented algorithms and service functions in the NetOS® core enable slicing (virtualisation) of wireless, packet and optical networks. These capabilities adapt to different network types by using programmable features of optical devices, transmission and links, as well as different Layer 0, 1, 2 and 3 constructs, such as wavelengths, SDH/SONET/OTN, VLANs, SSIDs, MPLS and so on.

A major innovation in the NetOS® virtualisation engine is the capacity to dynamically maintain quality of transport. This utilises a unique combination of analytical and heuristic models that take into account constant and time varying parameters of the transmission channel. This enables NetOS® to guarantee the quality of service and isolation of virtual networks for optical and wireless networks.

NetOS® slicing enables network operators to create a slice of a network across wireless, optical and packet transport with customised or application-specific topology and predefined quality of service such as bandwidth and delay. The sliced networks (virtual networks) are abstracted so that the complexity of heterogeneous optical, wireless, Layer 2/3 networks can be consistently managed via the rich set of APIs supported by NetOS®.

NetOS® utilises patented slicing technology that composes and manages multiple, coexisting, network slices, with programmable latency and bandwidth properties, across wireless, optical and packet transport networks. This is enabled with a rich set of APIs that abstract the complexity of network slices and provide independent control and operation of individual slices.

NetOS® is real

In the UK's first public trial of an urban 5G deployment, at the 5G Layered Reality event in Bristol, in March 2018, Zeetta Networks successfully demonstrated the capabilities of NetOS® in a live 5G network.

This demonstration encompassed several use cases, including Smart City Safety and real-time HD VR/AR applications, supported over the same physical infrastructure with dedicated network slices.

NetOS® was used to provision and operate multiple network slices, on-demand, across wireless, optical and packet networks, each with their own specific latency and bandwidth requirements.