Zeetta NETWORKS

NetOS powered by zeetta

WHITE PAPER

NetOS® – VENDOR-AGNOSTIC OPTIMISATION AND CONVERGENCE OF MULTI-LAYER NETWORK TECHNOLOGIES

Introduction – SDN and Network Visualisation

The rapid and immense success of open and programmable computing platforms, for example with the Open Compute Project[1] (OCP), has inspired similar ideas for telecommunications in the Telecom Infra Project[2] (TIP), of which Zeetta is a member. Key to the wave of innovations driving the TIP are the ideas for open and programmable networks, generally referred to as Software Defined Networking (SDN).

SDN is understood as a technology for a network control frameworkthat supports programmability of network functions and protocols. Importantly, this is achieved by decoupling the data plane and the control plane, tightly coupled in most network equipment, and providing open and standard APIs between them. This decoupling concept also appears, for example, as Control and User Plan Separation (CUPS) in mobile network architectures.

The separation of control plane and data plane means that the systems that determine how data should flow through a network – control plane – are distinct from the systems that do the forwarding – data plane. This allows, for example, the data plane to scale in response to traffic volume, without also requiring the control plane to scale in the same way.

This decoupling also means that control systems can integrate with different types of data plane, supporting multiple domains and multiple network technologies. As an example, a control plane that integrates optical and packet layers can be used to optimise traffic flow in a packet network over that optical network.

Alongside SDN, network virtualisation, principles are inspired by the compute domain. With network virtualisation, as with virtual machines (VMs) in the compute domain, the logical service is decoupled from the underlying network technology and physical hardware upon which it is realised. It is important to consider that network virtualisation is a distinct concept from virtual network functions (VNFs). Virtual network slices can be implemented over any type of network infrastructure, either a physical network or over VNFs.

- SDN and network virtualisation are the key technology enablers for creating an open, programmable and scaleable, network infrastructure to support services over networks, including the future 5G networks.
- Key areas are: 5G new radio technologies at the edge of the network, flexible optical networks for backhaul and core transport and slicing to maximise infrastructure utilisation.
- Existing SDN and virtualisation technologies were developed primarily for packet networks, whilst new techniques are required for new radio and optical networks to work along with packet networks.
- Network optimisation across multiple layers of optical, packet and radio requires awareness and control across multiple levels of network layer functions, protocols and services.
- Zeetta Networks is pioneering the development of a Network Operating System (**NetOS®**) for the realisation of an open and programmable converged optical, packet and radio network infrastructure.

[1] https://www.opencompute.org
[2] https://telecominfraproject.com

SDN combined with network virtualisation allows dynamic manipulation of the logical topology of the network and the creation of multiple coexisting network slices (virtual networks). Most importantly, just like compute VMs, the network slice realisation can be changed to support optimisation of physical resources.

Hence SDN and network virtualisation are two key technology enablers for creating an open and programmable network infrastructure.

The Challenge

New generations of Internet services are characterised by the global delivery of high performance network-based applications such as cloud computing, IoT and (ultra) high definition video streaming on demand that require high-capacity, low-latency, networks.

In response, the network infrastructure of the Internet is undergoing two major evolutions in core networks, and mobile access networks. At the mobile access edge, high speed wireless, known as "5G new radio" (5GNR), is offering ubiquitous high bandwidth. In core networks, where mobile traffic is backhauled to data centres, there is significant growth in high capacity optical networks.

SDN and virtualisation technologies, to date, have largely been developed in the context of electronic packet switched networks. The characteristics of such networks are very different from wireless and optical networks, that are analogue in nature and with highly non-linear and time-varying transmission characteristics.

The challenge, then, is how to bring the benefits of SDN and network virtualisation, discussed above, to this world of new radio and optical. In particular, how to do so in a way that supports integration of control, and so optimised virtualisation, of packet-based networks over radio and optical networks.

Zeetta Networks' vision

Zeetta Networks' vision is to enable the management of network slices as virtual networks over open programmable and converged multi-vendor network infrastructure.

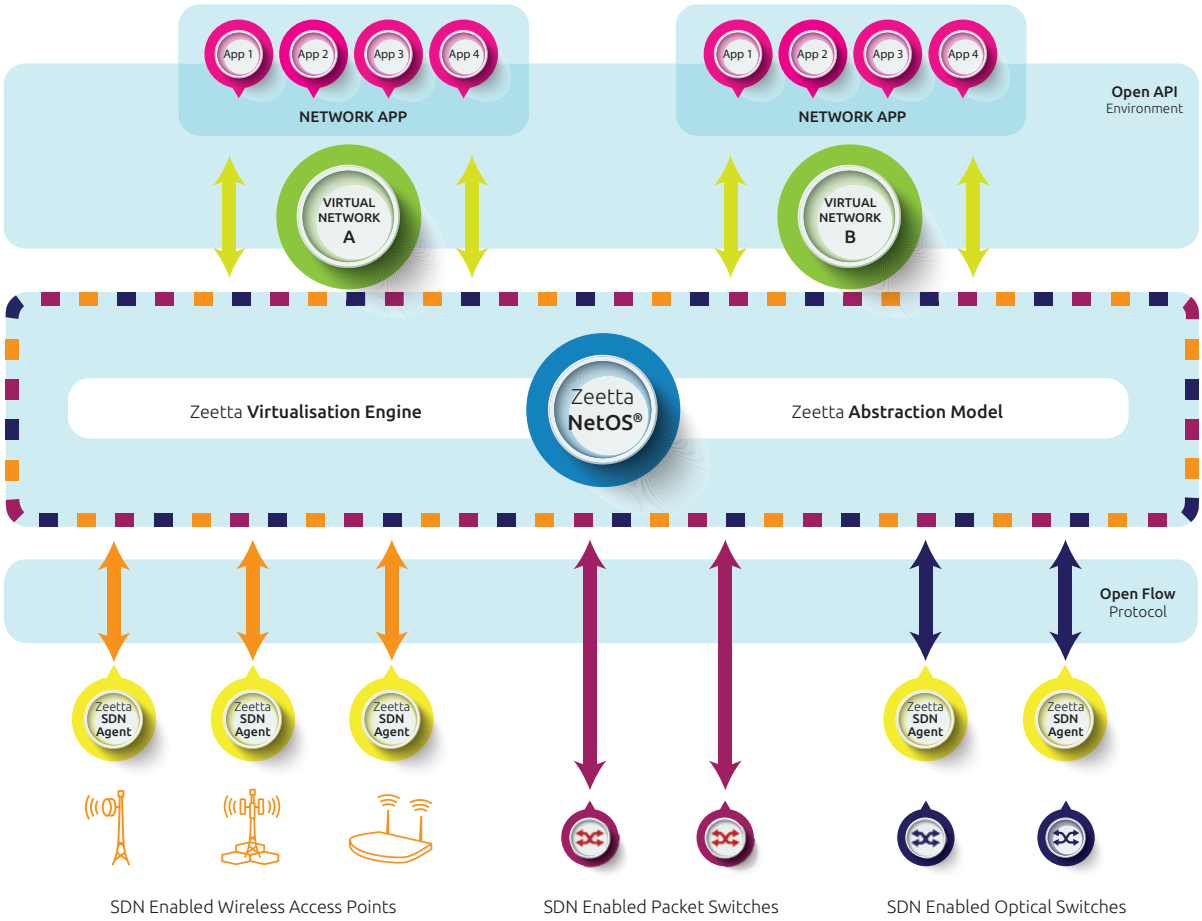

Figure 1: Open and programmable converged network architectural vision based on Zeetta's Product: NetOS®, SDN Agent, Virtualisation Engine

NetOS®

With NetOS® decision makers can manage network slices over an infrastructure composed of multiple vendors' network devices, open and programmable converged optical, packet and wireless virtual network infrastructure.

NetOS® is the SDN-based network operating system developed by Zeetta Networks. It is based on the OpenDaylight platform, extended with a completely new network abstraction model, virtualisation engine and network analytics as well as a Software Development Kit (SDK) for application and service developers.

NetOS® is flexible, programmable and extensible to support the integration of wireless, optical and packet transport technologies within a unified, multi-domain topology representation. This allows NetOS® to instantiate and control virtual network slices that are optimised across multiple network domains and levels.

NetOS® Abstraction

To seamlessly converge heterogeneous network switching and transmission technologies, NetOS® provides an abstraction that uniformly integrates the capabilities of transport and switching technologies at different layers.

This abstraction opens up complex network infrastructure for application and service developers, without requiring specific knowledge of the multiple underlying network technologies.

Importantly for the application developers, the NetOS® abstraction provides a generic programming, configuration and operational model for the wireless, packet and optical network domains.

NetOS® Virtualisation and Slices

Behind its abstraction, NetOS® provides network virtualisation, where logical network slices are created as overlay networks on an underlay. In the simplest sense, the underlay is physical network infrastructure, whilst the slice overlay is a representation of, say, an Ethernet service.

The key capability here is that the slice can be maintained even when the underlay changes. The abstraction manages the relationships between the overlay and underlay and can remap the overlay slice if the underlay properties change. If the Service Level Agreement (SLA) cannot be met by the underlay, then the slice overlay can be remapped. Or, indeed, if the underlay fails entirely, then the slice is automatically remapped.

The underlay can also be a slice, so that slices can be sliced. This allows for slices from an operator, for example, to be provided to an MVNO, who could, in turn, sell slices of the slice to its customers. Slices, as virtual networks, can also be provided with differing degrees of management control over the underlay resources, which could be virtualised also.

Some of the important consequences are that the utilisation of the underlay resources, at the physical layer, can be optimised. Rather than looking to over-provisioning as the only solution to meeting potential peak demand, an operator can have the service slices intelligently deployed.

This, in turn creates scope for new network service types that can be sold over under-utilised network underlay networks. Such network services could, for example, be used as best effort services for IoT devices, where the network could even signal potential best-effort service consumers when cheap network services are available. There are many ways in which the slice capabilities of NetOS® can be used to create new, consumer and application aware, service types like this.

Summary

NetOS® is an open, programmable networking platform for managing network slices over converged optical, wireless and packet switched networks. **NetOS®** provides a set of key technology enablers for managing slices in an open and programmable environment, including:

- Supporting packet, optical and wireless network abstraction and virtualisation.
- Utilising OpenDaylight as an open platform, extended with a network device abstraction model, virtualisation engine and network analytics, with an SDK to support application development.
- A unique abstraction technology that encapsulates the technological details of optical and wireless networks for application and service developers.
- Using virtualisation to create multiple coexisting and isolated virtual network slices, all sharing the same, optimised, physical infrastructure.

Zeetta Networks, 1 Friary, Bristol BS1 6EA, UK | Tel +44 (0)117 344 5304 | Email info@zeetta.com | www.zeetta.com

JN.18159