

NetOS

Putting the “Universal” back into uCPE

With Benu NetOS, businesses and service providers can experience the full benefits of NFV and extend cloud-centric technologies all the way to the customer premise. On a single uCPE, all network functions can be integrated into a single solution without getting locked into vendor’s custom hardware. This enables ultimate flexibility to combine best-of-breed solutions without the cost and complexity.

Virtualization on a single low-scale uCPE has different requirements than big server clusters in a data center. VMWare, OpenStack and other virtualization solutions are not appropriate. What’s needed is a virtualization layer that requires very little CPU and RAM footprint.

The NetOS solution provides:

- Universal whitebox support
- Universal virtual network function support
- Does not require custom hardware or heavy duty hypervisors

Unlike other uCPE software platforms, NetOS is an edge-native, versatile software middleware designed to support a wide range of third party Virtualized Network Functions. The days of being locked into one vendor’s solution are gone. Businesses now have the power to choose their own collection of network services, enabling ultimate flexibility and investment protection.

NetOS provides an open programmable data plane that encompasses the following functions:

- Lightweight hypervisor
- Virtual switch fabric optimized for higher performance and easier troubleshooting
- Orchestrated service stitching of VMs
- Subscriber and device-level visibility
- Layer 2 or Layer 3 service function
- Universal service function chaining of any VNF independent of their support of VXLAN, NSH

NetOS comes with zero-touch provisioning, eliminating any complex, manual configuration on the uCPE. NetOS uses the Benu Node Manager on the uCPE to connect to the cloud-based Benu Domain Controller to obtain its configuration and provide service orchestration. When the uCPE is deployed, it will automatically contact the Benu Domain Controller, authenticate, and download the appropriate services profiles.



Key Highlights

No Vendor Lock-in

- Regain the power to choose your own uCPE hardware and your own collection of VNFs
- Simplified Network Service Descriptors that hide all the complexity of Service Function Chaining and underlying technology with simple TOSCA descriptors
- Switch vendors or add capabilities without costly hardware swaps or network reconfigurations

Seamless Scalability

- Offload services to the cloud, which allows for an increase capacity without impacting performance or requiring a hardware switch
- Scale from ultra-low end CPEs to high end servers

Extensible and Interoperable

- Open, programmable software
- Support multi-vendor services
- Support any VNF, independent of VXLAN/NSH support
- API's adhere to ETSI SOL-003

Fully Loaded With Suite of Services

- Option to enable Benu Networks' extensive suite of services

Reduce OpEx With Zero Touch Provisioning

- TR-069 compliant for secure management of each uCPE

Minimize Hardware Cost

- Only requires 2 cores for 1Gbps throughput*

Ultra-Low Latency

- less than 0.020 milliseconds downstream, and 0.010 milliseconds upstream

* tested on Intel C3308



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Performance

The NetOS Platform is optimized for high networking performance. NetOS requires minimal footprint to deliver maximum networking performance. In stark contrast to other solutions, NetOS requires only 2 cores (1x DataPlane, 1x ControlPlane) and 2GB of host memory to achieve 1 Gbps of full duplex.

2 Cores 4 Ports Model name: Intel(R) Atom(TM) CPU C3338 @ 1.50 GHz			
Performance	Packet size (Bytes)	Mpps	Gbps
IP Forwarding	512	430	2.0
	1000	227	1.8
Gateway with NAT	512	187	0.8
	1000	179	1.4

In addition, NetOS provides “universal scaling” in that VNFs can be dynamically moved from the uCPE to the CSP Edge or cloud to boost capacity and thereby increase throughput by a factor of 10x! Thus, customers can purchase uCPE hardware that meets their typical needs without worrying about peak loads exceeding their hardware capacity.

SD-Edge Platform Capability

Built using Benu’s SD-Edge software, NetOS has the option to come fully loaded with a broad set of powerful network functions and services, ready to launch in an instant. With one product, businesses immediately have the opportunity to access to Benu Networks’ entire solutions set, including managed business services, managed home services, routing functions, CGNAT, firewall, content filtering, malware/phishing prevention, advanced bandwidth management with hierarchical quality of service (H-QoS) and more. Services can be turned on and off easily, and without requiring any extra cores, or replaced with 3rd-party VNFs.

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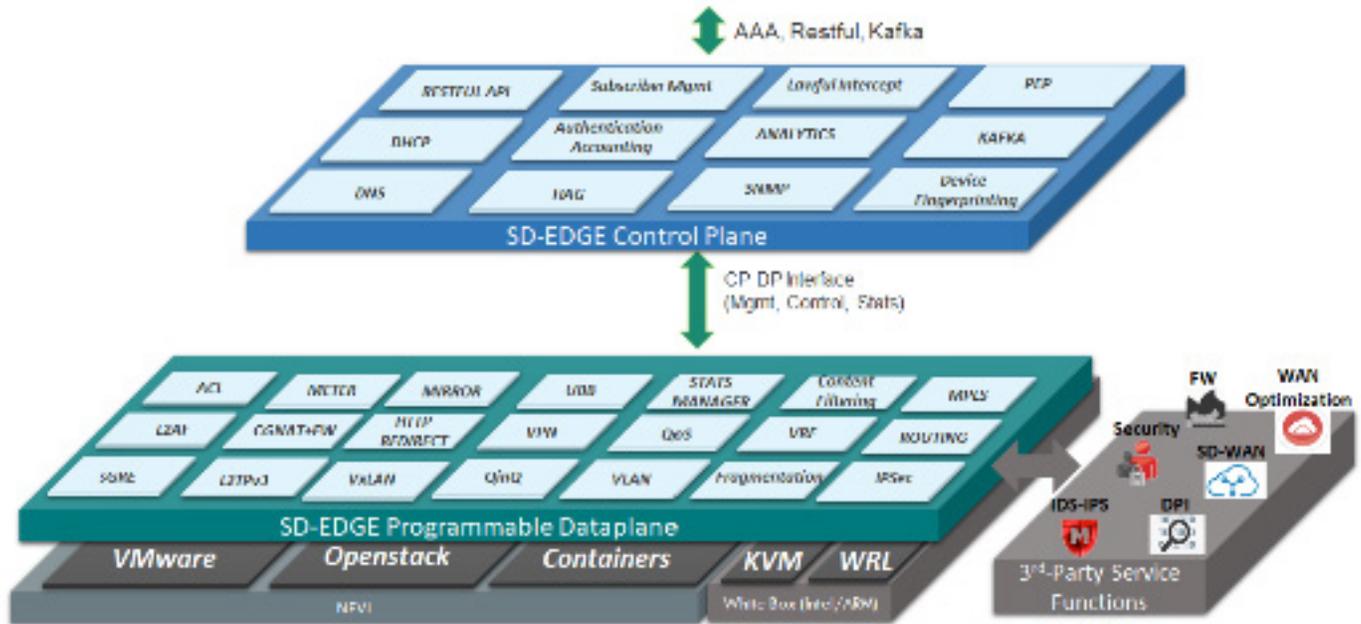


Figure 1: SD-Edge functions are an available option on the NetOS platform

Benu believes in open systems and we are committed to businesses having complete vendor flexibility, as NetOS supports a multitude of third party VNFs. This enables businesses to use best-of-breed solutions and to evolve their uCPE solution without having to replace custom vendor hardware. The architecture lends itself to interoperability and integration, as both physical and virtual machines can be orchestrated using the same set of standard APIs.

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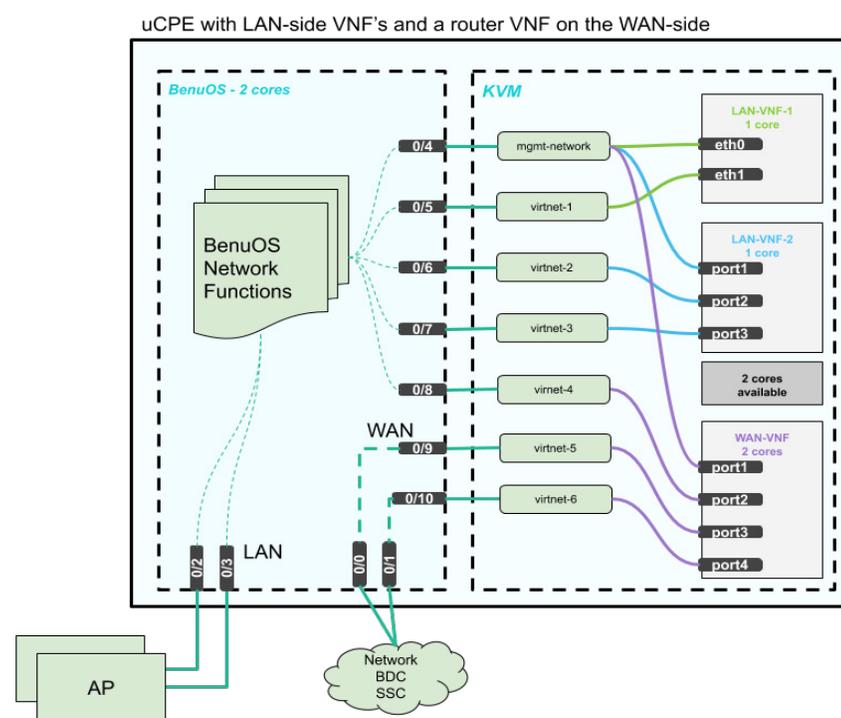
Switching Services Between uCPE and Cloud

Benu NetOS Flexi-Edge CSPs can provide services not only with the uCPE, but extends the service creation and management beyond the scope of physical uCPE. With BenuNetOS CSPs can easily create services in public cloud or private clouds. NetOS Smartbridge and service function chaining capabilities stitches services between different physical and cloud networks.

Platform Architecture

The NetOS Platform is architected for high performance networking and includes deep analytics and tracking, including Latency measurements and TCP flow resets, DNS latency, and more. In traditional network virtualization, packets are copied at each transition point, compounding latency and adding additional complexity and costs. NetOS bypasses this process and instead enables low latency, optimal throughput, and a simplified process without negative impacts.

The uCPE “Node” running Benu NetOS can be a physical device (eg. 8-Core Lanner, 4-Core Silicom, xMEG)



or a virtual entity running in the cloud (Public or Private). The Benu Node Manager parses network service descriptors and VNF descriptors to create a deployed service. The descriptors are JSON or YAML formatted for effortless integration with a third party OSS/BSS.

Virtual Networks are created using Network Descriptors (NSD), which then are attached to NetOS (DPDK). Once this happens, the networks can then be configured as though they are physical interfaces on the LAN or WAN side of the uCPE.

Using VNF Descriptors (VNFD - ETSI SOL-001 compliant) the Benu Node Manager creates a VNF and attaches it to the networks specified in the descriptor.

The uCPE Node reports VNF events (KVM), System-level events (Syslog), and System statistics (Kafka) to provide information about both host and guest VNF's.

Benu OS running as the VIM eliminates overhead introduced by Openstack by interfacing directly with VNF's running in KVM, saving time and costs. Additionally, it minimizes latency, avoiding packet duplication and other complexities. Latencies introduced by the Benu Dataplane are less than 20 microseconds downstream, and 10 microseconds upstream.

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Orchestration and NetOS APIs

Automate the deployment and management with orchestration integration and zero touch provisioning. Crafted for programmability, NetOS offers a set of APIs that can be used to orchestrate both physical and virtual nodes. A full range of VNF lifecycle management API's are supported: create, start, pause, resume, reboot, heal, terminate. All APIs adhere to the ETSI SOL-033 specification for clarity and increased extensibility. Any events generated by guest Virtual Machines are sent via POST to the Benu Domain Controller.

VNF Ecosystem

The NetOS Platform List of currently tested VNF's: FortiGate, VyOS, Benu BOSS, Juniper VSRX, Ubuntu, CentOS

About Benu Networks

Benu Networks is a leading software and solutions provider, simplifying the industry's most complex edge networks. With a comprehensive set of products and innovative solutions, Benu Networks delivers solutions to instantly transform legacy networks, elastically manage services, and carve the path to 5G.