DRIVENETS

Introducing DriveNets Network Cloud

From Traditional Chassis to Disaggregated Software-Based Networking

DRIVENETS

The huge growth in demand for network capacity and scale is driving service providers to rethink their network architecture. That growth is only expected to accelerate with the explosion of OTT services, IoT devices, and 5G rollouts. While the networking infrastructure necessary to support this traffic growth requires a sizable investment, service providers are currently operating on thin margins. As such, they are eagerly looking for innovations that can handle the increased network traffic while keeping costs under control.

While other parts of the networking world have moved to software and cloud-native architectures, most networks still remain hardware-centric, based on complex monolithic architecture. They are not taking advantage of newer software technologies that enable better resource utilization, service scaling and more valuable economic models.

Building Networks Like Clouds

Hyperscalers solved these challenges in the datacenter by advancing the cloud model with a pool of shared resources over virtual machines on a disaggregated architecture, across low-cost white box servers.

Given today's emerging competitive threats, many service providers are looking to adopt an architectural model similar to the hyperscalers – radically simplifying their network's operational model, and enabling optimal scaling and ease of innovation.

Building networks like cloud is about adapting cloud architecture principles to network design. Some of these principles include separation (disaggregation) of software and hardware, use of standard white boxes, virtualization and the ability to run multiple applications over a shared pool of resources. All of which aim to lower infrastructure costs and to accelerate innovation.

Market Needs

The growing demand for higher network capacity and scale creates two primary challenges for service and cloud providers:

- **Declining profitability** – Costs increase with capacity growth, requiring heavy network investments while revenue remains stagnant.
- **Increasing operational complexity** – Multiple routers and a variety of physical infrastructure increase operational complexity due to the wide range of hardware and software versions and maintenance procedures. This complexity is costly and slows network evolution and upgrades.

Network service providers are looking to adopt the cloud resource pooling approach and architectural model, adapted to their unique networks and requirements.

Networking Challenges and Trends

Today's networks are based on proprietary hardware-centric router infrastructure. Due to the monolithic design of the router, these networks are service-oriented, meaning that even in networks that are colocated, each service (whether a mobile backhaul, internet edge, business service or core network) runs on its own batch of dedicated chassis-based routers.

Since these dedicated resources cannot be shared as a pool of network resources, it results in an inefficient and costly physical infrastructure. Networks are designed for peak usage, leaving them severely underutilized most of the time. Concurrently, since router vendor revenue is tied to the number of ports sold, vendors are not motivated to change their "single-service" routing model to make networks more efficient.

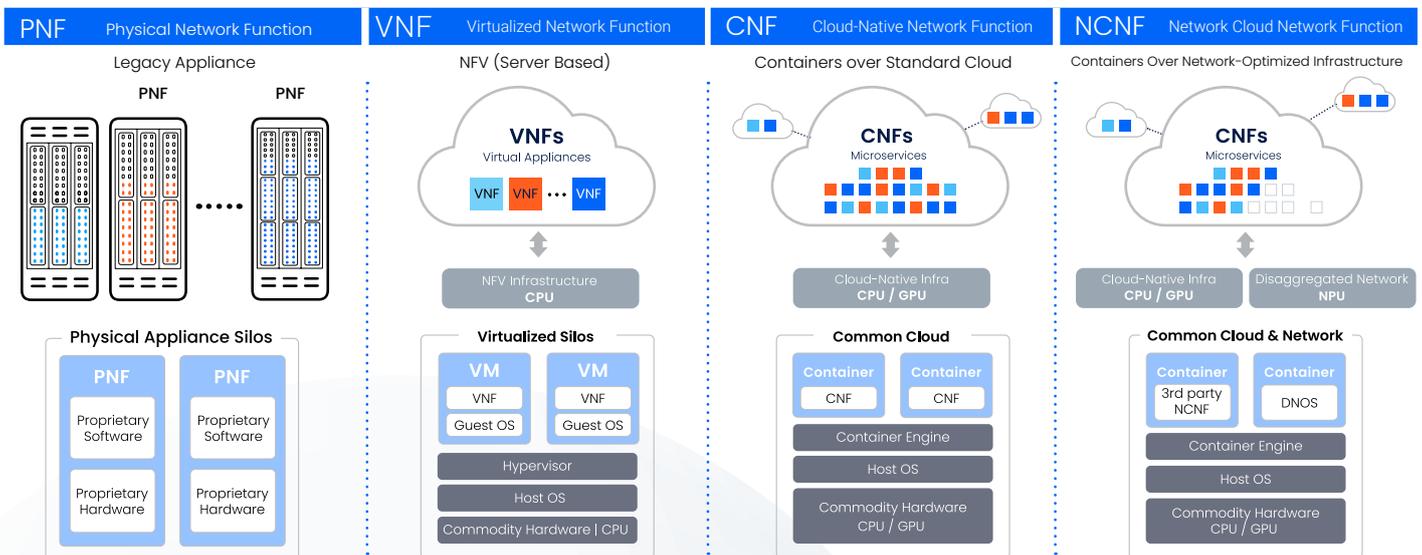The hardware-centric infrastructure imposes key challenges on service providers:

- **Profitability** – A strained cost structure where expenses are tightly linked to capacity
- **Scale** – Having to add services with monolithic software while avoiding upfront investments
- **Agility** – A slowed pace of development/innovation for hardware-based, purpose-built networks

When looking for a new network architecture that is software-based, high-scale, open, and simple to operate, we found that the hyperscalers have already solved these challenges for datacenters by radically changing their architecture. They disaggregated the software from the hardware and introduced a virtualization layer that allows multiple applications to share the hardware resources and consume them only when needed. With the new virtual machine (VM) resource sharing model, the high-end servers could be replaced with many low-cost white boxes.

Decoupling PNF into software (VNF) and commodity hardware   *Decoupling the monolithic app (VNF) into microservices (CNF)*   *Running NF on networking-optimized (NPU) cloud instances*

PNF Physical Network Function	VNF Virtualized Network Function	CNF Cloud-Native Network Function	NCNF Network Cloud Network Function
Legacy Appliance	NFV (Server Based)	Containers over Standard Cloud	Containers Over Network-Optimized Infrastructure

Network Functions run on Network Cloud instance, over CPU+GPU+NPU network-optimized white boxes

DriveNets Network Cloud Solution

To solve the same challenges for service and cloud providers, DriveNets has adapted and enhanced cloud approaches and applied the following principles to the DriveNets Network Cloud solution:

- **Software-based network** – The network operating system and services are based on microservices and containers
- **Disaggregation of hardware and software** – The software-based network can run over standard white boxes, and can scale to support a single white box router or a large router based on a cluster of 10s and even 100s of white boxes
- **Network resource pooling** – Fully virtualized network supporting any service on any port sharing a pool of networking resources, CPU processing power and more

Highlights

DriveNets Network Cloud introduces a radical, innovative, and cost-effective way to build networks. It applies cloud approaches to service providers' networks, significantly simplifying the network's operational model, and enabling substantial growth, rapid service innovation and greater service profitability.

- **Cloud-native software** – Built with containerized microservices, creating a unified shared infrastructure, and enabling any service, on any port, at any scale
- **Flexibility** – From a 4Tbps single-box router to a cluster of white boxes that operate as a single carrier-grade router of up to 691.2Tbps
- **Same building blocks, any use case** – Rich service offering including core, aggregation/peering, edge, access, data center interconnect (DCI), 5G, and more, using the same hardware building blocks and running on open standard white boxes (built on networking merchant silicon and COTS x86 servers)
- **Carrier grade ecosystem** – Full ecosystem including software, hardware, cabling, and professional services, meeting the demands of Tier-1 carrier-grade service providers
- **Software-based license model** – Independent from hardware constraints
- **Open, standard and field-proven** – Deployed in AT&T's core network, supporting the distributed disaggregated chassis (DDC) submitted to the Open Compute Project (OCP)

Architecture

DriveNets Network Cloud architecture is flexible and modular, enabling a variety of deployment models. It can run within a single white box (standalone mode) or in a cluster mode over multiple white boxes interconnected using Clos topology and operating as a single router.
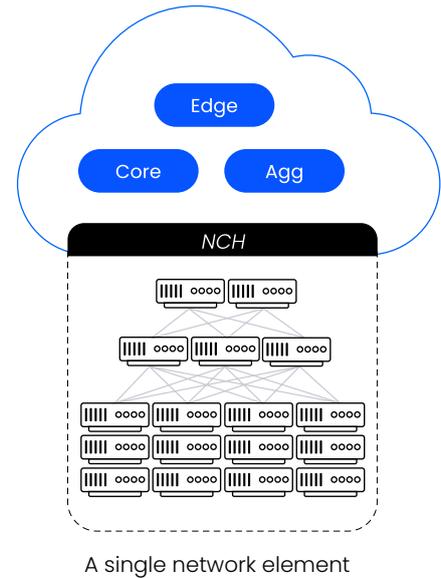
DriveNets Network Cloud takes the big router and breaks it down into white box building blocks, running cloud-based software on top of it. It disaggregates the control and data planes, allowing each to scale independently. The control-plane runs on x86 servers and the data plane is implemented with a cluster of white boxes. The data plane is built from just two building blocks: **Network Cloud Packet Forwarder** (NCP) and **Network Cloud Fabric** (NCF), and it scales from a single standalone solution of 4-12.8Tbps to a large cluster of 691.2Tbps made of dozens of white boxes operating as a single routing entity.

DriveNets Network Cloud cloud-native software also allows for additional services that run in separate software containers. Each networking function, which runs a **Service Instance** (SI) microservice in a cloud container, can be allocated with any hardware resources (physical interfaces, NPU, CPU, TCAM, QoS etc.) of the underlying hardware-shared infrastructure.

Monolithic Chassis

Agg. Router　　　Edge Router　　　Core Router

DriveNets Network Cloud
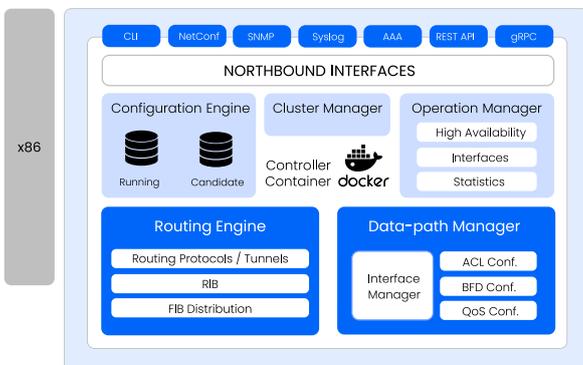
Edge

Core　　　Agg

NCH

A single network element
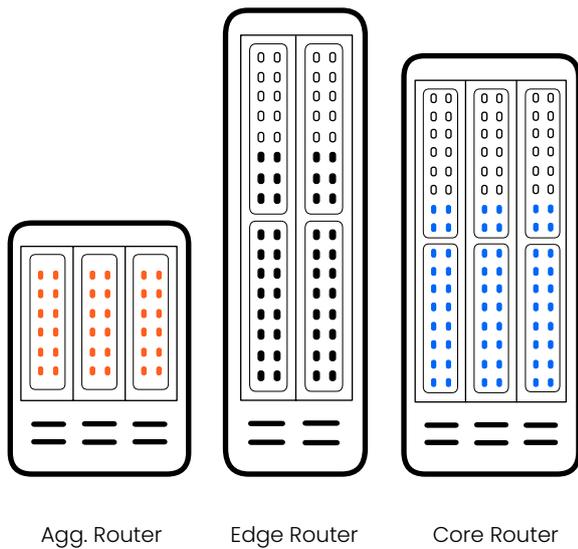
Unlike a typical Clos cluster, where every hardware/software router instance must be managed separately and looks like a separate router to other routers, the DriveNets Network Cloud makes a disaggregated "cluster' router look like a a single router in all respects. No matter how large or complex is the configuration, or how many white boxes are used, the cluster is connected and managed like a single network element. The same way cloud orchestration turns a series of connected servers into a resource pool of a unified virtual host, DriveNets Network Orchestrator (DNOR) enables disaggregated networks with cloud-computing-like shared infrastructure.
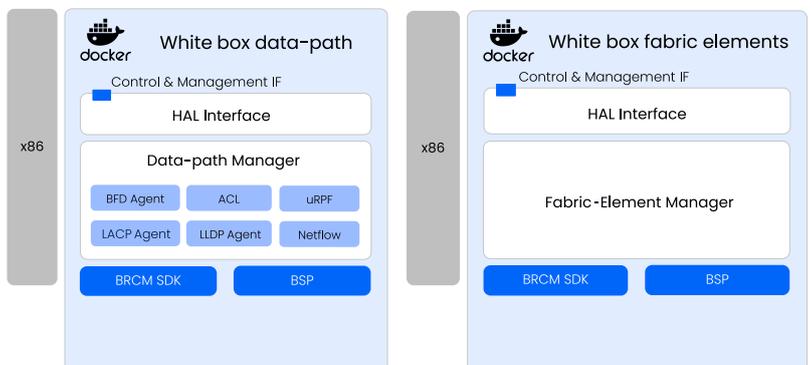
DriveNets Network Operating System (DNOS) network operating system is a cloud-native, distributed networking software, built on containerized microservices, which creates a unified, shared infrastructure over a distributed architecture - delivering the actual functionality from the bottom up.

To ensure open architecture, the DriveNets Network Cloud solution is ready to run on any network cloud-certified hardware platform, and is the first to support AT&T's Distributed Disaggregated Chassis (DDC) architecture, submitted to the Open Compute Project (OCP).

NCC - Network Cloud Controller　　　　　**NCP -** Network Cloud Packet Forwarder　　**NCF -** Network Cloud Fabric

| CLI | NetConf | SNMP | Syslog | AAA | REST API | gRPC |

NORTHBOUND INTERFACES

Configuration Engine
Running　　Candidate

Cluster Manager
Controller Container docker

Operation Manager
High Availability
Interfaces
Statistics

Routing Engine
Routing Protocols / Tunnels
RIB
FIB Distribution

Data-path Manager
Interface Manager
ACL Conf.
BFD Conf.
QoS Conf.

x86

docker White box data-path
Control & Management IF
HAL Interface

Data-path Manager
BFD Agent　ACL　uRPF
LACP Agent　LLDP Agent　Netflow
BRCM SDK　　BSP

x86

docker White box fabric elements
Control & Management IF
HAL Interface

Fabric-Element Manager

BRCM SDK　　BSP

x86

Hardware Abstraction Layer

SDK / BSP/ DPDK

Platform & Docker Orchestration

Base OS (Linux)

Network Operator Benefits

Open, software-based architecture is more efficient with network hardware resources and therefore more relevant to the traffic growth and demand changes impacting operators today. DriveNets Network Cloud solution supports a variety of network-function sizes with the same white box building blocks and can scale from a single-box based router to the largest router size available in the market, with the same software. This architecture offers the most efficient way to build networks while significantly reducing the amount of hardware resources required in the network, leading to significant benefits:

- **Lowest cost** – Unified, cost-optimized hardware building blocks, optimal resource utilization and multiservice over shared Point-of-Delivery (PoD)
- **Optimal scaling** – Any size distributed router with separate scaling paths for capacity and services, using he same building blocks for any use case
- **Ease of innovation** – Software-paced innovation for faster time to market

DriveNets Network Cloud solution simplifies the network's operations and offers carrier-grade, telco-scale performance at a much lower cost. A comparison of white box and traditional routers shows the clear value of DriveNets Network Cloud:

Traditional Routers	White Box Routers
Monolithic, chassis-based	Based on low-cost white boxes
Different chassis models and sizes are used in different locations in the network	Same white box building blocks (data plane) are used for any size router in any location
Vendor lock – same vendor software and hardware, low probability of mix-and-match vendors	Mix-and-match vendors - hardware and software sold independently from different/multiple vendors
Separate infrastructure for different networks and services, with minimal resource sharing	Cloud-native software enables different networks and services to run in separate containers over a shared physical infrastructure, maximizing resource utilization with virtualization
High cost	Low-cost standard networking white boxes from a choice of vendors, and cost-effective software licensing model
Complex and costly NFVs designed to scale services	Low-cost, cloud-native software and containers designed to scale services

Conclusion

The network is a key asset and differentiator for both service and cloud providers. Facing business and technical challenges, the traditional network model based on proprietary, chassis-based devices has become irrelevant. Service and cloud providers are now looking for alternative software-based solutions that are open, highly scalable, simple to operate, and low-cost.

DriveNets Network Cloud solution offers a single disaggregated networking solution for building core, edge, peering, and access network, as well as an open, scalable, simple, and cost-effective approach. The time for transforming to software-based networks has arrived. DriveNets Network Cloud makes it possible and real, today.

DRIVENETS

DriveNets is a leader in cloud-native networking software and network disaggregation solutions. Founded in 2015 and based in Israel, DriveNets offers service providers and cloud providers a radical new way to build networks, substantially growing their profitability by changing their technological and economic models. DriveNets' solution – Network Cloud – adapts the architectural model of cloud to telco-grade networking. Network Cloud is a cloud-native software that runs over a shared physical infrastructure of standard white-boxes, radically simplifying the network's operations, offering telco-scale performance and elasticity at a much lower cost. For more information, visit us at **www.drivenets.com**