Infinera Converged Network Operating System (CNOS)

Disaggregate and Accelerate Network Innovation

TRANSFORMING NETWORK ELEMENT ARCHITECTURES

New emerging network concepts and applications - as in 5G networks - require fast technology innovation cycles. Yet traditional monolithic network element architectures restrict the flexibility for changes and increase the cost and complexity of the network. To accelerate innovation and prepare the network for new applications, the disaggregation of hardware and software components delivers the promise of easily adding and upgrading best-in-breed functions. Infinera Hyperscale Carrier Architecture (HCA) adopts this principle by disaggregating the Network Operating System (NOS) from the routing hardware.

INFINERA CONVERGED NOS IN CARRIER NETWORKS AND DATA CENTERS

BOOSTING FLEXIBILITY AND PERFORMANCE WITH DISAGGREGATION

In the expanding ecosystem of open white box switches, the Infinera Converged NOS (CNOS) offers high performance hardware-independent flexibility and disaggregated software components including a Linux operating system, hardware abstraction layer, IP stack, and network protocol suite. Based on Open Compute Project elements, CNOS provides broad support for white box switches with Open Network Linux (ONL) running on open hardware and installed using ONIE. CNOS includes a sophisticated hardware abstraction layer that supports both standalone and multi-unit forwarding architectures as well as support for protocols such as MPLS. CNOS relies on our field-proven IP/MPLS stack for applications requiring high performance, high scalability, and high resiliency. The user space IP stack decouples the stack from the kernel, thereby supporting in-service software upgrades. CNOS is designed with open APIs to simplify integration into existing environments and to enable operators to reap the benefits of a programmable infrastructure.

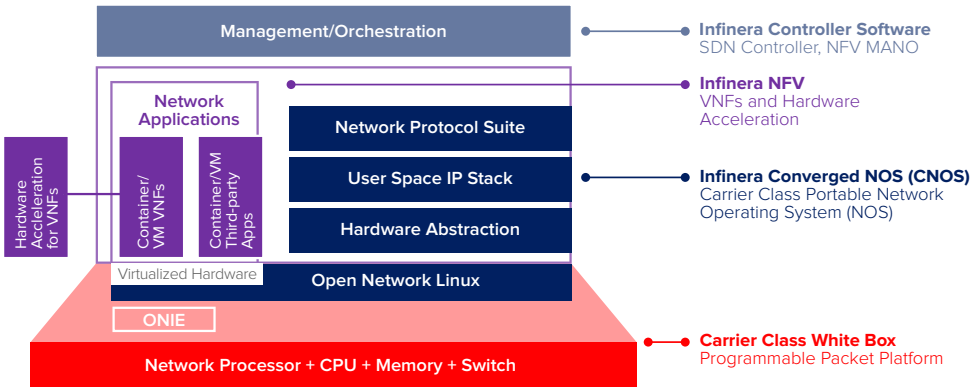

Figure 1: Infinera Converged NOS (CNOS) Architecture

BENEFITS OF THE INFINERA CONVERGED NOS ON OPEN NETWORKING PLATFORMS

- **Provides a contemporary software architecture** leveraging open source, Linux, and the proven Infinera IP/MPLS stack
- **Offers a modular protocol suite** that enables customers to choose the right protocols for the application, e.g., Infinera IP/MPLS, open source, or commercial protocol stacks
- **Accelerates innovation cycles** with open APIs that guarantee interoperability with existing systems allowing operators to focus on virtualizing and automating their infrastructure
- **Promotes platform independence** to support the growing ecosystem of white box switches for carrier, cloud, and enterprise applications
- **Delivers hardware disaggregation** enabling the Converged NOS to be purchased independently from white box switches
- **Incorporates flexible and resilient deployment** options, including white box switches, virtual machines, multi-unit stacked switches, and leaf/spine architectures
- **Supports standard provisioning tools** and ancillary applications and monitoring agents

BUILDING MULTI-UNIT NETWORK ELEMENTS

Hardware abstraction, open APIs, and the modular NOS software structure define the framework for building network elements starting from single units up to multi-units in highly scalable leaf/spine architectures. These components enable seamless scaling capacity and capabilities such as Network Function Virtualization (NFV) as required for Mobile Edge Computing (MEC) and Provider Edge router applications.

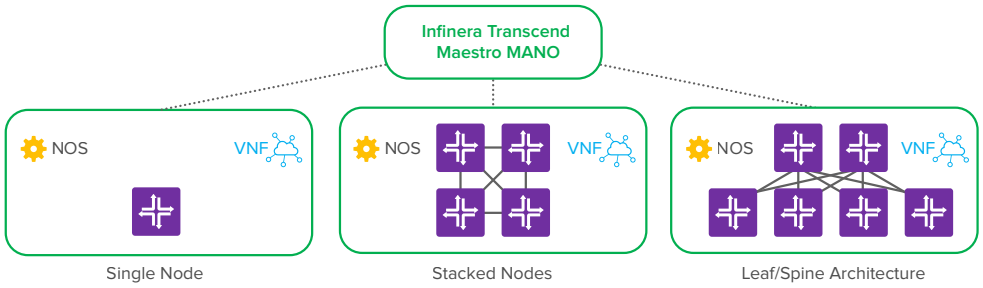

Figure 2: Highly Scalable Network Element Architecture Options

CUSTOMIZING FUNCTIONS AND ACCELERATING TECHNOLOGY INNOVATION

Open source is the starting point for carrier networks and data center operators who want to build or customize their own solution. Open APIs and a high degree of dynamic modularity of CNOS enable a quick replacement of protocol stacks with open source components to improve time-to-market and maneuver through fast technology innovation cycles. Individual protocols and sub-components for ancillary functions such as server tools or NFV can be loaded and upgraded independently from one another.

CNOS APPLICATIONS IN CARRIER, CLOUD, AND ENTERPRISE NETWORKS

CNOS capabilities including platform independence and protocol modularity are ideal for a broad range of applications in carrier, cloud, and enterprise networks.

CARRIER APPLICATIONS

CNOS is built for robust carrier class network operations characterized by sophisticated packet processing and forwarding mechanisms along with a high degree of service availability. By addressing new application requirements for enhanced capacity, synchronization, and lower latency, CNOS extends the capabilities of mobile networks with programmable carrier class white boxes. In a multi-unit architecture, components can be easily added, replaced, and upgraded in-service for minimal downtime and smooth integration into existing systems. The carrier class management plane empowers self-healing and graceful recovery from exceptions and outages. Open APIs guarantee interoperability for newly purchased software or simplified integration of sub-components with new functionality. The Infinera disaggregated router with CNOS together with the advanced, multi-vendor Infinera Transcend SDN controller enables new flexibility to extend the router capabilities to multiple use cases. By leveraging best-in-class NFV solutions running as part of the router setup, the Infinera solution addresses various applications, such as PE router applications where vBNG or vCGNAT are required, as well as MEC use cases.

CLOUD APPLICATIONS

For cloud applications that require high capacity, high port count, and high scalability, cloud fabrics can be built using standard data center-centric white boxes running simple IGP protocols. L2 services requiring protocols such as VPLS, VXLAN, and EVPN interconnect these data centers. Gateway nodes connect data centers to other data centers or to end-users/customers typically via IP backbones, IP transit networks, and peering exchanges. Devices used in these applications require support for large forwarding tables, large packet buffers, and protocols such as IP/MPLS or segment routing. These capabilities are emerging on white box hardware today, and CNOS enables these capabilities in cloud provider networks.

ENTERPRISE APPLICATIONS

Enterprises can benefit from CNOS in their campus, branch, data center, and backbone networks. Offering a programmable and scalable architecture, CNOS is ideal for deployment models from standalone to virtual machine, stacked, or leaf/spine fabric. For enterprises transitioning to SDN-based control architectures, CNOS can be deployed with OpenFlow instead of traditional IP/MPLS protocols. To further simplify deployments, CNOS supports third-party integration for popular configuration management tools including Chef, Puppet, Ansible, or Salt or for custom applications and monitoring agents.