

Pluribus VirtualWire Software

Powering the Next-Generation Test Lab and Cyber Range

Highlights

- Comprehensive layer 1 switching for next-generation test lab and cyber range environments
- Programmable software-defined architecture enables API-driven automation
- High-density interface speeds scaling from 10/100 Mbps to 1, 10, 25, 40, 100 and 400 Gbps
- Hybrid support for Layer 1 and Layer 2/3 interconnections to simulate full production environments
- Interconnect geographically distributed environments with seamless resource sharing across sites while maintaining full Layer 1 transparency
- Scales from 100s to 1,000s of devices/ports in a single, fully interconnected fabric without the physical limitations of a fixed-density chassis
- Integrated with Quali CloudShell for unified end-to-end lab orchestration and automation

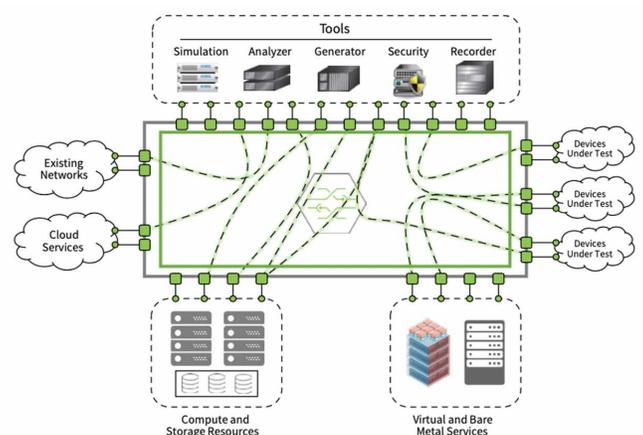
The Pluribus VirtualWire™ solution automates and streamlines interconnections for test lab and cyber range environments and transforms operations into an agile, elastic and self-service environment that improves resource utilization, decreases test cycles, and lowers operational costs. Leveraging next-generation networking technology, VirtualWire scales and optimizes the lab environment with production-like precision while reducing complexity and improving operational efficiency to transparently interconnect servers, devices, and test equipment across local or distributed environments.

Pluribus VirtualWire is an integrated physical layer feature set of the deployment-proven Netvisor® ONE Operating System (OS) that enables transparent layer 1 connections across Open Networking hardware switches. VirtualWire transforms traditional optical or electrical Ethernet connections to emulate a physical wired connection so that interconnections are mapped between two or more physical ports in single switch, or across a distributed Fabric environment. As a result, VirtualWire enables the creation of a virtualized, software-defined patch panel to create transparent physical layer connections between devices. As a result, interconnected devices see each other as being directly connected, with all traffic passed-through the interconnected ports as if they are connected by a physical wire enabling all protocols and anomalous packets to be exchanged unmodified.

SDN Powered Automation

The VirtualWire solution leverages the power of next-generation SDN technology to transform how physical layer connectivity networks are built and operated. By leveraging the exceptional value and flexibility of Open Networking switches, operators can build highly scalable and dynamic environments that enable automating interconnections for lab operations or subscriber interconnection. The result is a data center-class environment that delivers reliable, high-performance and low latency layer 1 connectivity that replicates production-class networks to enable real-world test scenarios.

The VirtualWire scale-out fabric architecture simplifies interconnection within a single lab, or across geographically distributed locations to support large-scale operations. VirtualWire empowers organizations to dynamically orchestrate the underlying network topology enabling local or remote operation without having to rewire or change configurations to instantly share expensive lab resources located anywhere. The result is dramatically simplified operations that improves equipment utilization, reduces provisioning time, and lowers equipment and operational costs.



VirtualWire provides transparent layer 1 connectivity enabling interconnected DUTs, UUTs, and devices see each other as being directly connected with all traffic passed across the interconnected ports unchanged

Cable Once and Automate

VirtualWire enables the flexible and transparent cross-connection of any combination of switch ports across a single switch or multiple switches across a distributed topology enabling rapid changes without touching a cable. Each port can be configured as either a bidirectional, or unidirectional connection. Depending on the mode of operation, multi-port traffic can be replicated at wire-speed to multiple ports. This enables multiple tools or devices under test (DUTs) to send a single flow to be delivered to multiple DUTs or end-points. In addition to layer 1 functionality, depending on the operational mode, Netvisor ONE can apply advanced network services to allow hybrid operations supporting Layer 1 and Layer 2/3 interconnections in a single fabric on common hardware to simulate full production and test environments without incurring incremental latency or traffic degradation.

VirtualWire capabilities include:

- Transparency to Ethernet frames and protocols
- End-to-end link state tracking
- Port mirroring and traffic replication
- Dynamic wire-speed filtering
- Low latency media and speed conversion
- Multi-tenant segmentation to compartmentalize lab operations
- High availability and interconnection link resiliency Integrated telemetry for traffic visibility

Use Cases

VirtualWire provides reliable and consistent physical layer connectivity to support virtually any environment that requires continuous transparent layer 1 interconnection. Some example use cases for VirtualWire include:

- Test lab interconnection and automation
- Validation and interoperability testbeds
- Lab as a Service (LaaS)
- CyberSecurity testing and validation
- Co-location and MSP cross-connect
- Automated subscriber interconnection

Runs on Open Networking Hardware

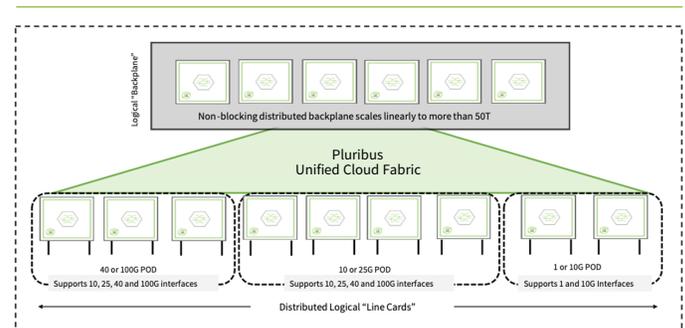
Netvisor ONE OS runs on many Open Compute Project (OCP), and Open Network Install Environment (ONIE) hardware compliant switches, including the Pluribus Freedom™ 9000 series network switches. Open Networking hardware delivers high-performance switching and exceptional operational flexibility along with significant cost savings. Capacity is elastic, so additional switches and interfaces can be added as additional ports or bandwidth is needed. This enables seamless expansion to build multi-terabit scale-out designs capable supporting thousands of end-points with simultaneous connections to meet the most demanding operational requirements.

This open networking foundation provides operators with a more flexible choice of hardware options to build scale-out lab fabrics with any combination of 1, 10, 25, 40, or 100 Gigabit Ethernet interfaces, with a seamless upgrade path to 400G and higher speeds. To save space and reduce the cost per connection, these switches deliver up to 10x the port density per rack unit (RU) over legacy layer 1 systems with support for up to 128x 10G ports and 32x 100G ports in a single RU.

Scale-Out Deployments with VirtualChassis Architecture

Leveraging the distributed, scale-out architecture of the Unified Cloud Fabric, the Pluribus VirtualChassis™ architecture is built using high-performance, cost-effective single rack unit fixed configuration switches that collectively operate and behave as a single logical switch. The VirtualChassis is managed as unified entity and seamlessly scales-out to support from 100s to 1,000s of ports. This provides the operational and manageability benefits of a chassis without the associated high cost and technical limitations delivering a greater degree of operational flexibility.

The VirtualWire Fabric overcomes the density constraints, mixed media support and interconnectivity challenges experienced with legacy layer 1 systems – enabling the consolidation of disparate unconnected layer 1 islands into a single unified and remotely operated Fabric.



The scale-out Pluribus VirtualChassis can be located in a single rack, distributed across top of racks, or deployed in geographically distributed locations

Intrinsic Automation Simplifies Operations

Extensive programmability and automation enables building VirtualWire topologies in software in minutes. All configurations are software-defined enabling virtually any provisioning to be rolled-out quickly, from any location with minimal effort. Operators can provision and initiate configuration changes for all switches with a single command through Command Line Interface (CLI) or RESTful APIs, reducing configuration time by up to 90% over traditional box-by-box provisioning. Operators can define and store multiple test configurations for later use or reuse.

Pluribus UNUM leverages the intrinsic fabric automation to further streamline operations to automate provisioning, simplify device and fabric management and enable intuitive visualizations of DUT and device interconnections across the lab fabric. In addition, lab orchestration can be seamlessly integrated into many popular automation platforms. Quali CloudShell integrations allows plug and play end-to-end automation and orchestration across a global lab or interconnected environment to orchestrate and automate the provisioning of virtually all lab resources powering a self-service, blueprint-driven dynamic environment.

Warranty and Support

Pluribus Networks offers a wide range of advanced services spanning the entire test lab network lifecycle to protect investments and help accelerate success when deploying and optimizing the VirtualWire and the Netvisor ONE operating system. Multiple extended support options are available, including on-demand global support, on-site support, advanced hardware replacements, and professional implementation services. Maintenance options includes direct access to a team of expert network engineers with deep networking experience, and our self-service on-line Customer Portal. For more information about Pluribus support options, visit <http://www.pluribusnetworks.com/support> or contact a Pluribus Networks authorized reseller.

Ordering Information

Pluribus Network Freedom Series Open Networking switches

The Pluribus Freedom™ 9000 Series switches are a fully integrated, turn-key Open Networking solution that is available pre-configured with the Pluribus Netvisor ONE Operating System (OS) enterprise license. The Pluribus Freedom 9000 Series switches are best-in-class, programmable Open Network platforms built on the deployment-proven Broadcom StrataXGS® switching ASICs to provide high-capacity, standards-based networking.

- Pluribus Freedom 9664-C – 64 QSFP28 ports support 1x 100/40G ports and up to 16 ports support 4x 25/10G ports
- Pluribus Freedom 9532L-C – 32 QSFP28 ports support 1x 100/40G, or 4x 25/10G ports
- Pluribus Freedom 9432-C – 32 QSFP28 ports support 1x 100/40G, or 4x 25/10G ports
- Pluribus Freedom 9572L-V – 48 SFP28 ports support 1/10/25G ports and 6 QSFP28 ports support 1x 100/40G or 4x 25/10G ports
- Pluribus Freedom 9372-X – 48 SFP+ ports support 48x 10/100M, 1/10G and 6 QSFP+ ports support 1x 40G or 4x 10G
- Pluribus Freedom 9460-X – 48 SFP+ ports support 48x 1/10G ports and 6 QSFP28 ports support 1x 100/40G with up to 2 ports configurable as 4x 25/10G
- Pluribus Freedom 9372-T – 48 RJ-45 ports support 100M, 1/10GBase-T and 6 QSFP+ ports support 1x 40G or 4x 10G
- Pluribus Freedom 9460-T Switch – 48 RJ-45 ports support 1/10GBase-T and 6 QSFP28 ports support 1x 100/40G with up to 2 ports configurable as 4x 25/10G

Pluribus VirtualWire Single-Switch License (licensed per device)

The VirtualWire feature set enables layer 1 switching capabilities for lab automation, interconnect and network packet broker capabilities. VirtualWire is an add-on license for Freedom 9000 series switch and is available as an operating license for compatible Open Networking hardware.

- ONVL-F10G-VW-LIC – VirtualWire single-switch license for 1/10G switch
- ONVL-F25G-VW-LIC – VirtualWire single-switch license for 25G switch
- ONVL-F100G-VW-LIC – VirtualWire single-switch license for 32-port 100G switch
- ONVL-F100GXL-VW-LIC – VirtualWire single-switch license for 64-port 100G switch

Pluribus VirtualWire Fabric License (licensed per device)

Provides all VirtualWire capability and adds the Unified Cloud Fabric capability to enable the scale-out VirtualChassis architecture. VirtualWire Fabric is an add-on license for Freedom series switches, and is available as an operating license for compatible Open Networking hardware.

- ONVL-F10G-VW+-LIC -- Pluribus VirtualWire + Fabric license for 1/10G switch
- ONVL-F25G-VW+-LIC -- Pluribus VirtualWire + Fabric license for 25G switch
- ONVL-F100G-VW+-LIC -- Pluribus VirtualWire + Fabric license for 32-port 100G switch
- ONVL-F100GXL-VW+-LIC -- Pluribus VirtualWire + Fabric license for 64-port 100G switch

Software license and switches do not include support, order support separately.

Specifications

For a complete list of features and specifications, please see the Netvisor ONE and relevant Pluribus Freedom 9000 series switch data sheets. In addition to the base capabilities provided by the Netvisor ONE OS and optional Fabric license, VirtualWire capabilities* include:

- Layer 1 Mode, Layer 1+ VLE Mode, Layer1+ VPG Mode
- Layer 1 connections transparent to Layer 2 and Layer 3
- Layer 1+ enables connections to stretch over any WAN or network infrastructure
- Failure propagation and error pass-through
- Dynamic Path Building and Interconnect Optimization
- Unidirectional and bidirectional traffic controls
- Speed/media conversion
- Link state tracking
- 1:1, Many:1, 1:Many traffic replications
- Dynamic layer 2/3/4 traffic filtering
- nvFlow integrated traffic visibility telemetry
- IPFIX export for nvFlow metrics to third-party management systems

*NOTE: Functionally varies between VirtualWire operational modes and hardware deployed