Data Sheet

Pluribus UNUM Platform

Unified Management, Automation and Analytics for the Adaptive Cloud Fabric

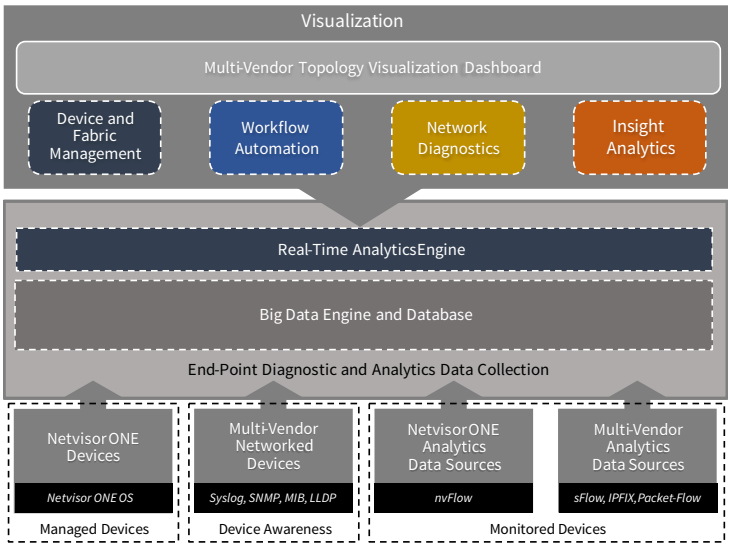
Highlights

- Advanced management platform that enhances the intrinsic automation of the Adaptive Cloud Fabric
- Simplifies provisioning and operating a complex network, or groups of networks
- Workflow automation with pre-built templates for zero touch provisioning
- Dynamic topology mapping with multi-vendor network visualization
- Advanced diagnostics and analytics for multi-vendor networks
- Intuitive and consistent user interface for seamless navigation across management and analysis modules
- Optional Insight Analytics supports extensive performance management and analytics

Pluribus UNUM™ is a unified management platform that integrates a comprehensive range of advanced management capabilities. It enhances the intrinsic automation of the Adaptive Cloud Fabric™ architecture with workflow automation, topology visualization, network diagnostics and integrated performance analytics. Pluribus UNUM liberates network operators from the complexity of provisioning and operating a complex network, or groups of networks, by automating the complete network lifecycle from implementation to operation and optimization, enabling intent-based network operations with vastly reduced deployment times. It simplifies management interactions, eliminates the Command Line Interface (CLI) learning curve and allows a broader range of users to operate the network while minimizing the potential for errors by minimizing direct human interactions with individual devices.

Pluribus UNUM is an agile, multi-functional web management portal that front-ends the distributed peer-to-peer Adaptive Cloud Fabric architecture. It combines an elastic big data database and intelligent analytics engine with an intuitive and consistent user interface that allows seamless navigation across fully integrated management and analysis modules. The UNUM platform combines deep intelligence with powerful real-time and historical visualization to provide a unified tool-set to provision, manage, troubleshoot and proactively manage the Fabric environment. Key capabilities include:

- Device and fabric management and provisioning
- Workflow automation with zero-touch provisioning
- Dynamic multi-vendor topology mapping
- Multi-vendor device and network diagnostics
- Real-time multi-vendor network-wide monitoring with advanced analytics



The UNUM architecture consists of a multi-function web portal with a big data database and intelligent analytics engine that unifies automation, management and analytics

Unified Big Data Engine

The Pluribus UNUM architecture is built on a fast, scalable and elastic big data engine capable of ingesting, aggregating and analyzing large volumes of diverse network diagnostic and performance data from across distributed network deployments in real-time at scale. Collected data is analyzed and indexed as it is ingested, and UNUM maintains historical data including network state, device diagnostic data and network performance related metadata. Common data is shared across UNUM modules to enable contextual cross-linkage with multi-dimensional analysis workflows. The real-time analytics engine generates alarms and delivers proactive insights and as well as queried data on-demand to support specific diagnostic and analytics activities. Granular performance management can also be performed with the optional Insight Analytics module activated.

Automation Speeds Time to Deployment

Pluribus UNUM permits operators to automate common deployment and configuration tasks from a single visual touch-point so one click can equal a thousand actions. The combination of Fabric and workflow automation dramatically reduces operational complexity and significantly speeds deployments for large-scale networks by up to 95 percent faster over manual box-by-box manual configurations. UNUM leverages the Fabric APIs to distribute configurations across the topology enabling rapid execution with accuracy and consistency.

Workflow Automation

Pluribus UNUM workflow automation simplifies the process of building and provisioning next-generation software-defined networks. Pre-built customizable playbooks leverage deployment-proven best practice designs allowing network operators to quickly define, provision and deploy network configurations for an entire Fabric topology at scale in minutes. This significantly speeds time to deployment and helps to prevent inconsistencies and misconfigurations.

UNUM workflow automation enables precise zero touch provisioning for any-sized network – scaling from single switch and two-switch clusters, to more advanced leaf and spine topologies. The UNUM platform automatically discovers eligible devices and allows the network operator to select which devices to include in the Fabric configuration. Once the devices are selected, UNUM automates the topology build-out in minutes with only a few clicks without touching a single device.

Fifteen pre-defined automated playbooks are available for multi-vendor brownfield environments where the Netvisor® ONE powered switches are only deployed in either a leaf or spine placement, or greenfield environments when the Adaptive Cloud Fabric will be used in both the leaf and spine placements. Playbooks include automated designs for layer 2 or layer 3 implementations, such as BGP and OSPF, as well as various high availability options. Operators can quickly modify the pre-built playbooks to meet unique operational needs and can create customized playbooks to automate and consistently replicate configurations.

Fabric Commit Process

To help eliminate the risk of inconsistent network configurations, Pluribus UNUM leverages the advanced transactional model of the Adaptive Cloud Fabric to validate that all provisioning and policy has been consistently implemented across every member network device. As UNUM begins to implement the desired configuration, the Netvisor ONE OS validates that all targeted switch devices have the capacity to physically support the requested configuration. To assure operational consistency, Netvisor ONE OS verifies that all devices have received the configuration and simultaneously executes the configuration across all devices.

Network Diagnostics and Fault Management

The UNUM platform continuously monitors the Fabric and collects extensive physical link layer and device level data from Netvisor embedded telemetry and compatible multi-vendor network elements via syslog, SNMP and sFlow. Metrics are stored in the common database and leveraged across the UNUM platform to proactively identify emerging anomalies that can affect network availability and performance.

Real-time and historical diagnostic views enable contextual analysis with event-driven insights into network and device health enabling operators to rapidly identify, troubleshoot and resolve network fault, availability and performance issues. Device statistics provide a picture of device health with CPU, memory and table utilization statistics, and link-level metrics identify congestion, traffic errors, interface flapping, and packet drops. Flexible filtering allows operators to fine-tune an investigation to focus on specific time periods, devices or activities to speed root cause isolation. Historical diagnostic data is maintained for a rolling seven-day window allowing the network operator to analyze previous performance levels with five second granularity.

Flexible Alerting

The optional alerting module enables flexible, user-defined alerting notifications to quickly identify emerging operational issues based upon network status changes, error state or individual device issues. The UNUM big data engine continuously monitors Key Performance Indicators (KPI) to identify anomalies and generates real-time alert notifications when measured data crosses specific thresholds. Operators can leverage predefined KPIs or build customize alerting for user-definable KPI triggers and thresholds.

Real-time alert notifications can be delivered to any number of people or defined groups. Different classes of alerts can be targeted to specific IT staff based upon a specific incident type or effected portion of the network. Alerting can be delivered via e-mail, through popular collaboration platforms, such as Slack, through third-party IT Service Management platforms, such as ServiceNow, or through IT alerting platforms such as xMatters using Webhooks APIs. UNUM alert notifications can contain a unique link with one-click access to alert detail and the analysis workflow permitting operators to quickly drill-down for rapid triage, targeted troubleshooting and remediation.

Real-Time Topology Visualization

Pluribus UNUM provides an interactive live network topology map to visualize an Adaptive Cloud Fabric network. UNUM automatically discovers all connected devices and builds a dynamic view of the network topology including compatible adjacent third-party networked devices and end-points that support the Link Layer Discovery Protocol (LLDP). Netvisor vPort intelligence allows the visualization of servers and services correlated to end-points.

The topology view delivers an accurate representation of the Fabric topology with real-time traffic and state information overlaid on the topology. A single instance of Pluribus UNUM can seamlessly scale to visualize very large distributed Fabrics and multiple interconnected fabrics in a single unified topology view.

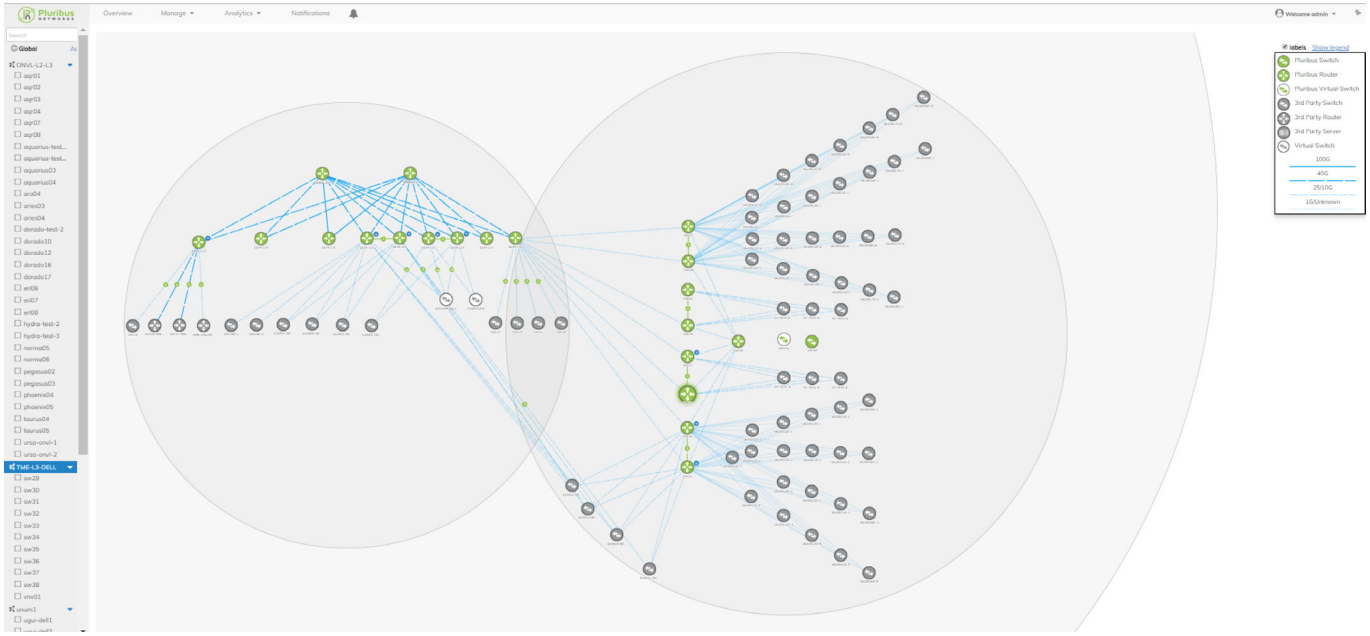
Device Auto Discovery

Leveraging the automated intelligence of the Adaptive Cloud Fabric, UNUM performs autonomous multi-level network discovery to scan the network and auto-detect changes to network topology and state as devices or end-points are moved, added or removed. The discovery process is an automated background task that is non-disruptive to network operations and does not create an unnecessary load on the network. The topology view is automatically updated in real-time and notifications are indicated on the live topology dashboard and alerts can be generated based upon user-define criteria.

Interactive Real-time Visualization

The Interactive topology map provides a real-time holistic view of the active network topology and is an ideal primary dashboard for managing network operations. Operators easily and quickly create customized physical network topology views for a specific fabric, or multiple fabrics, with simple drag-and-click operation to meet diverse operational needs.

The topology dashboard provides a comprehensive at-a-glance view of the current state and health of network operations. Granular flow-on-flow traffic path visualization superimposes traffic flows across the topology to expose traffic volume and applications traversing the network. Unified cross-platform workflows speed analysis and simplify troubleshooting allowing operators to quickly isolate flows between any two end-points and drill-down to launch debugging tools or Insight Analytics for deeper analysis and troubleshooting.



The real-time Topology Dashboard provides a comprehensive and interactive view of the Adaptive Cloud Fabric topology along with connected networked devices, end-points and services with drill-down access to diagnostic and analytics data

Device level diagnostics and configuration updates can also be initiated from the interactive topology view with a single-click from any connected Netvisor device icon. Operators can view a device health snapshot or health over time for metrics such as CPU, memory and table utilization, link layer utilization and device state.

End-Point Intelligence

UNUM leverages Netvisor ONE OS vPort intelligence to identify Fabric-connected end-points. Operators can click and view all active end-points connected to each switch directly from the network topology dashboard. When the Insight Analytics module is activated, operators can drill-down to view real-time and historical end-point performance metrics for an entire switch, a specific switch port, or specific end-point.

Insight Analytics

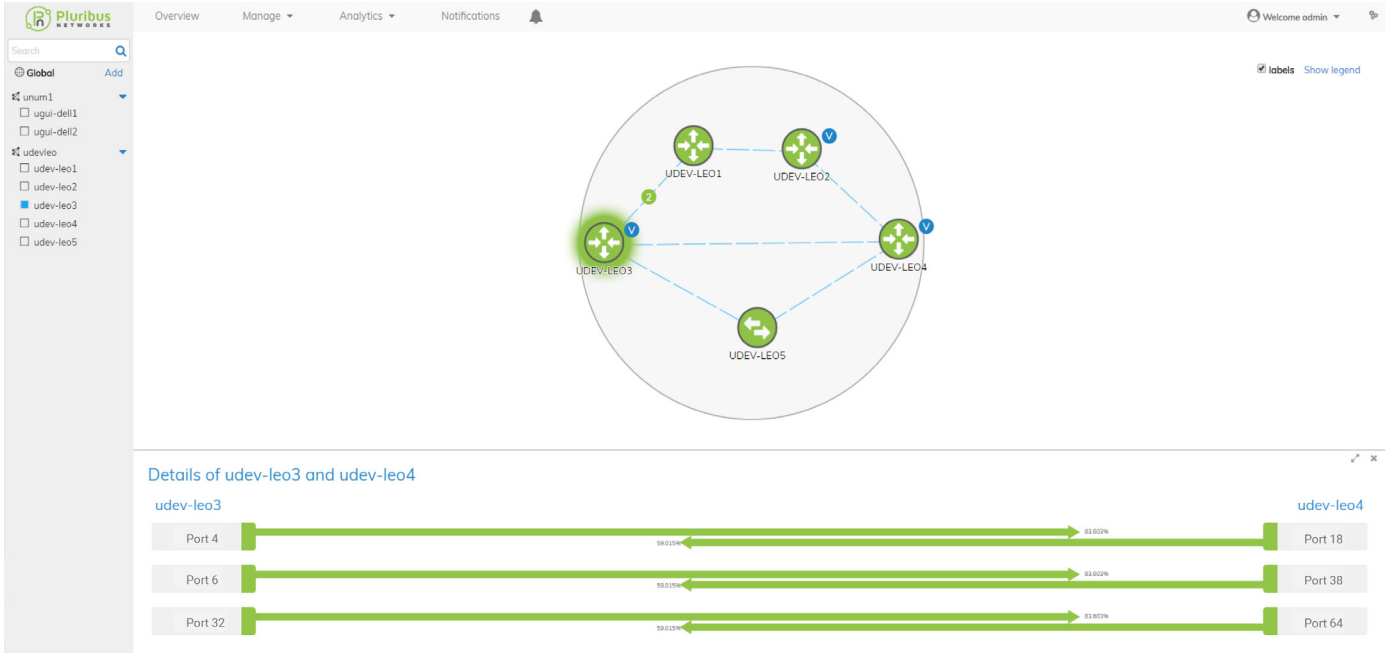
Insight Analytics is a powerful integrated analytics module within the Pluribus UNUM platform that provides the IT operations team with proactive insight into network and application performance to assure peak operating performance and meet user experience expectations. Insight Analytics leverages embedded Netvisor monitoring telemetry, sFlow and packet-flow data sources to enable pervasive visibility across the network – eliminating the need for expensive network probes or complex network monitoring overlay networks.

Integrated Netvisor telemetry monitors every TCP connection, including traffic within a VXLAN tunnel, across the entire Fabric at the speed of the network to track east/west and north/south traffic flows, and virtualized workloads to expose important network and application performance characteristics.

Insight Analytics leverages the collected network intelligence from the UNUM database to build knowledge of the network operating environment and enables contextual drill-down from dashboards and analysis views. The UNUM analytics engine constantly monitors and analyzes all traffic and transactions to identify network and application performance characteristics allowing IT operations to quickly identify performance trends and interrelationships in real-time. User-defined alert notifications can be generated when anomalies are discovered such as volumetric changes, performance deviations or for threshold-based violations enabling rapid triage to precisely pinpoint root cause and speed resolution. Insight Analytics provides extensive operational intelligence that supports many performance management use cases allowing the operators to quickly pinpoint performance issues, accelerate troubleshooting, improve operational intelligence, identify security risks and speed remediation.

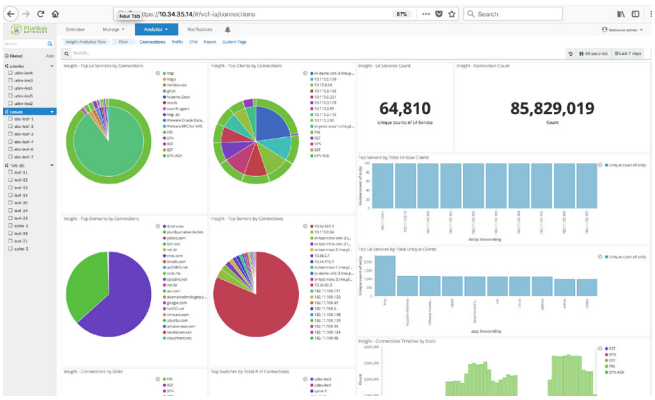
Network Intelligence Powers Intent-Based Networking

Insight Analytics tracks network and end-point service state and performance across the Adaptive Cloud Fabric to understand how the users and services are consuming the infrastructure, and conversely how the infrastructure is supporting the users and services.



UNUM enables the visualization of port-level traffic related metrics between devices to understand utilization and drill-down to deeper diagnostic metrics

The intelligence garnered from across the Fabric enables operators to analyze and compare actual versus desired performance and implement corrective actions such as changes to policy, rerouting traffic to implement on-demand changes to the infrastructure. Since all visualization is done within the same platform, changes can be implemented from a single-pane of-glass simplifying operations and speeding change implementation.



Insight Analytics leverages embedded Netvisor telemetry, sFlow and Packet-Flow data to enabled real-time monitoring of network and application performance

Licensing

The Pluribus UNUM platform is simple to deploy and can manage and support any sized network with multiple Fabrics distributed across multiple locations. Licensing is elastic, enabling pay-as-you-grow flexibility. Insight Analytics is a fully integrated module of UNUM that is optionally activated through a license key. Insight Analytics is available in two versions depending on the monitoring capacity required. The standard version supports up to 100 million flows and the high capacity version supports up to two billion flows.

Warranty and Support

Pluribus Networks offers a wide range of advanced services spanning the entire network lifecycle to protect investments and help accelerate success from initial deployment to ongoing optimizations. Multiple extended support options are available, including on-demand global support, on-site support, advanced hardware replacements and customized technical training. Professional implementation services can help design, deploy and optimize the operating environment tailored to your organization's specific requirements. 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

The Pluribus UNUM software can be deployed as an OVA /virtual appliance on customer provided hardware, or can be delivered pre-configured on a server appliance for turn-key deployment. Ordering information is for Pluribus UNUM, Insight analytics and the optional hardware appliances. Support is not included and the desired support should be ordered separately. Subscription-based options are available.

Pluribus UNUM Software

- UNUM-LIC — Pluribus UNUM Unified Management, Automation and Analytics Platform, includes support for 10 Netvisor devices.

Insight Analytics Module License

Insight Analytics is optionally licensed in addition to the Pluribus UNUM software.

- IA-MOD-LIC — Pluribus Insight Analytics module - supports up to 100 Million flows and includes first 10 monitored Netvisor devices.
- IA-HC-MOD-LIC — Pluribus Insight Analytics High-Capacity (HC) module license supports 100 Million+ flows and includes the first 10 monitored Netvisor device. Cannot be deployed on customer hardware – High Capacity (HC) server appliance required.

Pluribus UNUM Server Appliance

- AP-BASE-HW — Standard hardware server appliance for UNUM software or UNUM + Insight Analytics Module supporting up to 100M flows. Hardware only – requires software licenses.
- AP-HC-HW — High Capacity hardware server appliance for UNUM + Insight Analytics Module supporting over 100M flows. Hardware only – requires software licenses.

Pluribus UNUM Virtual Appliance Operational Requirements

Pluribus UNUM application is deployed as an OVA on customer provided hardware. The installation of Pluribus UNUM and Insight Analytics should be on a dedicated system with the following requirements for each VM:

- **Hardware requirements:** Eight (8) vCPUs, 64 GB RAM, 300 Gb HD
- **Hypervisor requirements:** VMware ESXi version 5.5 and 6.x
- **Client requirements:** Google Chrome (Version 44+), Mozilla Firefox (version 39+)

Pluribus Hardware Server Appliance Specifications

Standard Server Appliance Hardware Specifications

(for complete details, refer to the Pluribus UNUM appliance data sheet)

- Single server with 4 CPU cores (8 vCPU), 128 GB Ram, 480 GB SSD,
- Dual 1G Base-T NIC, dual 10G Base-T NIC
- IPMI 2.0 + KVM with Dedicated LAN
- Dual power supplies

High-Capacity Server Appliance Hardware Specifications

The UNUM High Capacity Server Appliance is optimized to support medium to large Insight Analytics deployments where higher flow volume and storage capacity are required. Requires the high-capacity Insight Analytics software. Available only with a Pluribus provided hardware appliance. (for complete details, refer to the Pluribus UNUM appliance data sheet)

- Quad Server chassis
- Dual power supply
- Each server provides:
  - 16 CPU cores (32 vCPU), 64 GB Ram, dual 1.2 TB SSD
  - Dual 10 G Base-T NIC
  - IPMI 2.0 + KVM with Dedicated LAN

Platform Scalability

OVA or Standard Server Appliance Scalability

Fabric Management

- Up to 100 Netvisor ONE devices
- Up to 6 Adaptive Cloud Fabrics

Insight Analytics

- Ingestion rate of up to 1,000 nvFlow or sFlow connection records per second combined
- Long-term retention of up to 100 million nvFlow and sFlow records
- 30-day rolling window (FIFO) up to 100M nvFlow and sFlow records combined
- 7-day rolling window (FIFO) of Syslog and SNMP records

High-Capacity Server Appliance Hardware Scalability

Fabric Management

- Up to 200 Netvisor ONE Devices
- Up to 12 Adaptive Cloud Fabrics

Insight Analytics

- Ingestion rate of up to 10,000 nvFlow and sFlow connection records per second combined
- Long-term retention of up to 2.5 Billion nvFlow and sFlow records
- 30-day rolling window (FIFO) up to 3 billion nvFlow and sFlow records combined
- 7-day rolling window (FIFO) of Syslog and SNMP records

Specifications

The following are highlights of features provided by Pluribus UNUM platform. Many automation capabilities are integrated as part of the Netvisor ONE OS and are not included in this summary. Detailed specifications for Insight Analytics can be found in the Insight Analytics data sheet.

Operational

- Runs in a VM as a virtual appliance
- Single node deployment
- High performance cluster supported for analytics
- Device inventory
- Manual device discovery
- Automatic device discovery via LLDP
- Zero touch provisioning (ZTP)
- Per device logs of all actions taken by the portal
- Device connectivity status (up/down)
- Network Provisioning - Configuration
- Switch configuration management
- Change history tracking
- Device configuration validation
- View devices through network provisioning
- Filter view of network provisioning based on devices
- Topology mapping for Netvisor enabled devices
- Third-party device topology mapping and visualization requires LLDP

Task Management

- Task scheduling
- Task panel identifying completed and pending tasks
- Automated task creation
- Log files for all tasks and commands issued to the fabric

Configuration

- Automated ongoing device configuration change management
- Automated detection and rollback of invalid configuration changes
- Network-wide Rollback supported from Netvisor OS

Telemetry supported

- nvFlow for real-time analytics stream from Netvisor devices
- sFlow
- SNMP
- Syslog

Workflow Automation Playbooks

Leaf-Spine Configurations

The following automation playbooks are provided for leaf-spine topologies

Leaf-Spine Playbook	Leaf	Spine	ZTP Provisioning
Layer 2 Leaf and Layer 3 Spine	Netvisor ONE OS	Netvisor ONE OS	• Sets up fabric of the switches from hostfile • Auto discover topology • Create clusters • Create trunk • Create VLAG • Create VLANs • Create vRouters • Cluster between spines • Create VRRP interfaces on spines • Leafs switches in cluster • Leaf switches not in cluster • Mix of leaf switches in cluster and not in cluster
Layer 2 Leaf and Layer 3 Spine	Netvisor ONE OS	Third-party	• Sets up fabric of the switches from hostfile • Auto discover topology • Create clusters • Create trunk • Create VLAG • Create VLANs • Leafs switches in cluster • Leaf switches not in cluster • Mix of leaf switches in cluster and not in cluster
Layer 3 Leaf and Layer 3 Spine with OSPF	Netvisor ONE OS	Netvisor ONE OS	• Sets up fabric of the switches from hostfile • Auto discover topology • Create clusters • Configures L3 Link addresses • Create Loopback interfaces • Setup BFD • Setup OSPF • Leafs switches in cluster (Create VRRP Interfaces for Clusters) • Leaf switches not in cluster (Create SVI for Non-cluster nodes) • Mix of leaf switches in cluster and not in cluster
Layer 3 Leaf and Layer 3 Spine with OSPF	Netvisor ONE OS	Third-party	• Sets up fabric of the switches from hostfile • Auto discover topology • Create clusters • Configures L3 Link addresses • Create Loopback interfaces • Setup BFD • Setup OSPF • Leafs switches in cluster (Create VRRP Interfaces for Clusters) • Leaf switches not in cluster (Create SVI for Non-cluster nodes) • Mix of leaf switches in cluster and not in cluster
Layer 3 Leaf and Layer 3 Spine with BGP	Netvisor ONE OS	Netvisor ONE OS	• Sets up fabric of the switches from hostfile • Auto discover topology • Create clusters • Configures L3 Link addresses • Create Loopback interfaces • Setup BFD • Setup BGP • Leafs switches in cluster (Create VRRP Interfaces for Clusters) • Leaf switches not in cluster (Create SVI for Non-cluster nodes) • Mix of leaf switches in cluster and not in cluster
Layer 3 Leaf and Layer 3 Spine with BGP	Netvisor ONE OS	Third-party	• Sets up fabric of the switches from hostfile • Auto discover topology • Create clusters • Configures L3 Link addresses • Create Loopback interfaces • Setup BFD • Setup BGP • Leafs switches in cluster (Create VRRP Interfaces for Clusters) • Leaf switches not in cluster (Create SVI for Non-cluster nodes) • Mix of leaf switches in cluster and not in cluster

Two-Switch Clusters

The following automation templates or playbooks are provided for two-switch cluster topologies:

Cluster Playbook	ZTP Provisioning
Layer 2 Switch Cluster	• Setup fabric (two switches) • Create cluster • Create VLANs with option to add untagged ports • Create LAGs • Create vLAGs
Layer 2 Switch Cluster with VRRP	• Setup fabric (two switches) • Create cluster • Create VLANs with option to add untagged ports • Create LAGs • Create vLAGs • Create vRouter • Setup VRRP
Layer 3 Switch Cluster with BGP and VRRP	• Setup fabric (two switches) • Create cluster • Create VLANs with option to add untagged ports • Create LAGs • Create vLAGs • Create vRouter • Setup VRRP • Setup BGP
Layer 3 Switch Cluster with OSPF and VRRP	• Setup fabric (two switches) • Create cluster • Create VLANs with option to add untagged ports • Create LAGs • Create vLAGs • Create vRouter • Setup VRRP • Setup OSPF

Single Switch Deployments

The following automation templates or playbooks are provided for single switches:

Single-Switch Playbook	ZTP Provisioning
Layer 2 Single-Switch	• Setup fabric (single switch) • Create VLANs with option to add untagged ports • Create trunk (LAG)
Layer 3 Single-Switch with BGP	• Setup fabric (single switch) • Create vRouter (router-type hardware) • Setup loopback IP & router id • Create L3 Interface • Setup BGP
Layer 3 Single Switch with BGP Uplinks and Layer 2 Downlinks	• Setup fabric (single switch) • Create VLANs with option to add untagged ports • Create trunk (LAG) • Create vRouter • Setup BGP • Create SVIs
Layer 3 Single-Switch with OSPF	• Setup fabric (single switch) • Create vRouter (router-type hardware) • Setup loopback IP & router id • Create L3 Interface • Setup OSPF
Layer 3 Single-Switch with OSPF Uplinks and Layer 2 Downlinks	• Setup fabric (single switch) • Create VLANs with option to add untagged ports • Create trunk (LAG) • Create vRouter • Setup OSPF • Create SVIs

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