be networks

Delivering the Power of Intent-Based Networking (IBN) to Dell Enterprise SONiC Data Center L2/L3 Fabrics

Combined Solution Benefits

Verity greatly simplifies Dell Enterprise SONiC lifecycle operations across multiple sites through a simple-to-use single pane of glass

- IBN solution enabling IT staff to focus on the high-level tasks of delivering services - the intent - not the how

- Network Source of Truth (NSoT) for the intended network state which is continuously audited and validated

- True Zero Touch Provisioning (ZTP) solution greatly reducing Day 0 to Day N design and deploy intervals from hours to minutes

- Standardized to Dell SONiC best practices

- Verity and Dell SONiC lockstep software feature release cycles

Current Challenges

For businesses' digital transformation processes to be successful, infrastructure and operations (I&O) leaders must deliver new applications and services at hyperscale and hyperspeed. These transformation initiatives are having massive impacts on the data center including increased complexity, pressure to reduce downtime (both planned and unplanned), the accelerating need for GenAI Ethernet infrastructure, the requirement for greater agility, and the need for staff with deeper and broader skill sets.

It is imperative that modern enterprise data centers leverage the same open technologies used by hyperscale cloud providers to achieve the required agility, efficiency, and resiliency to meet the rapidly growing and dynamically changing needs of the business. Enterprises can no longer rely on proprietary, inflexible solutions nor continue to use legacy operations practices in the modern data center era.
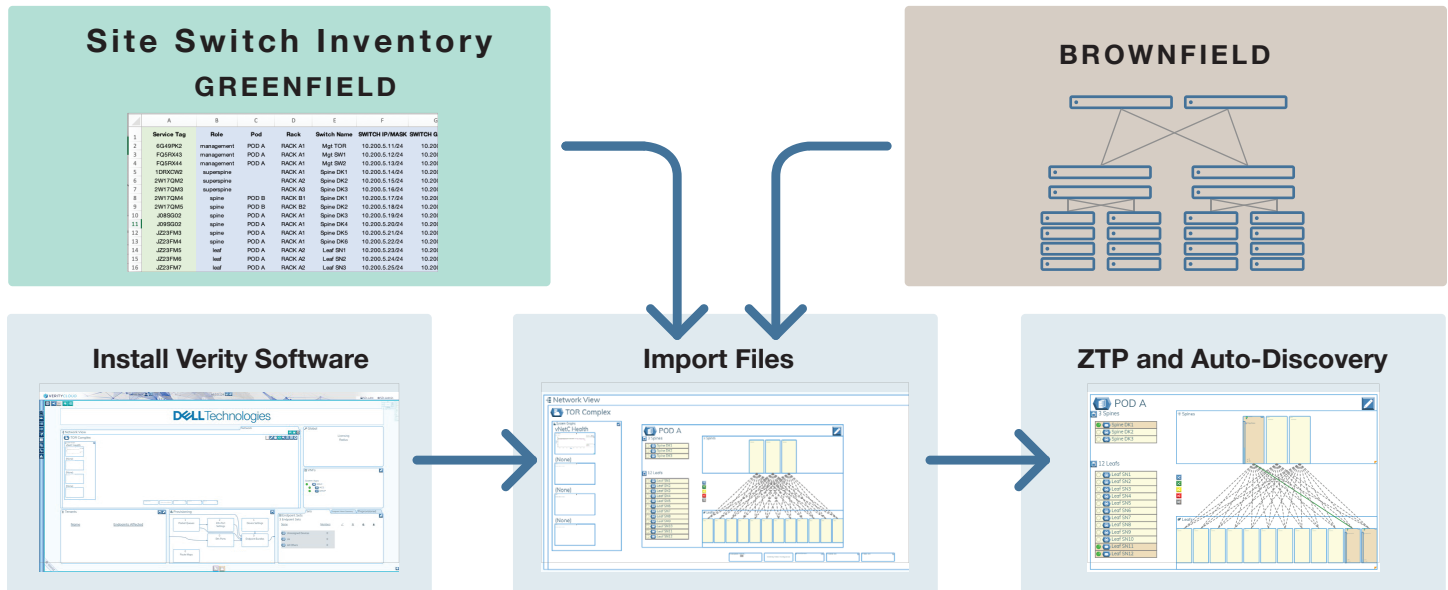
Combined Solution

The powerful combination of Dell Enterprise SONiC and the BE Networks Verity vendor-agnostic L2/L3 fabric orchestration solution addresses these key challenges head-on by delivering the high levels of automation, agility, and resiliency required by the modern data center, all at cloud-scale economics.
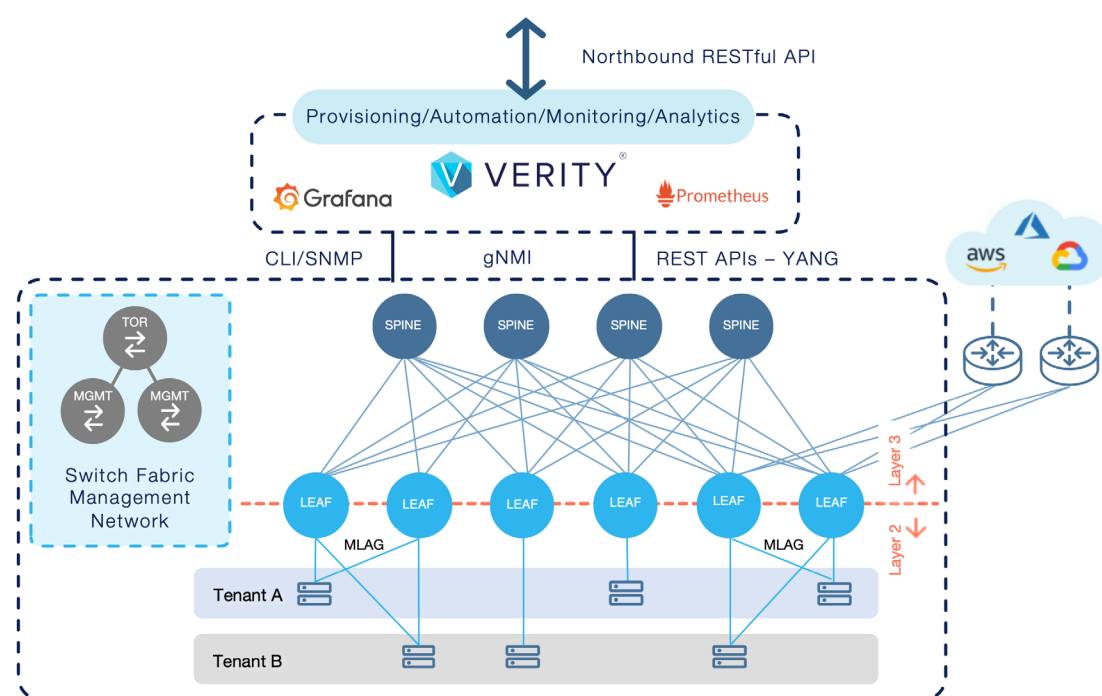
Key Attributes

- No agents or scripting

- Vendor agnostic – supports mixed vendor environments

- Enables graceful brownfield migration to OCP switches and SONiC

- Seamless integration of Data Center and Edge plus Management Network

- Verity releases in lockstep with Enterprise SONiC releases

Adding Value at All Stages of the Deployment Lifecycle

Site Switch Inventory
GREENFIELD

BROWNFIELD

Install Verity Software

Import Files

ZTP and Auto-Discovery

From Boxes to a Standing Data Center in Minutes

Greenfield Deployments

Day 0: Simple and Flexible Design Process

Before any network hardware is unboxed, racked, and powered on, Verity can automatically generate a data center site topology map for each network device planned for deployment. This is accomplished by importing a CSV file that contains basic site design information such as site name, switch names and roles (leaf, spine, etc.), IP addresses, etc. When a site inventory report is available, switch service tag information is added to the CSV file and uploaded to the Verity orchestrator. Verity generates and displays the entire data center network map indicating that all switch profiles are in a pre-provisioned state.

Day 1: ZTP Deployment Model

Verity enables the true ZTP installation of Dell Enterprise SONiC switches with only the ONIE boot code installed. The switch hardware for the L2/L3 fabric and the out-of-band switch management network can be unboxed, racked, powered, and cabled to a fully operational status immediately with no on-site configuration required.

Once powered and cabled, Verity provides the necessary DHCP responses enabling the switches to locate their respective SONic images. When the ZTP process completes, the switches call into the Verity orchestration solution and are ready for provisioning. The detailed network topology is auto-discovered, reported, and displayed on the site map. Additionally, the switch interconnects are mapped and validated with anomalies reported.

Day 1: Intent-Based Networking Provisioning Model

Verity uses an industry-leading, declarative IBN model that enables IT teams to focus on delivering data center and cloud network services using a simplified, intent-driven methodology. This is accomplished by eliminating the need to convert desired network intent into a series of complex and manually input configuration tasks. Instead, Verity intelligently captures network intent on the administrator's behalf through a series of intuitive templates and dropdown menus. Verity then converts the required network intent into a string of configuration commands that are automatically pushed to the data center network fabric with 100% accuracy.

Day N: Authoritative Network Source of Truth

Verity acts as the single, authoritative data repository for all network fabric configuration parameters and physical inventory for both fabric and attached devices as well as the out-of-band fabric management network. It is impossible to achieve the required high levels of automation and security without this accurate, live view of the intended network state. Representative configuration data collected by the Verity orchestrator include IP addresses, interface parameters, VLAN mapping, VXLAN configurations, neighboring devices, etc., and device inventory metadata such as model, firmware version, MAC addresse, etc. Additionally, Verity continuously audits the current operational network state against the intended state, with deviations being alerted and auto-remediated.

Brownfield Deployments

A Graceful Transition to Dell Enterprise SONiC Fabrics in Four Easy Steps

Verity enables a simple, highly automated migration from Dell OS10, various sunsetting NOS solutions such as Big Switch and Pluribus, and third-party proprietary switches to Dell switches running Dell Enterprise SONiC distributions.

Step 1: ZTP Creation of the Fabric Underlay

Treated as a greenfield deployment, the underlay design follows Dell Best Practices for 3- & 5-stage Clos creation. The underlay can be designed and pre-staged with no hardware present. The design is imported from a simple CSV file. Once imported, the pre-provisioned fabric design is visible on the Verity GUI.

Step 2: Digital Twin Overlay Fabric Creation

BE Networks offline tools are used to map config files extracted from the existing hardware into Verity provisioning templates. These files are then imported into Verity automatically creating the underlay. The overlay can also be pre-staged and visible on the Verity GUI with no new hardware present. Ensure Verity is in read-only mode.

Step 3: Compare Verity Digital Twin Configs for Each Switch

Validate that the Verity generated SONiC configs match the Tenant provisioning configs of the existing leaf switches. Clear any discrepancies. Ensure Verity is in read-only mode.

### Step 4: Move Leaf Connections to New Dell Hardware

Once hardware is installed, each device auto connects to Verity to receive the correct SONiC image. Place Verity in read/write mode to auto push the correct config bundles to each new Dell SONiC switch. Move workload cables from existing leaf ports to new Dell leaf ports. Leverage site topology and redundancy to minimize service impact.

Benefits of Migrating to Dell SONiC and Verity

70%

70% Reduction in Downtime

80%

80% Reduction in OPEX
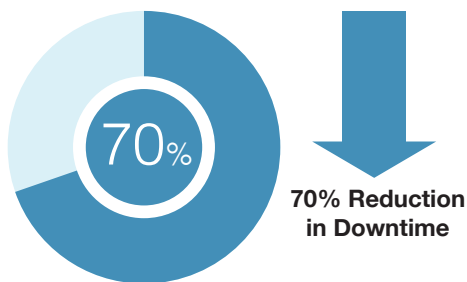
Increased Network Uptime

Human error is the #1 cause of data center downtime. According to industry data, the percentage of outages caused by human error ranges from 60 percent to 70 percent. With Verity as the single point of management, the process of device-by-device provisioning using error-prone syntax is eliminated. Additionally, Verity's provisioning algorithms alert operators of actions that could be service impacting. Coupling these capabilities with Dell Enterprise SONiC NOS and Dell Technologies' best practices, effectively eliminates all human error-induced outages.
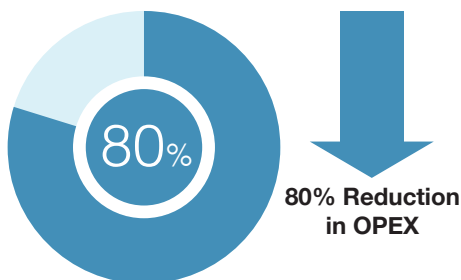
Reduced OPEX

The combined solution's centralized management, Zero-Touch Provisioning (ZTP), Intent-Based Networking (IBN), and detailed, actionable analytics deliver game-changing increases in operational effciency as well as reducing the skill sets required for day-to-day tasks. Task times for normal activities such as onboarding new tenants, adding new switch instances, upgrading firmware versions, and identifying and remediating service issues are reduced by 80 to 90 percent.

Increased Security

Verity serves as the single Network Source of Truth (NSoT) and continuously audits the current state of the network against the intended state. Any deviations trigger alerts with configurable options for auto-remediation or referral to the operator for appropriate action. Centralized management also ensures consistent policies across devices and sites.

Verity Key Features

Monitoring and Observability Dashboard
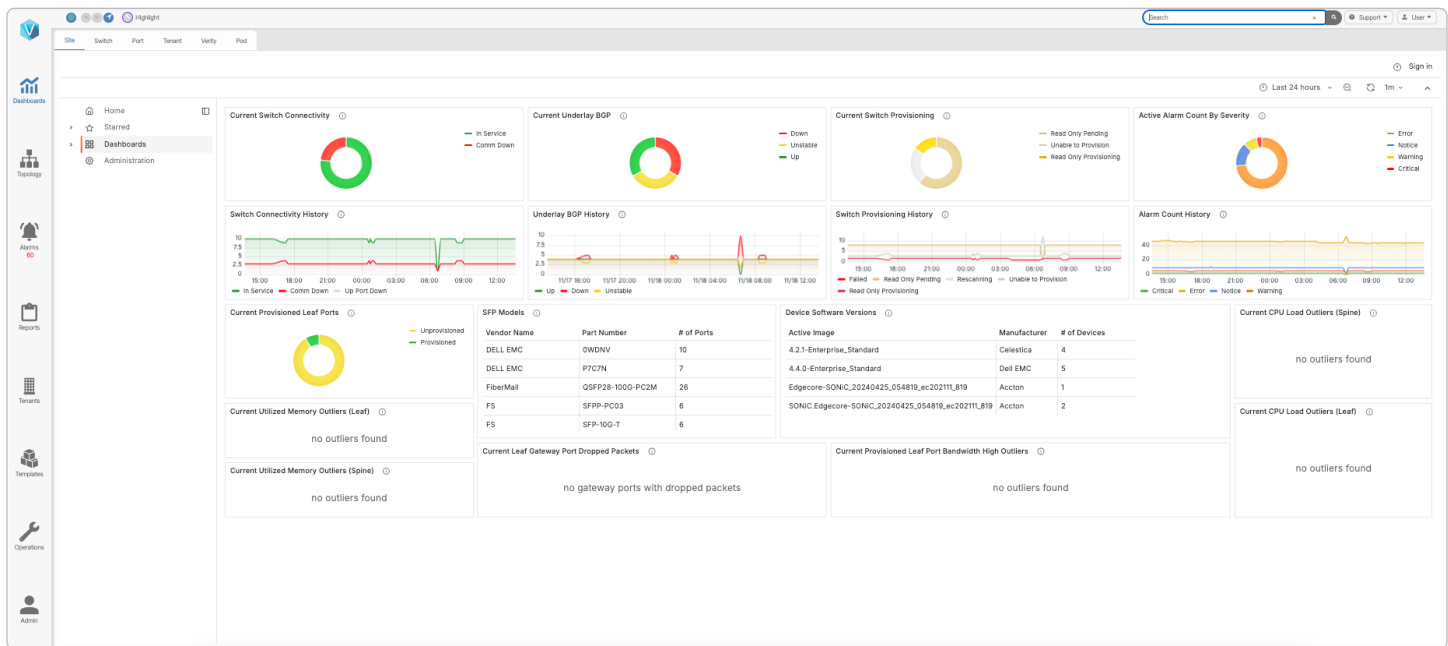
The **Dashboard** is a simple, intuitive network infrastructure observability and alerting tool providing real-time and historical detailed, actionable insight into network state and performance. The navigation panel presents a series of dashboards grouped by **Site, Pod, Switch, Port, Tenant,** and **Verity**. Each dashboard displays a broad set of relevant data such as: status (up/down), alarm severity, bandwidth utilization, CPU usage, temperature, memory usage, and more.

Live, Zoomable and Navigable Fabric Map

Precise visibility of how the network is configured and what is connected to it

Verity delivers precise visibility of how the network is configured and what is connected to it by providing the operator with a live view of the current state of the data center fabric. With just a few clicks, network operators can zoom in or out on various tenants, devices, sites and down to the individual switchport level.
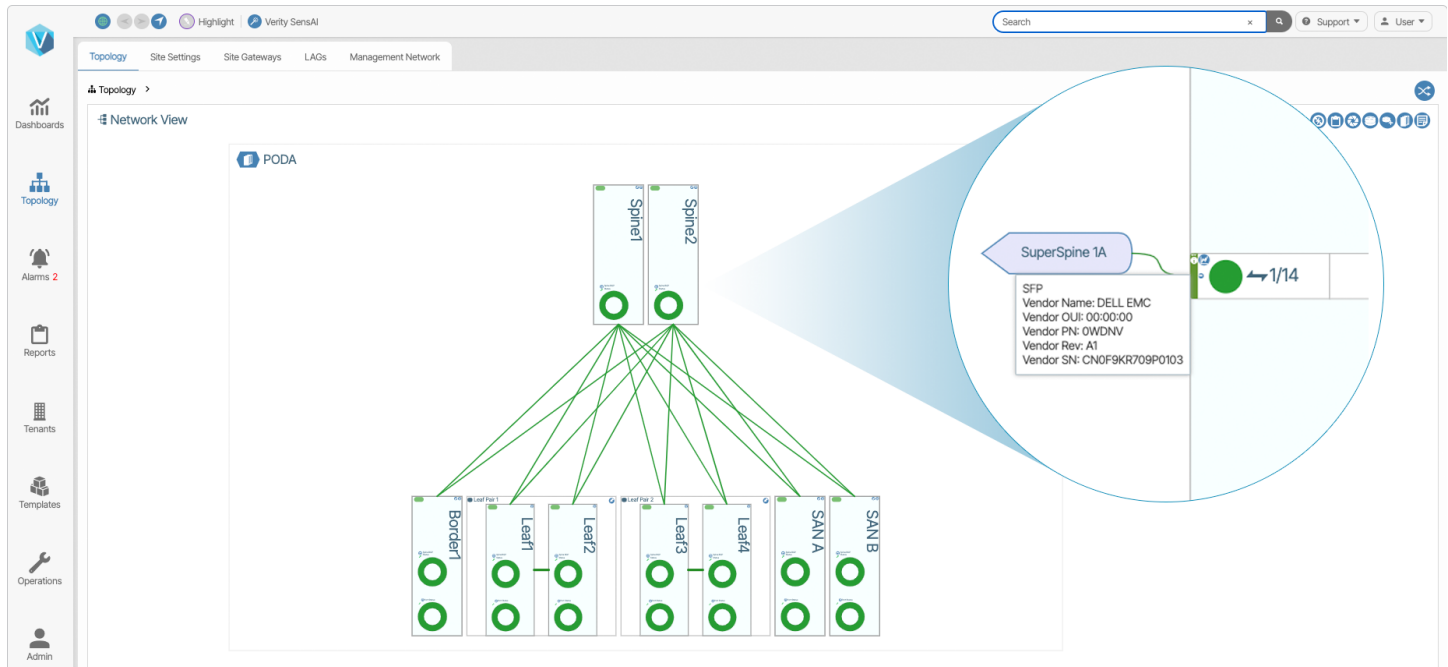
Key Verity Features Continued

Extensive Reporting Capability

All reports are customizable, filterable, and exportable via the GUI as CSV or JSON files as well as through the northbound RESTful API.

Reports are available for all infrastructure switches and attached tenant devices and incllude metadata such as manufacturer, model, current firmware version, device unique identifier (MAC address, service tag, etc.), and device role (leaf, spine, etc.).

The table below provides a complete list of the reports by category.
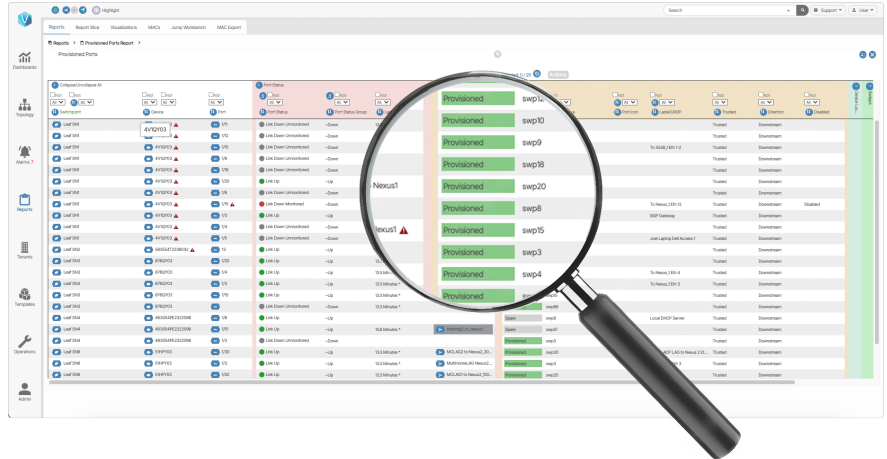
Provisioning	Route Map Defs	Network	System Components	Licensing	Specific Use
All Provisioning	AS Path Access Lists	Switch Comm Status	SDLCS	Tier Licensing Utilization	LLDP on Edge Ports
Unused Provisioning	Community Lists	Devices	DHCP Leases		DHCP Assigned IPs
Badges	Extended Community Lists	> Management Devices			Optics
Device Controllers	IP Prefix Lists	> Superspine Devices			Firmware Package Usage
Device Settings	Route Map Clauses	> Spine Devices			Preprovisioned Switchpoints
Eth-Port Profiles	Route Maps	> Leaf Devices			Isolated LANs
Eth-Port Settings		Ports			Static Connections
Gateway Profiles		> Fabric			SFPs
Gateways		> Provisioned			Active Captures
Groups		> Spare			Pending Changes
Services		LAGs			Overridden Provisioning
Switch Bundles		Internal IPs			
Switchpoints		Underlay Connections			
Tenants		External BGP Connections			
		DHCP Relays			
		Underlay Route Tables			
		Tenant Route Tables			

Network Time Traveler

Network Time Traveler automates the process of creating and managing the offline backups of the intended configured network state by exercising version control of Verity's configured objects. The backups can be scheduled to occur automatically at intervals set by the operations team or can executed on demand, e.g., before a major NOS version upgrade.

SONiC Image Management

Switch NOS upgrades typically necessitate a device reboot causing major disruption to critical workloads and end-user traffic. Verity's solution to this problem is a featured called **Image Update Sets**.

Image Update Sets allow administrators to organize switches into user-defined groups and target these distinct groups for software updates. This approach enables Verity to leverage the redundancy of active switches to maintain network availability during the update process.

The trade-off is a temporary loss of system capacity, but this allows IT teams to safely upgrade the network in the least disruptive manner.

AI and ML Workload Support

Verity fully supports critical SONiC features required to optimize high-performance, low latency network environments:

Remote Direct Memory Access (RDMA) over Converged Ethernet (RoCE v2) ensures low-latency and high throughput communications essential for GenAI and machine learning (ML) workloads.

Cut Through Switching allows dsta frames to be forwarded with minimal delay, further improving the efficiency of AI network infrastructures.

NVMe/TCP Storage Network Support

NVMe/TCP enables high-speed, low-latency storage access over standard Ethernet networks, leveraging existing infrastructure for cost-effective scalability, faster data transfer, and improved efficiency compared to traditional protocols.

Multiple SONiC Distributions Support

Verity is a vendor-agnostic network fabric orchestration solution supporting open hardware and SONiC distribution from multiple vendors. For currently supported models, visit https://be-net.com/hardware.

Verity High-Level Architecture
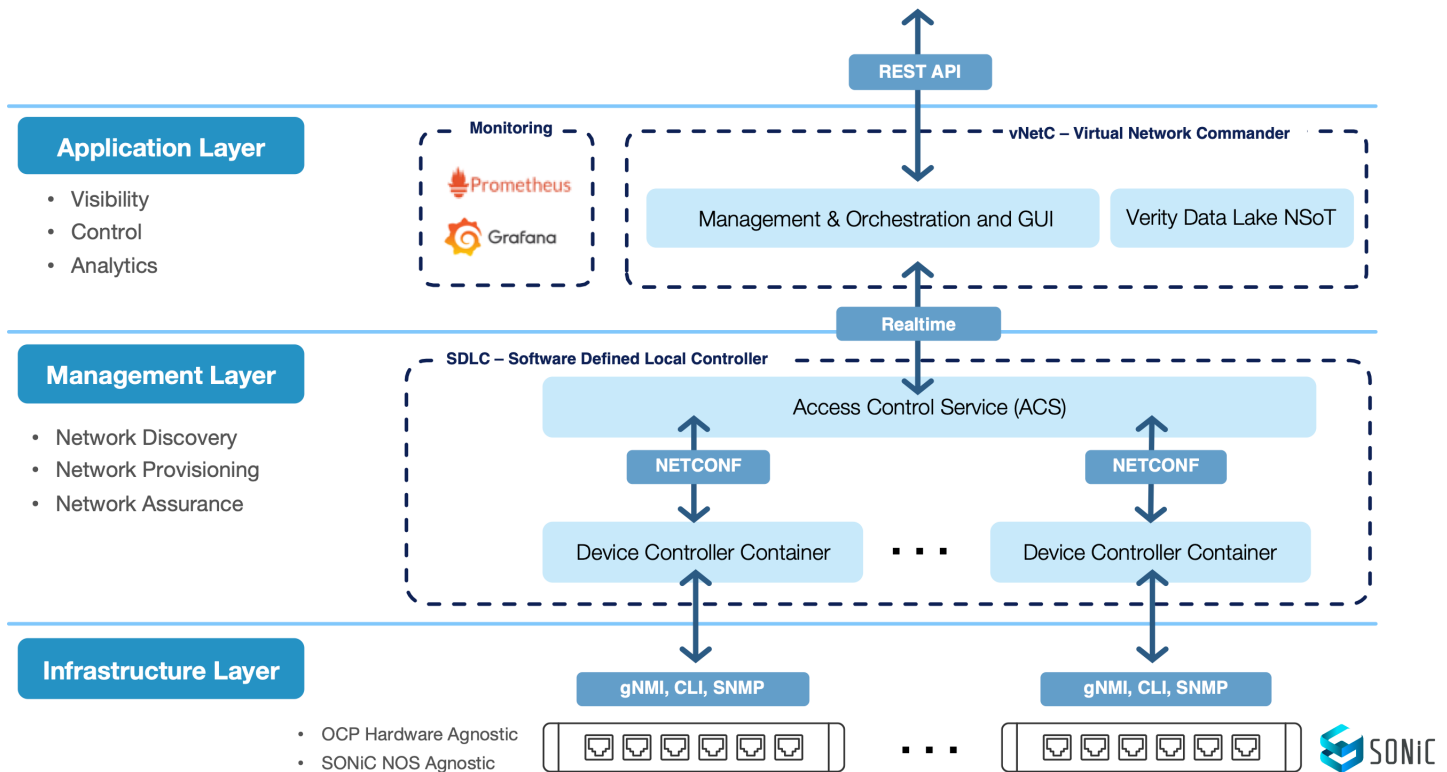
Verity uses three separate virtual machines (VMs) that split application, control, and observability duties. The **Virtual Network Commander (vNetC)** VM runs the web-based GUI and is responsible for all application-layer services for network visibility, orchestration, analytics, and the northbound RESTful API.

The **Software-Defined LAN controller (SDLC)** VM consists of a series of containers that map one-to-one to the underlying managed switches. The SDLC is responsible for the control layer services such as network discovery, provisioning, and assurance. Multiple SDLCs may be required to support larger networks. The SDLC communicates with the managed devices through their native management interface protocols, eliminating the requirement for on-device or off-device agents.

The **Monitoring VM** (optional) is a telemetry dashboard that provides users with comprehensive, granular graphical real-time and historical visibility into network performance.

Verity SKUs and Ordering Information

Verity is licensed under a simple, easy-to-understand, per-switch subscription model:

- Each managed switch requires a license
- 1-year, 3-year or 5-year terms
- No charge for the Verity software components (vNetC, SDLC, and Monitoring)
- No premium feature charges
- 2 license tiers based on managed switch downlink port speed capability
- Licensee is eligible for all maintenance and feature releases for the life of the license term

Tier 2: Universal SKUs - Applicable to All Switches Regardless of Port Speed or Role			
Description	**License Term**		
	1-Year SKU	**3-Year SKU**	**5-Year SKU**
Verity Orchestration Subscription License per Managed Switch for Cloud or Edge	AC772023	AC534119	AC534220
Verity Orchestration Subscription 1-Year Renewal License for Expiring **3-Year** License	AC969802		
Verity Orchestration Subscription 1 Year Renewal License for Expiring **5-Year** License	AC969803		
Tier 1: 1G Switch-Only SKUs Applicable to OOB Management & Low Speed Access Switches			
Verity Orchestration Subscription License per Managed Switch 1G Max non SFP Downlink Ports for Cloud or Edge	AD084888	AD084887	AD084884

Tier 1 is for fixed-port configuration switches with the majority of downlink ports being less than or equal to 1Gbps RJ45 ports (no SFPs). Tier 1 license SKUs are valid for out-of-band (OOB) management switches and 1G fixed-port speed access switches. Tier 2 licenses are for all other switch configurations regardless of vendor, model, port speed, or role e.g., superspine, spine, or leaf.

Supported Switch Hardware Models and NOS Versions

The table below shows the Dell Technologies supported switch models and NOS versions. Verity also supports the concurrent management of   multi-vendor open hardware switches and SONiC distriubtions. This capability provides maximum supply chain flexibility.

Tier	Model	NOS
1G	E3248P-ON S3248T-ON N3248TE-ON N3248P-ON	Dell Enterprise SONiC Lite 4.4
Multi-Gigabit	N3248X-ON N3248PXE-ON E3248PXE-ON	Dell Enterprise SONiC Lite 4.4
25G	S5212F-ON S5224F-ON S5248F-ON S5296F-ON	Dell Enterprise SONiC Standard 4.4
100G	Z9264F-ON S5448F-ON S5232F-ON	Dell Enterprise SONiC Standard 4.4
400G	Z9664F-ON Z9432F-ON Z9332F-ON	Dell Enterprise SONiC Standard 4.4
800G	Z9864F-ON	Dell Enterprise SONiC Standard 4.4

Supported Hypervisors

VMware ESX and KVM.

Verity Virtual Machine (VM) Requirements

Resource Sizing*

vNetC VM Resource Requirements	vCPU	RAM (GB)	Disk (GB)	Storage I/O Bandwidth (Mb/s)
Minimum	8	16	128	
1 - 100 Switches	8	16	128	17.0
101 – 500 Switches	8	16	128	125.0
501 – 1,000 Switches	15	32	128	125.0
1,001 – 5,000 Switches	75	157	128	605.0

SDLC VM Resource Requirements	vCPU	RAM (GB)	Disk (GB)	Storage I/O Bandwidth (Mb/s)
Minimum	4	4	41	
1 – 100 Switches	12	24	51	1.0
101 – 500 Switches	52	102	251	1.2
501 – 1,000 Switches	102	200	501	1.3
1,001 – 5,000 Switches	502	981	2,501	2.5

Monitoring VM Requirements	vCPU	RAM (GB)	Disk (GB)	Storage I/O Bandwidth (Mb/s)
Minimum	4	16	100	-
1 – 100 Switches	4	16	225	17.0
101 – 500 Switches	4	16	727	65.0
501 – 1,000 Switches	4	16	1,323	125.0
1,001 – 5,000 Switches	4	16	6,366	605.0

Supported Hypervisors

VMware ESXi 7.0
KVM

Client Site Requirements

Google Chrome

A resource calculator is available. Contact your local Dell Technologies representative.

Specifications

The following are highlights of key capabilities supported by Verity.

Network Design and Protocols
3- and 5-stage Clos architectures
Leaf/Spine/Superspine
BGPv4
Static routing
Dynamic BGP peers
HA leaf/TOR switch (MLAG, ESI)
MP-BGP EVPN – Type 2, 3, 5
VXLAN & VTEP
VRFs
Inter-VRF routing
L3 SVI
L3 anycast gateway
DHCP relay
RoCE v2
NVMe TCP storage network
Cut-through switching
Link state tracking

Telemetry
NOS versions
MAC tables
DHCP snooping
BGP sessions
Routing table
External route display
LLDP edge ports
SFP metadata
Cable breakout configurations
Hostname
LAG/MLAG state
Current running configuration
System Resource utilization
Device health/state
Errors on interfaces
Cabling visualization
Integrated Grafana dashboard

Workflows
ZTP with ONIE
SONiC image management
Configurations
Network discovery

Network Policy
Ethernet port profiles
Breakout cable profiles
Route maps
AS path ACLs
Community lists
Prefix lists
Priority queuing (PQ)
DSCP-Pbit mapping

Security
Role-based access control (RBAC)
Multiuser admin
HTTPS GUI
802.1x Edge Ports
2FA CAC Support for user login