LEARNING MADE EASY

VMware Cloud Foundation Operations for Networks

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Businesses depend on their computer networks. In today's distributed, digital-first experience world, there would be almost no collaborative work and transactional operations if it weren't for reliable and secure networks. They keep organizations running by getting workloads and data where they need to go to keep operations humming while keeping employees and customers connected and engaged.

Although networks are arguably too critical to fail, application outages and vulnerabilities that lead to breaches happen all the time. Cloud adoption has led to ever-growing complexity in enterprise networks. Enterprise infrastructure and operations (I&O) teams, including cloud architects, network engineers, and site reliability engineers (SREs), need visibility across hybrid environments that span on-premises, private, public, and edge cloud environments to understand the interrelated and interdependent nature of their physical and virtual resources. As applications and infrastructure have become more dynamic and automated, so too must the tools these teams use to understand and troubleshoot issues.

According to a Forrester study, enterprises experienced increased network mapping efficiency by as much as 80%, reduced time spent monitoring their network by over 75%, and decreased network outages by as much as 50%. Forrester found that an average enterprise an gain up to $3.9M in benefits with VCF Operations for networks.

The solution provides the following key capabilities:

- **End-to-end network visibility:** Build optimized, highly available, and more secure network infrastructure for VMs and Kubernetes containers across hybrid and multi-cloud environments.
- **Advanced troubleshooting:** Troubleshoot applications down to traffic flows and the network stack. See how entities are communicating, including new VMs on the network, new services, new firewall rules, and blocked flows.
- **Predictive analytics:** Minimize risk during application migrations, optimize network performance, and confidently manage the scaling of NSX deployments.
- **Efficient migration planning:** Combine planning and migration through the integration with VMware Cloud Foundation Operations HCX.

VCF Operations or networks is a component of VMware Cloud Foundation. VCF Operations or networks works with VMware NSX, also a component of VCF, to build an optimized, highly available, virtual private cloud (VPC)–enabled secure network infrastructure.

VCF Operations for networks Assurance and Verification models the network to maximize uptime and validates that business intents are compliant in the network.

In this guide, you discover how VCF Operations for networks helps enterprise I&O teams deliver better business outcomes with intent-based networking.

Recognizing the Value of Combining Real-Time Monitoring with Intent-Based Networking

Intent-based networking is software that helps businesses plan, design, and operate networks with better availability, resiliency, and agility. It takes the "intent" of the business and verifies the appropriate network rules and configurations are being followed. Intent-based networking is automated and is always aware of the current state of the network.

An example of a business-intent rule is never allowing accessibility between external web servers and the finance segment of the network. As networks change daily, these intents can sometimes be accidently bypassed, causing issues. A company can have hundreds of business-intent rules that span segmentation, reachability, compliance, resilience, and other network best practices. Verifying that intent is always being met is a challenge due

to the layers of complexity between inter- leaving virtual infrastructure, physical infrastructure, underlay and overlay technologies, connections to the public cloud, and the various network requirements of hundreds or thousands of applications that many enterprises deploy.

Another example of intent is reachability intent. For example, a pair of routers in a data center may not have failover paths properly configured. Reachability intent detects this misconfiguration, thereby avoiding a potentially serious future outage which otherwise would not have been visible because the current traffic flow is correct. This example illustrates how verification can find problems you can't necessarily see in your current traffic flows.

Intent-based networking depends on verification, which is a discrete function that continually validates — in real-time — that business intent is being achieved and automatically notifies when it isn't achieved.

REMEMBER

Verification may sound a lot like monitoring, but they aren't the same thing. Monitoring solutions gather data about what has already happened on the network, intent-based networking understands what should be happening on the network, and verification ensures that it is happening.

TIP

Intent-based networking does not replace traditional real-time monitoring tools. When these capabilities are combined, intelligence can be applied to interpret and understand the data that's collected in much the same way that the human brain interprets and understands what the eyes see.

Unlocking the Power of Intent-Based Networking

Until recently, networking professionals haven't had the right tools to proactively manage their networks. Manual checks like traceroutes, pings, and opening up browsers to try out services haven't provided strong assurances that the network will perform as required. Monitoring traffic and flows has proven useful, but it only finds problems after the fact.

VCF Operations for networks is a proactive and comprehensive approach to improve network reliability and security by mitigating and eliminating network outages and vulnerabilities. Many vendors provide live (network flow) or predictive (intent verification) capabilities, but not both. VCF Operations for networks combines live and

predictive views to provide a uniquely comprehensive view of the network that is needed in today's complex multi-cloud and hybrid environments.

REMEMBER

Live view tools typically provide access to real-time flows, metrics, network logs, streaming telemetry, application programming interfaces (APIs), packets, and analytics/machine learning that provide high-level insights such as application behavior and performance. A model tells you what could happen on your network.

VCF Operations for networks illustrates how the combination of the live view and the mathematical model provides a uniquely comprehensive picture of your network. The live view shows you what is happening and leverages analytics to provide higher-level insight from this data, particularly about applications, by identifying and understanding application behavior and performance. Then, the intent verification capability tells you what could happen and helps you determine if your network is prepared to meet application needs and follows architectural best practices.

VCF Operations for networks ensures network verification by building a deep understanding of network infrastructure to model and mathematically verify network-wide policies. Its secret sauce is collecting data from each device in the network and then translating it into a network-wide model that understands network data flow behavior system wide. It uses mathematical modeling to help analyze and verify hybrid physical and virtual networks so I&O teams can ensure that they remain resilient and secure.

VCF Operations for networks first builds a formal model of the network, which represents all the ways that data can flow through the network. Because the network depends on many devices working together, the verifier's model has to incorporate a variety of equipment (for example, routers, firewalls, load balancers, virtual networks, and so on) and many vendors, models, and protocols, to build a model of the whole network as one system. Next, it uses the model to verify that all possible data flow behavior matches the original business intent (see Table 1-1).

For organizations looking to eliminate network downtime and vulnerabilities, common use cases for VCF Operations for networks Assurance and Verification include the following:

- Topology visualization
- Troubleshooting
- Proactive problem detection

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Install and Collect	**Create a Network Wide Flow model**	**Select Best Practice Policies and Review Results**	**Implement Custom Policies**
Gain Deep accuracy into the network reality through data plane state collection	See a prediction of all possible data flow through a patented verification engine	Pinpoint policy vulnera-bilities via mathematical verification of policies in a best-practice library	Tailor the solution to network needs through configurable policies and complete API programmability

Table 1-1: VCF Operations for networks: How it works

Topology visualization

One of the biggest challenges with managing modern networks is the lack of visibility into them. Incomplete visibility increases risk, because it's harder to troubleshoot when something goes wrong or if the organization is being hit by a cyberattack.

With a visual representation of the network topology, I&O teams can create and sustain a streamlined and efficient network design. A topology map also acts as a helpful reference point if teams are trying to find the root cause of errors. And it's also critical for having a complete understanding of network functionality.

VCF Operations for networks features for topology visualization include the following:

- **Context-aware network map:** VCF Operations for networks displays the topology of the physical and virtual network. It shows both overlay and underlay network connectivity, allowing I&O teams to auto-discover devices and links and perform topology exports.
- **Path visualization:** Team members can see from point A to point B, as well as many-to-many and any-to-any paths. The solution also shows backup and equal cost multipath (ECMP) routing paths.
- **Object visualization:** VCF Operations for networks allows I&O teams to view both physical and virtual components.
- **Problem visualization:** The solution highlights both events and failures and displays heat maps to show the extent of problems.

Troubleshooting

When I&O teams operate in reactive mode, they're always putting out fires.

They have neither the time nor the resources to proactively protect enterprise networks from disruption or breaches. Ultimately, this costs organizations more money as well as time, and it limits IT agility to respond to business needs.

VCF Operations for networks is a single solution enabling networking staff to

- Analyze problems using end-to-end network behavior
- Perform root-cause analysis
- Understand the health of physical and virtual devices

Interactive search capabilities in VCF Operations for networks not only provide teams with root-cause analysis of network and device problems, but also deliver actionable intelligence. VCF Operations for networks features for troubleshooting include the following:

- **Interactive search:** With robust search capabilities, I&O teams always know whether critical services are reachable. They can segment sensitive resources, perform flow analyses, and understand network resiliency and consistency.
- **Issue correlation for actionable insights:** VCF Operations for networks allows I&O teams to correlate issues from both network and application perspectives to get actionable insight into whether intents are being achieved. Although the entire library of business intents may be relevant in a search for the source of a problem, what's important is that team members can see intent violations that are relevant to the incident being fixed.
- **Physical and virtual device health checks:** The solution allows I&O teams to understand immediately if the organization has any performance issues across any of thousands of devices on the network.

Proactive problem detection

Unfortunately, most businesses today depend on manual troubleshooting and monitoring methods. Yet they're full of inaccuracies and they don't always catch network noncompliance to network intent. The result is I&O teams spending the bulk of their time reacting to every networking problem as a one-off issue instead of building best practices for networking and compliance.

By incorporating industry best practices for network design and compliance with industry and government regulations, VCF Operations for networks enables I&O teams to up-level their ability to design a robust and reliable network.

VCF Operations for networks features for proactive problem detection include the following:

- **Predictive outage detection:** VCF Operations for networks can help predict when a network segment is going to have issues, giving I&O teams enough time to address them before they become bigger problems. This supports greater network reliability and resilience.
- **Verification of business intent:** The solution supports out-of-the-box and user-defined network intents. It verifies if the devices and network intents meet the configurations of the overlay and underlay networks and supports both the devices and network intents.

Crown Jewel Analysis

Crown Jewel Analysis provides rich insights into the reachability of critical assets in the event of a potential security event. The findings can be used to secure vital virtual machines, physical IPs, and other entities in an environment.

It showcases the number of reachability points and the dependent entities vulnerable at each reachability point. Users can select critical VMs and physical IPs as Crown Jewels to analyze and view existing flow-related information, relationships between the entities based on flows, the number of entities directly connected to the Crown Jewels, and total incoming traffic flow to them.

The Crown Jewels Analysis report lists all related entities and recommended firewall rules to protect these objects.

Guided Network Troubleshooting

Troubleshooting network issues can often be a time-consuming and time-critical ordeal. Guided Network Troubleshooting (GNT) can be used to troubleshoot supported entities from a single page. GNT creates a dependency graph for the entity selected for troubleshooting and provides metric correlation and possible anomalies that can influence performance and functionality. The intuitive and automated root-cause analysis provided by GNT can significantly reduces time-to-insight and speeds up troubleshooting time.

Looking to the Future with Intent-Based Networking

As enterprises increasingly understand the business value of intent-based networking, new use cases and innovations will emerge. In the near future, VCF Operations for networks will leverage more application information and automation to proactively predict and resolve issues before they happen.

Intent-based networking is only the beginning. Business intent is ultimately defined in the applications that run on the network, so intent-based networking will evolve to become more application driven. Today, intent and verification are user- and system-defined using low-level entities such as IP addresses and virtual machines. Soon, users will be able to define intent at a high level and the system will automatically infer best-practice intent at that level to ensure availability of required connectivity; consistency of the network across virtual machines, tiers, and environments; and network security best practices; among others. VCF Operations for networks uniquely understands the live application context and can translate this information to network requirements — and improve an IT group's productivity.

TIP

Check out the following resources from VMware to learn more about VCF Operations for Networks:

- VCF Operations for Networks web page
- Hands-On Lab for VCF Operations for Networks
- VCF Operations for Networks blogs

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