VMware Telco Cloud Operations: Next-Gen Service Assurance

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Executive Summary

Communication service providers (CSPs) are undergoing dramatic changes on several levels: software is enhancing or displacing physical infrastructure; new types of services have outpaced traditional traffic; and networks have expanded to support new applications. These changes, in turn, have stressed legacy service assurance models to the breaking point. It is time for a change. In place of siloed, manual-intensive tools, VMware Telco Cloud Operations allows service providers to manage their physical infrastructure and new virtual networks as a single unit, rapidly and cost-effectively resolve network performance issues, and ensure a consistently high level of service delivery across all domains.

The wide-ranging features and integrations of Telco Cloud Operations reflect the tasks confronting today's network operations teams. The solution provides holistic monitoring and service assurance; automated configuration, fault and performance management; a range of incremental service components; gateways to existing solutions, such as VMware Smart Assurance; and a RAN-to-edge-to-core strategy for 5G. Leading benefits include improved end-customer experience, stricter compliance with SLAs, prioritization of service-impacting events, reduced OpEx, and cross-domain/cross-tier visibility. All of these characteristics lead to faster operationalization of services and faster time to revenue. Telco Cloud Operations is also well-suited for managed service providers (MSPs), many of which rely on it to monitor their managed services offering, and large enterprises facing similar challenges.

Digital Transformation of CSPs

In the midst of their 5G transformation, CSPs require agility, rapid responses to a dynamic landscape and cost-optimization. To meet these demands, they are deploying virtualized networks, container-based applications and new services such as SD-WAN. In addition, they must support new IoT and Edge applications that require high-performance, low-latency networks, while maintaining core networks built on traditional devices and services. Given this complexity, a major need going forward is simplification.

Current Situation
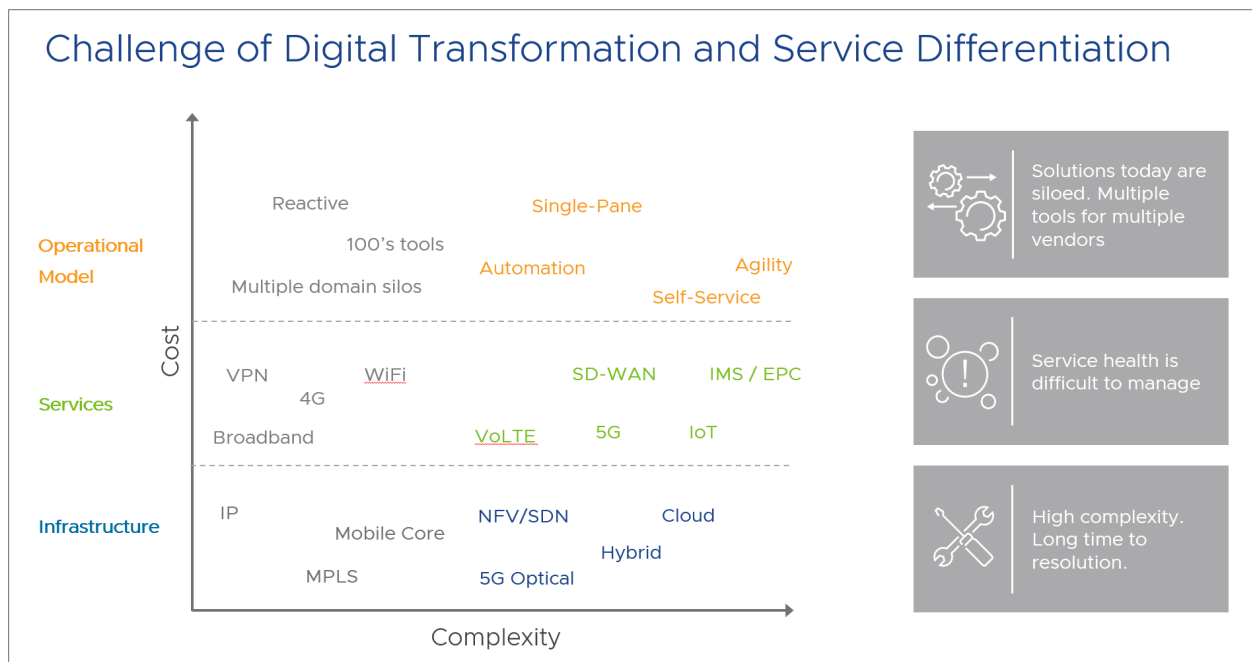
Network monitoring and service assurance are well-established components of CSP operations. The challenge is that these tools have traditionally been tied to particular devices or service delivery paths. With services now riding over complex hybrid (physical and virtual) networks, it has become increasingly difficult to manage the service health and achieve timely resolution of problems that arise.

Siloed Operations, Multiple Tools

After years of network and services evolution, CSPs are undertaking yet another transformation, this time into 5G digital service providers. Increased service offerings have meant greater revenue opportunities, but they have been accompanied by dramatically increased operational challenges.

These new networks, which can consist of millions of devices, must interoperate with those already in place. They must somehow also understand each other. At the service layer, unique configuration interfaces and management tools have proliferated. But large CSPs today may have several hundred such tools and procedures in place, typically siloed, creating a massive juggling exercise at the Network Operations Center (NOC) or Service Operations Center (SOC). In addition, everyone is looking to cut costs as profit margins erode. There is pressure to do more with the same or fewer resources. It is no wonder that many operations teams feel as though they are falling behind or spinning their wheels.

Managing Service Health

A primary concern of any operator is maintaining service health. This is especially the case when bound by precise service level agreements (SLAs) to enterprise customers. How is this possible, however, amidst the mix of software-defined networks and container-based applications, new high-performance edge and IoT applications, and core networks built on traditional devices and technologies?

The status quo is unsustainable. Many service providers now get close to 100,000 network alarms per day. Traditional tools are simply not designed to handle the diverse systems and the constant changes that characterize today's heterogenous networks. They force experienced network administrators to spend considerable time sifting through alarms, investigating problems and trying to determine true causes of outages or performance degradation. Other scarce resources are devoted to maintaining traditional Element Management System (EMS) tools with updated rules and scripts.

It is as though everyone needing any level of medical attention arrives at the ER, only to find the hospital, having no reliable way to triage this mass inflow of patients, is unable to separate a sprained ankle from cardiac arrest. Moreover, this model diverts excessive resources to the reactive or "acute care" end of the spectrum, away from prevention.

Long Time to Resolution

Given existing operational support at many CSPs, time spent in the "waiting room" can be unacceptably long. The challenges to resolving service-impacting network incidents are real, but so is the relatively narrow window within which they have to resolve these events.

The multi-vendor, multi-technology, multi-cloud mix poses a significant hurdle to network management and service assurance. It takes time to sort through a complex matrix of layers and domains. Yet customer patience is limited. The timespan within which an operator can respond to problems without triggering customer complaints can be as short as 20 minutes. Operators without effective service assurance tools have little chance of achieving a mean time to resolution (MTTR) that meets customer expectations.

What's Needed?

Given the tremendous increase in the complexity and cost of operationalizing, monitoring and managing the networks of today and tomorrow, CSPs can no longer depend on tools of the past. What's needed is an intelligent, integrated and automated approach to service assurance.

Telco Clouds Operations Summary

Telco Cloud Operations is a holistic service assurance solution that allows CSPs, MSPs and large enterprises alike to monitor and manage their traditional physical infrastructure and new virtual networks as one. It enables them to rapidly resolve network performance issues and ensure consistent delivery of services.

Based on a containerized architecture, Telco Cloud Operations automatically discovers the components of complex networks and presents the user with a comprehensive, graphical topology view. Leveraging an advanced, self-adapting engine, it automatically identifies root causes of problems, prioritizes them, suppresses extraneous alarms, and notifies the operator. It uses machine learning (ML)-based analytics to extract network performance insights, detecting and alerting on anomalous behavior to preempt issues that may affect performance. Faster remediation comes through integration with Operations Support Systems (OSS) and orchestration tools for closed-loop actions. In short, the solution provides an automated approach to reducing operational expenses, increasing uptime, meeting SLAs, and operationalizing new services faster.

Evolution of Telco Cloud Operations

Telco Cloud Operations was built on a highly successful service assurance solution and sits at the top of VMware's Telco Cloud portfolio, above the Infrastructure and Orchestration layers. The preexisting product, VMware Smart Assurance, has been deployed across an install base of CSPs, MSPs, large enterprises and government organizations around the world. Telco Cloud Operations takes the learnings, experience and technology that were built into and evolved over the years with Smart Assurance, transforming it into an architecturally modernized product that focuses on the monitoring and automation of next-generation networks.

Quantitative Benefits

The benefits of Telco Cloud Operations are discussed throughout this paper, and expanded upon in the 'Customer Benefits' section, but several key business advantages can be noted upfront:

Speed to market. Operators can rapidly deploy Telco Cloud Operations. Within a short time, it will automatically discover the entire network topology and the relationships between both physical and virtual devices and then continuously update this topology and relational map as the network is actuated.

Lower OpEx. By automating many processes and maintaining a consistent configuration of network devices, customers using Telco Cloud Operations promote a stable network environment that eliminates unnecessary configuration corrections. Its root cause analysis (RCA) engine automatically triages incidents, sifting through the thousands of symptoms (extraneous alerts) to pinpoint what is actually causing a problem. Being able to locate the "needle in the haystack" leads to additional OpEx savings. This functionality has been able to automatically identify the root causes of over 92 percent of problems for one large telco customer, enabling operations teams to focus instead on the most difficult network incidents or other higher-value tasks.

Higher SLAs. Higher performing networks in turn allows CSPs to offer more stringent SLAs (and charge more for them) knowing they can identify and resolve issues quickly and provide higher-value customer experience.

Time to Revenue. The combination of quicker deployments, automated routine tasks, saved (and re-deployable) resources and more valuable SLAs can lead to both higher and more rapidly realized revenue. MSPs, who can now easily add new enterprise customers to the environment without increasing the number of monitoring staff, offer compelling illustrations of these benefits.

Telco Cloud Operations Features and Integrations

Telco Cloud Operations was built with an expansive capability to integrate, scale and perform. In strategic terms, it leverages its powerful features to drive service assurance automation across preventative, reactive and proactive fields. Architecturally, it combines a range of new service components with gateways to existing products, including VMware's well-established Smart Assurance solution.

Cross-tier, Cross-domain Intelligent Assurance

Telco Cloud Operations provides CSP operations teams with end-to-end visibility of complex, hybrid networks. The range of view extends in all directions: from core to edge to enterprise to RAN domains on the horizontal axis; and through layers of physical network, virtualization, applications/VNF, services and orchestration on the vertical axis. Integrated throughout are Telco Cloud Operations' three key tenets: fault management, performance management and network configuration management.
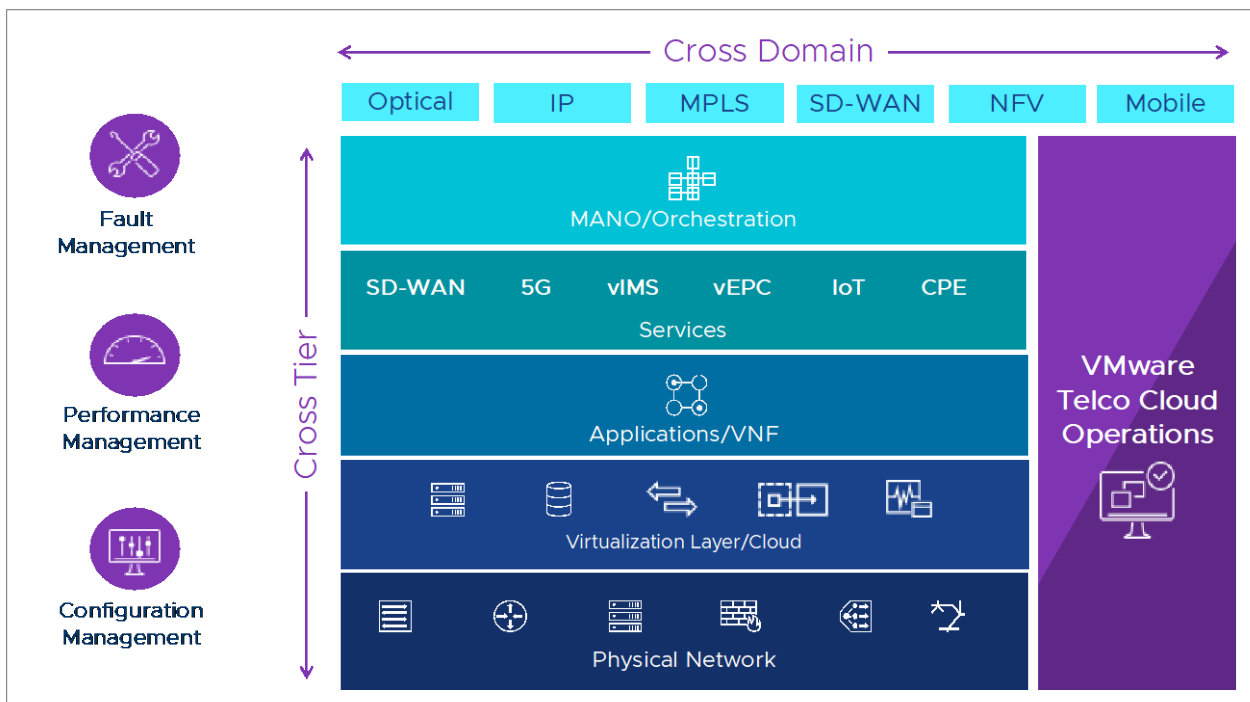
The powerful capabilities of this complete service assurance solution derive from the following design considerations and features:

Containerized Architecture. Built on top of OS-level virtualized Docker containers, Telco Cloud Operations is a containerized solution, enabling it to adapt to rapidly evolving networks. Traditional service assurance tools, by contrast, are unable to handle the diverse systems and constant changes in today's increasingly software-defined networks. This advanced architecture enables Telco Cloud Operations to scale up or down over app-based deployments, achieving task-specific goals and exchanging data required for management and reporting.
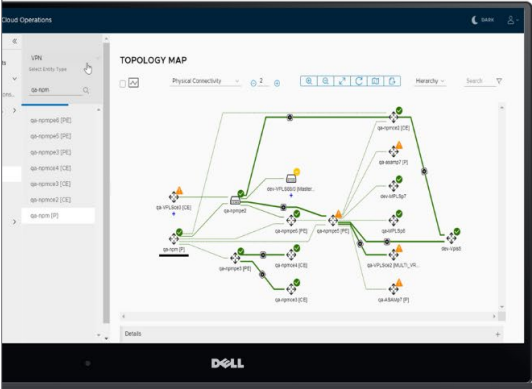
HTML UI. The new single sign-on (SSO) UI is based on Project Clarity's open-source design system, employing UX best practices, HTML/CSS language and the web application framework Angular. Providing different access levels, the Telco Cloud Operations UI uses a Grafana-based reporting interface on top of Elasticsearch distributed NoSQL database for rapid searching and analysis, providing CSPs and enterprise customers with raw and enriched data, including performance analytics specific to a particular customer network.

Secure Multi-Tenancy. In Telco Cloud Operations, multi-tenancy gives service providers a flexible, operational framework to group and report managed objects and services. A service provider admin user would be able to define access control for tenant users in specific domains, such as metrics, events and topology. As such, each tenant can access operational UI views containing data points of their own networks and resources, and not those of any other tenants. This multi-tenancy feature uses an open-source identity management, secure SSO solution that can authenticate users natively, as well as through external identify providers, such as LDAP/AD.

Auto-Topology Discovery and Actualization. Via SNMP, CLI/SSH, HTTP, and API integration with orchestrators and controllers, Telco Cloud Operations queries devices and acquires MIB and other data needed to map a CSP's multifaceted network in a variety of domains (MPLS, IP, NFVI, SD-WAN, vIMS, SDN). Support for discovery protocols and methods, along with VMware's extensive expertise in topology mapping enables the solution to correlate and represent more than 4,000 physical and virtual devices from multiple vendors today.
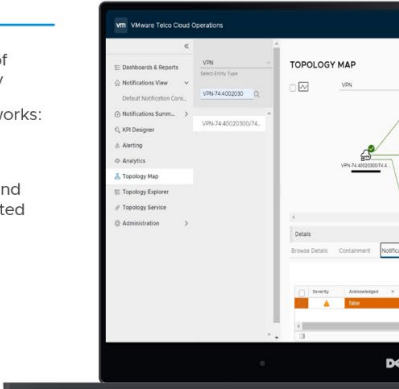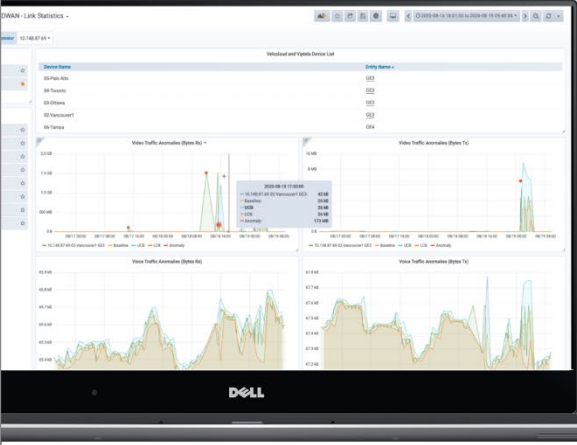
ML for Advanced Performance Analytics. The scale and diversity of cloud and new mobile systems, along with the real-time nature of 5G, make it imperative to transition into machine learning (ML) paradigms. Telco Cloud Operations enables dynamic baselining and thresholding of performance, anomaly detection and notifications, and correlation of performance KPIs with services and tenants, all the while building and retaining a historical database. The current ML focus is on overall performance analytics; but with a Kafka bus that enables CSPs to inject and share information with other tools, this feature is evolving toward increased flexibility, greater analytics and more automation.

Performance Analytics for Multi-Vendor Networks
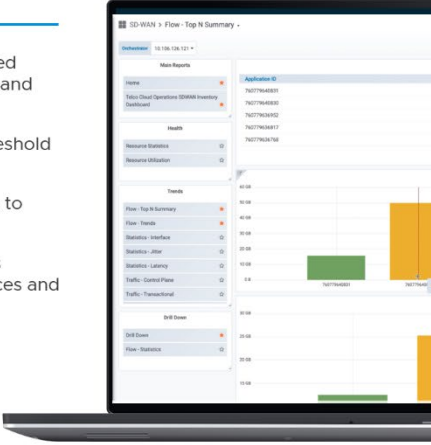Cross-Tier Visibility and Performance Analytics for SD-WAN, LAN, and WAN

Machine learning-based dynamic thresholding and anomaly detection

Notifications once threshold breached

Performance analytics to meet SLAs

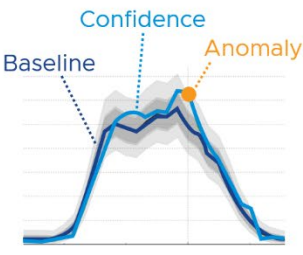Cross Domain – spans physical, virtual, services and tenants

Anomaly and Baseline Performance Graphs

Device and Applications Analytics Dashboard

Root-Cause Analysis. Telco Cloud Operations employs a multi-dimensional model-based engine for both object-oriented analysis (involving object classes, attributes, behaviors, etc.) and causal propagation for connecting problems with symptoms. It establishes connections by traversing multi-layered relationships, looking for problem signatures based on an understanding of causal propagation and topology, and identifying the problem's signature or root cause. Given visibility into tenants, it can also rank alerts according to business impact. This capability unburdens operations teams from spurious alarm analysis, placing truly useful information at their fingertips.

Machine Learning Anomaly Detection for Business Impact Analysis
Performance & Fault Analysis for Proactive Assurance

Confidence
Anomaly
Baseline

Codebook Correlation

Machine learning performance analytics
Performance Counter Dynamic Thresholding

Root Cause Analysis Correlation Engine
Correlation of performance KPIs, services and tenants

Business Impact
Automated Performance Degradation Identification

SD-WAN Multi-Vendor Monitoring and Analytics. A visibility gap between the underlying infrastructure and virtual network in SD-WAN deployments can impede effective service assurance. Telco Cloud Operations addresses that challenge by providing end-to-end SD-WAN topology for any selected tenant, a map of logical relationships, and performance metrics on SD-WAN tunnels, including jitter, latency, loss percentage, etc. It interlocks with the SD-WAN orchestrator, such as *VMware SD-WAN* or Viptela, and supports a common information model expandable to multiple vendors.

vSphere/vCenter, Red Hat, NSX-T, Cisco ACI. Correlating virtual and physical networks is a capability that Telco Cloud Operations extends across a range of infrastructure, including *VMware's vCenter*, the centralized management app for managing VMs and the ESXi hypervisor; Red Hat's enterprise virtualization product KVM OpenStack; *VMware's NSX-V and NSX-T network virtualization and security solutions*; and Cisco's ACI SDN solution. Telco Cloud Operations integrates with these solutions to create a logical and physical representation of both the virtual and physical elements of these networks.

Telco Cloud Infrastructure Integration. Telco Cloud Operations integrates with other VMware solutions in the Telco Cloud portfolio, such as *Telco Cloud Infrastructure* and *Telco Cloud Platform*, enabling further automation in a coordinated fashion. In particular, it supports virtualized infrastructure managers (VIMs) *vCloud Director (vCD)* and *VMware Integrated OpenStack (VIO)*. It also integrates with *vRealize Operations Manager (vROps)*, which provides operations management for private, hybrid and multi-cloud environments in a unified AI-powered platform.

Virtual Evolved Packet Core (vEPC). Already in use with 4G but a key part of 5G network architecture, vEPC is becoming mainstream, with some mobile operators already running half of their mobile traffic across virtual infrastructure. Telco Cloud Operations supports a common information model and enables automatic discovery and monitoring of vEPC infrastructure, supporting the Affirmed Networks vEPC today and others via the common model. It also supports the policy and charging rules function (PCRF), mobility and management entity (MME), serving gateway (SGW) and packet data network gateway (PGW) VNF layers for 4G LTE and VoLTE.

Virtual IP Multimedia Subsystem (vIMS) for VoLTE. If an alarm is raised, such as a high session count, indicating that too many VoLTE calls are being handled by a particular component, Telco Cloud Operations will immediately correlate the alarm to the related vIMS service (since this could result in dropped calls and the inability to initiate additional calls). From within the same portal, a workflow in the related orchestrator can be automatically triggered to scale up the capacity of the vIMS service by adding resource capacity, without the need for human intervention. Once the job is completed, the alarms are automatically eliminated, and the status is returned to normal.

Data Collectors and Data Stores. Telco Cloud Operations' unified data model includes a real-time data collector framework to capture, filter, enrich, and transform data from multiple technology domains. Numerous collectors are available out-of-the-box and over 4,000 virtual and physical devices are supported today. Elasticsearch provides an event store for active and historical notification events, performance metrics, and customized KPIs, allowing for ML-based analytics to be applied to this data for proactive performance management. Topology data are stored in a graph database and used to understand the relationships between multi-vendor devices and services for rapid, automated root cause and impact analysis of network problems.
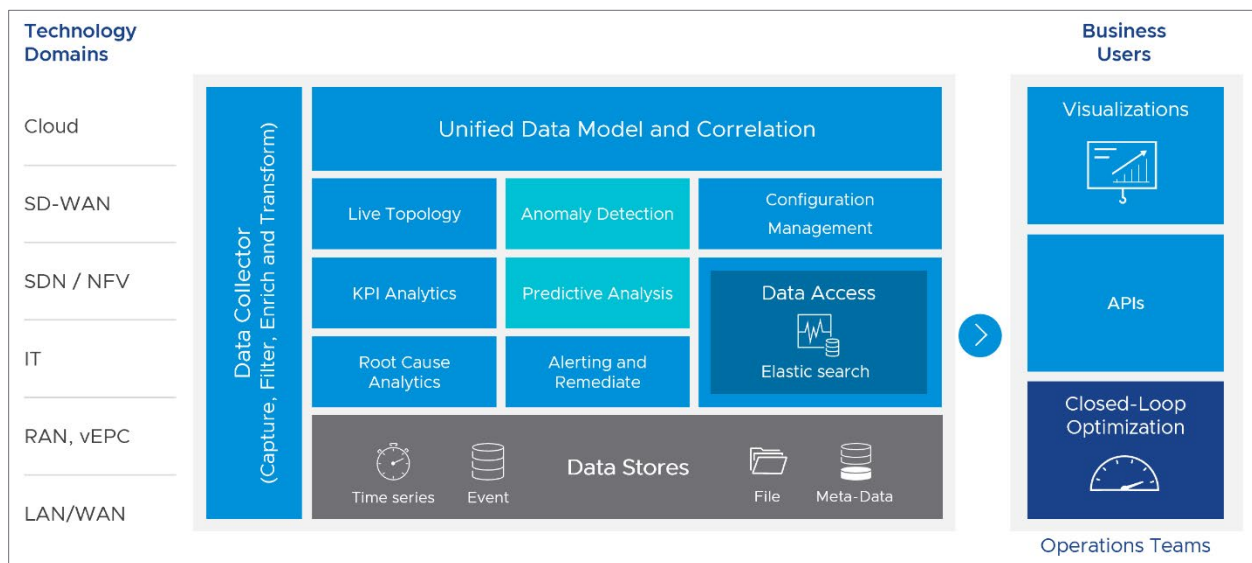
Service Assurance Automation Strategy

Along with the intelligence generated by a holistic platform, Telco Cloud Operations also provides operators with actionable next steps to more efficiently manage their services. In many scenarios, building upon appropriate integrations, these workflows can be automated, thus supporting a closed-loop service assurance model. The three primary domains for implementing this strategy involve preventative configuration, fault management and proactive maintenance.

Preventative Configuration Management

A baseline task for any service assurance platform is to ensure that network device configurations are stable and compliant. It has been estimated that 60 to 80 percent of service-impacting network outages are caused by change and configuration errors. The challenges to maintaining effective control include a high number of network devices, the frequency with which they are changed in some way, and the need to comply with internally or externally mandated specifications.

To meet those challenges, Telco Cloud Operations leverages the *Network Configuration Manager (NCM)*, an add-on product comprised of application and device servers and deployed in a distributed architecture for efficiency and scalability. This well-established solution automatically discovers network device configurations, keeps back-ups of them, and performs continuous audits to ensure compliance with corporate and regulatory requirements. Using NCM, an operator can search for a particular subset of devices within a designated network, site or subnet; identify gaps in compliance; and then push a configuration change, software patch, or other update using ITIL-compliant change processes and workflow approvals. Integrated within the Telco Cloud Operations family, NCM can save operators tremendous time over legacy investigatory and resolution processes, reduce errors, boost security and tighten compliance with customer SLAs.

Fault Management

An enduring network management problem is that when alarms pop up and notifications arrive – and they can surface in overwhelming quantities – operators do not necessarily have a clear understanding or view of the underlying problem. The automated root cause and correlation engine at the heart of Telco Cloud Operations cuts through the noise of alarm storms to isolate their source. It automatically (quickly and without human errors) reduces tens of thousands of network events into a limited number of actual root causes.

In some cases, RCA has driven a more than 95 percent reduction in the number or alarms, which translates into significant time and resources saved. By identifying service and tenant impact, this RCA engine also enables an operator to prioritize next steps. Integration with OSS and service management systems, such as ServiceNow and Remedy, then enables a user of Telco Cloud Operations to begin remediating problems automatically. Through a closed-loop integration with orchestrators, it can also trigger scaling of compute resources in the event of congestion, thereby avoiding an overload of the network and minimizing customer impact.

Proactive Performance Management

Getting ahead of incidents is the endgame in service assurance. This is where ML paradigms come into play. By automatically establishing dynamic baselines for performance analytics, Telco Cloud Operations can then identify anomalies that traverse designated thresholds, and so identify potential service performance degradation. Its management analytics cover a wide span of metrics, such as: packet loss and jitter impacting SD-WAN; increases in vCPU contention or memory usage; declines in bandwidth consumption on a physical router interface; increases in interface utilization and discard rates of specific interfaces; and spikes in traffic causing increases in high packet rate. All of these above factors can impact service quality.

Proactive identification of incidents and their root cause not only results in faster remediation. It also enables operators to more rapidly notify customers, for instance via ServiceNow or Remedy, within the narrow timeframe of an incident, outside of which customers are much more likely to register formal complaints. Even better, of course, is being able to prevent or anticipate network issues before they become service-impacting.

Telco Cloud Operations Architecture

Telco Cloud Operations is built as a "manager of manager" on top of existing deployments, and it uses gateways to extract data from systems that are already installed, such as VMware Smart Assurance. The menu of services above the gateways range from reporting to KPIs to alerting to analytics to collectors and beyond. This architectural combination of service components (nine of which are discussed below) and seamless integration with stand-alone VMware and third-party solutions enables custom-fit, future-proof installations deployed with minimal disruption.

Incremental Service Components

User Interface (UI). Telco Cloud Operations has a feature-rich dashboard that offers a clear and expansive view of an operator's networks. A single display that can present unified data, this UI eliminates the need for operations teams to switch from console to console, vendor to vendor, stitching together bits of information on their own. It enables filtering by specific enterprise customers and offers visibility into all edges, hubs, gateways, orchestrators and other network elements. Other platform functionalities found here include event management, notifications, RCA, KPI design, performance management analytics and more.

Reporting. Tightly integrated within the Telco Cloud Operations UI is the Grafana-based, leading-edge capability for visualizing time series. An open-source project of the Grafana Labs, Grafana allows a user, given appropriate privileges, to query, view, understand and generate customized analytics reports wherever the data or events are stored. MSPs and CSPs can give their tenants access to view reports pertinent to their specific networks, while preventing access to other tenants' networks.

Kafka Messaging. Telco Cloud Operations leverages Apache Kafka to connect, inject, stream and share data from other tools and sources. This bus for real-time communications enables the flexibility and enhanced analytics that drive holistic network assurance automation. The open messaging platform with standard APIs facilitates the sharing of information both northbound and southbound.

KPI Designer. Telco Cloud Operations enables users to design, create and deploy their own KPIs on-the-fly, leveraging the interactive UI of the KPI Designer. Able to combine multiple metrics together as needed, this KPI service can then feed these metrics into the Grafana-based reporting tool for use in monitoring overall network health. A customer can use it to define static and dynamic thresholding, the latter managed by ML analytics.

Alerting. Displayed in the Telco Cloud Operations UI, notifications and alerts are delivered when thresholds are breached, anomalies detected, or other events observed which merit the attention of operations teams. Integrated with an RCA engine, the Alert Service presents indicators that have been processed through a triage filter, with spurious or symptomatic alerts deprecated in favor of those linked to root causes of events. A net result is fewer and more impactful alerts.

Analytics. This component of Telco Cloud Operations enables several core functionalities, including easy visualization of analytics for network services (link statistics, packet loss, latency, jitter, MOS scores, etc.) and device statistics (CPU utilization, temperature, etc.); automatic establishment of baselines, thresholding and anomaly detection; and triggering of alerts or notification when thresholds are breached. The Analytics supports SNMP, IP SLA, sFlow, SD-WAN and VNF performance metrics and enables the capture of NetFlow information in standard templates from any device that supports NetFlow. It integrates with the KPI service.

Collector. Telco Cloud Operations collects fault and performance metrics from thousands of network devices using various industry-standard data collection methods. Currently available examples include Cisco ACI collectors, which fetch overlay and underlay metrics from the Cisco ACI APIC; SD-WAN collectors for gathering data from VeloCloud and Viptela infrastructure; the vIMS (for VoLTE) collector; Kafka streaming collector; NetFlow collectors; VMware Infrastructure vCenter and NSX collectors; and SNMP collectors from host, router, switch, firewall, etc. Telco Cloud Operations provides a gateway for customers who have already installed VMware Smart Assurance.

Topology. Through advanced auto-discovery capabilities, Telco Cloud Operations can automatically discover the topology of multi-vendor, multi-domain physical networks (IP, MPLS, optical, servers, switches, routers, etc.) including parent/child/sibling relationships; and virtual hybrid clouds (VMs, SDNs, SD-WAN, vIMS, vEPC, NFV, etc.). When mapping services to underlying infrastructure, it autonomously builds an inventory catalog and topology map within hours; and when new devices or virtual functions are moved, added or changed, it continuously updates this topology and relationship map. It supports 4,000 devices out of the box.

Orchestrator, BSS, OSS Interface. Through APIs with SD-WAN orchestrators, SDN controllers, OSS/BSS tools, and service management systems, such as ServiceNow and Remedy, Telco Cloud Operations can offload routine, manual tasks for automated, closed-loop remediation actions. Integration with orchestrators such as VMware's SD-WAN Orchestrator enables consistent operations.

Components of Existing Products

To deploy Telco Cloud Operations and benefit from the services and applications described above, one need not uninstall VMware's popular Smart Assurance solution or other VMware products, such as the Network Configuration Manager (NCM) and the Management and Reporting (M&R) solution. These products interoperate perfectly well.

Fault RCA and NCM

Telco Cloud Operations leverages fault RCA capabilities and an automated RCA engine. Telco Cloud Operations stitches together virtualized and physical network infrastructure monitoring, analyzing events and inter-relationships of thousands of devices and drives automated RCA. It then extends into the business services and applications level, relating RCA to the impact a service degradation will have on specific customers.

Another successful and pre-existing product, NCM is also part of the automation strategy of Telco Cloud Operations, responsible for the preventative configuration management described earlier in this paper. NCM can be integrated with VMware Telco Cloud Operations to dramatically reduce the time required to investigate and resolve change and configuration-related issues. The NCM application server can manage one or many device servers; those, in turn, can manage thousands of network devices.

Data Gateways and Smart Assurance

For customers that already have VMware Smart Assurance installed, Telco Cloud Operations offers a gateway free of charge between existing Smart Assurance deployments and Telco Cloud Operations. This option presents customers with all the advanced capabilities offered within Telco Cloud Operations, without having to replace the collectors and customizations they have already deployed.

Similarly, the legacy M&R product integrates with Telco Cloud Operations. By means of another gateway, current M&R customers can protect that investment, use the existing reports they have already developed, and transition to the new reporting service if and when appropriate.
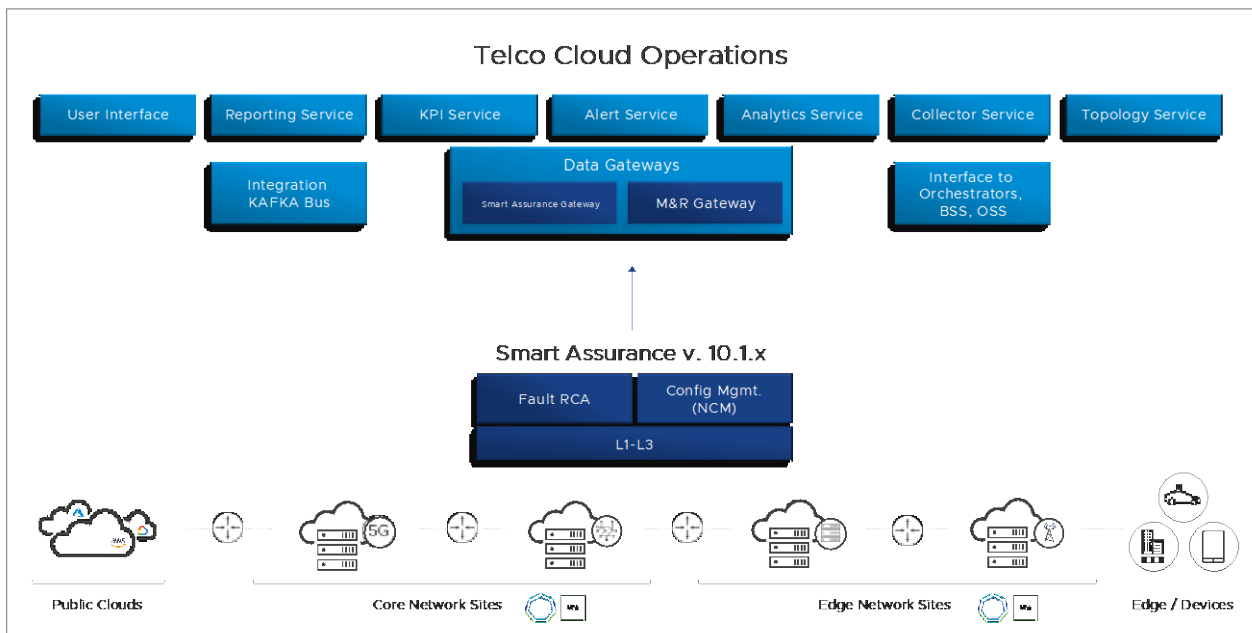
Assurance from RAN to Edge to Core
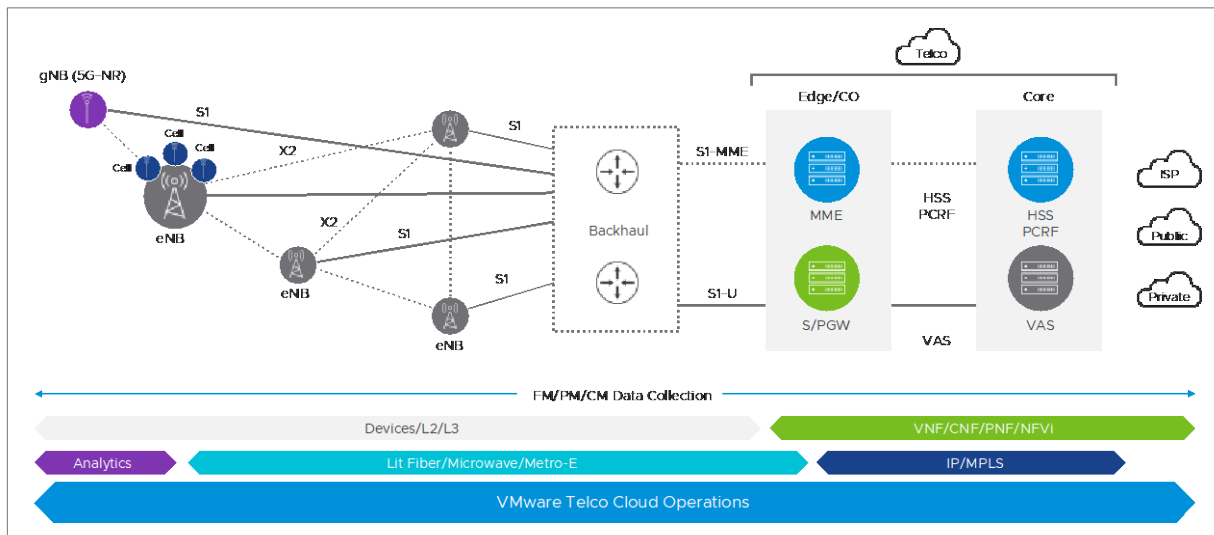
Just as Telco Cloud Operations has gateways and interfaces that tap into legacy monitoring tools, so too it opens up to solutions geared toward emerging service delivery platforms, such as those involving the RAN and IoT, or multi-access edge computing (MEC) or 5G. Telco Cloud Operations is capable of monitoring and assuring services not only in the regional and centralized data centers of mobile operators, but also in cell sites, which vRANs are transforming into mini-data centers with radios.

By working with mobile network automation firm Cellwize, Telco Cloud Operations can ingest RAN topology data from Cellwize's RAN automation and orchestration platform to provide RAN-to-core-to-edge visibility. From the same single pane of glass, operators are able to see a comprehensive view of eNodeBs, gNodeBs, X2 and S1 connections, MMEs and site routers, in addition to their core backhaul and MPLS networks. This holistic scope of monitoring and management leads to multi-vendor simplification and standardization across all service delivery domains. Automated RCA also enables potential closed-loop actions, such as self-optimization and self-healing. This is exactly the end-to-end functionality needed to be able to offer new enterprise services—whether higher tiers of service or private LTE networks under an SLA.

Customer Benefits

Telco Cloud Operations sets up a virtuous cycle that benefits CSPs, large enterprises and MSPs, as well their own customers. As detailed below, in addition to driving improved customer experience for end users, it provides holistic network and performance visibility, reduces OpEx, sharpens the focus of operations teams, enables tighter SLAs, accelerates time to revenue, and is particularly well-suited to the needs of MSPs:

Improved Customer Experience. Telco Cloud Operations allow CSPs to turn the idea of "customer first" into a reality in several ways. Real-time, analytics-driven monitoring enables proactive discovery of service-impacting problems; and automation tools can both preempt issues (for instance, through preventative scaling of compute resources) and notify customers of issues that have arisen and/or actions taken in response, thereby improving quality of experience (QoE) for end users in the process.

Cross-Tier/Domain Visibility. From a single pane of glass, Telco Cloud Operations customers can filter by their end customer and/or device type; create customer-specific access and reports; visualize dynamic performance baselines, anomalies, flow statistics and performance analytics; trace services across all domains for faster insights; and monitor and manage networks at the transport, physical, virtual and services layer, including SD-WAN. The platform crosses infrastructure tiers and service domains and supports more than 4,000 physical and virtual devices from multiple vendors.

Reduced OpEx. Telco Cloud Operations frees up resources through automated network discovery and updates, a self-updating rules engine and automated remediation. The payoff can be big. Auto-correlation, filtering and prioritization enabled one customer to reduce network alarms by 95 percent, eliminating the need to review thousands of alarms. In other cases, Telco Cloud Operations has cut weekly operational analysis time from 25 hours to 1 hour; reduced the number of monitoring screens from 5 to 1, and enabled customers to manage twice as many devices simultaneously with the same number of staff.

Service Prioritization. Telco Cloud Operations helps NOC and SOC teams move away from crisis-mode "firefighting" to a strategic focus on an automatically triaged set of tasks. It automatically suppresses extraneous alarms, correlating and prioritizing events based on customers, cost and service impact. As a result, CSPs can focus immediately on what matters most, whether services, VIP customers or other business needs.
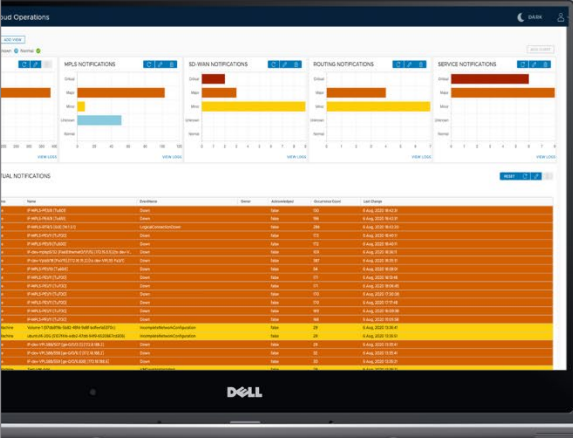
SLA Compliance. Telco Cloud Operations can help operators meet existing and more stringent (and higher-value) SLAs by providing easily visualized analytics for networks, services and devices, and by automatically establishing baselines, detecting anomalies and generating alerts when thresholds are approached or breached. Telco Cloud Operations customers have realized an 80 percent faster mean time to identify (MTTI) problems and 60 percent faster mean time to resolve (MTTR), with automatic remediation coming in many cases through integration with OSS and service management systems.

Faster Time to Revenue. By enabling customers to spend less time manually triaging their networks, Telco Cloud Operations enables NOC staff to embark on higher level projects. Scenarios for better utilization of staff resources vary, but they can include redeploying technical staff from traditional operations support roles to those closer to the revenue-generation, such as sales support. Being able to guarantee higher levels of service – as noted above – can quickly translate into higher value. Telco Cloud Operations is especially adept at enabling faster time to revenue for MSPs.

Better Managed Services. Telco Cloud Operations facilitates the addition of enterprise customers (tenants) for MSPs, without the need for additional monitoring staff. After using the platform to automatically discover their enterprise customers' SD-WAN and various LAN networks, they can simply spin up new VMs as needed. They can share detailed reports with customers, giving them the confidence that their high-value SLAs are being met. Dynamic discovery and cross-correlation of physical devices, overlay and underlay network mapping, and smart streamlined operations all enable MSPs to rapidly operationalize new revenue-generating services.
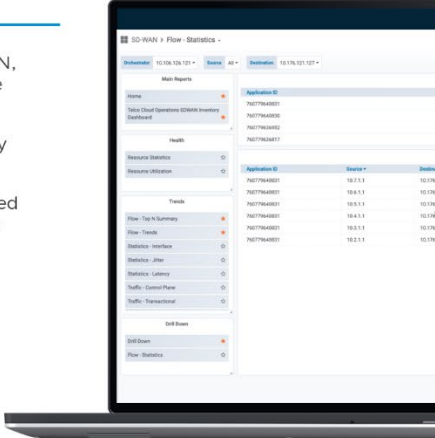
Why CSPs Need Telco Cloud Operations

For operators familiar with VMware's powerful and proven Smart Assurance product, the decision to upgrade to Telco Cloud Operations is relatively straightforward. For enterprises and CSPs who have already deployed VMware's network virtualization platform, Telco Cloud Operations is also a logical enhancement to their network operations infrastructure. For any CSP with both virtual and physical assets and services – including 5G – that already runs or will be deployed over these infrastructures, Telco Cloud Operations constitutes a crucial next step in network assurance.

Telco Cloud Operations was neither built from scratch nor designed on a white board without regard for existing networks and devices. To the contrary, it gives operators unparalleled visibility across all networks and devices and provides them with the intelligence needed to manage existing multi-vendor virtual, physical and SD-WAN networks as one. The complexity and cost of operationalizing, monitoring and managing these heterogenous networks has increased exponentially – and these networks continue to evolve. Monolithic management tools with manual processes and scripts cannot scale. An intelligent, integrated and automated approach to service assurance is required. VMware Telco Cloud Operations meets this need.

A real-time, cloud-native automated service assurance solution designed to bridge the gap between the physical and virtual worlds, Telco Cloud Operations provides holistic monitoring and network management across multiple layers of the network for rapid insights, lower costs, greater revenue velocity and improved customer experience. Its cloud-native architecture, advanced HTML5 UI, ML-based advanced analytics, enhanced performance analytics, and support for vEPC and SD-WAN make it the logical and timely choice for CSPs, MSPs and large enterprises seeking to simplify the monitoring and management of their complex networks.