amdocs

hybrid network operations

tech brief

#2: the role of inventory in SD-WAN fulfillment and service assurance

The SD-WAN advantage

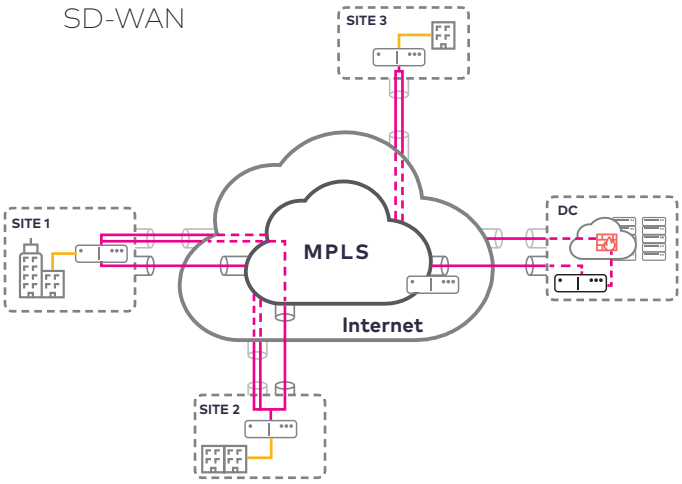
A software-defined wide area network (SD-WAN) harnesses software defined networking (SDN) technology to create a wide area network for enterprises.

SD-WAN offers a number of key advantages over traditional WAN technology. It reduces network infrastructure costs and enables a far more flexible and secure cloud-based network that can proactively respond to real-time network conditions by changing the data path. It enables organizations to dynamically add, modify or remove WAN connections as needed, and improve security.

SD-WAN is often used to support virtual customer premises equipment (vCPE) functions across multiple sites. Since there is no need for expensive fixed circuits or dedicated proprietary hardware, once the WAN service has been designed and created, an SD-WAN can potentially be fulfilled in minutes rather than days. Despite these advantages however, most service providers remain far from achieving smooth SD-WAN fulfillment or consistent service performance.

What can go wrong?

Even with SD-WAN's dynamic, self-managing characteristics, service providers can face a number of issues during network fulfillment and operation of an SD-WAN, as a result of the complexity of a multi-site, physical/virtual hybrid network. Most commonly, issues involving policy creation and management, network topology, traffic flow, network and virtual infrastructure (VI) capacity, and physical/virtual network function (PNF/VNF) compatibility can each cause service degradation and a less than satisfactory customer



experience. The result is a need for costly manual intervention to correct the issues.

The following are a few examples of potential issues:

- Incompatibility between different vendor devices on the SD-WAN causing unexpected performance problems
- Inadequate validation and testing of hybrid physical and virtual network functions causing issues with interoperability between PNFs and VNFs.
- Poor quality network and resource data from the existing network leading to insufficient network capacity.
- Traffic flow imbalance due to inaccurate policy implementation particularly with forward/reverse policies applied at the service gateways.
- Incorrect VNF ordering and grouping into service function chains (SFCs) causing performance issues.

Improving SD-WAN deployment - what needs to happen?

As service providers adopt network virtualization they need to manage mixed hybrid networks running over both physical and virtual network infrastructure. These hybrid networks are inherently more complex to design and operate and require new systems and processes to manage them. One such system is the hybrid-ready inventory, designed to manage both physical and virtual network resources simultaneously to provide real-time end-to-end views of the hybrid network.

The path to rapid SD-WAN deployment starts with the creation of a new SD-WAN service type prior to market availability. The new service type is designed and created in a service design tool, with associations to the relevant virtual network functions (VNFs) and network underlay components, as required. Once the design is approved, the necessary metadata should be automatically generated in a hybrid inventory system for new services and resources. The new service type is then tested and moved into production ready for marketing.

A new SD-WAN service instance is triggered by a customer service order that is received with a list of service requirements. For example, an SD-WAN service could be ordered with secure IP-VPN, network firewall, and application-aware routing, all to be delivered over 5G or FTTP connections to each branch office. A corporate order could include tens or even hundreds of branch offices.

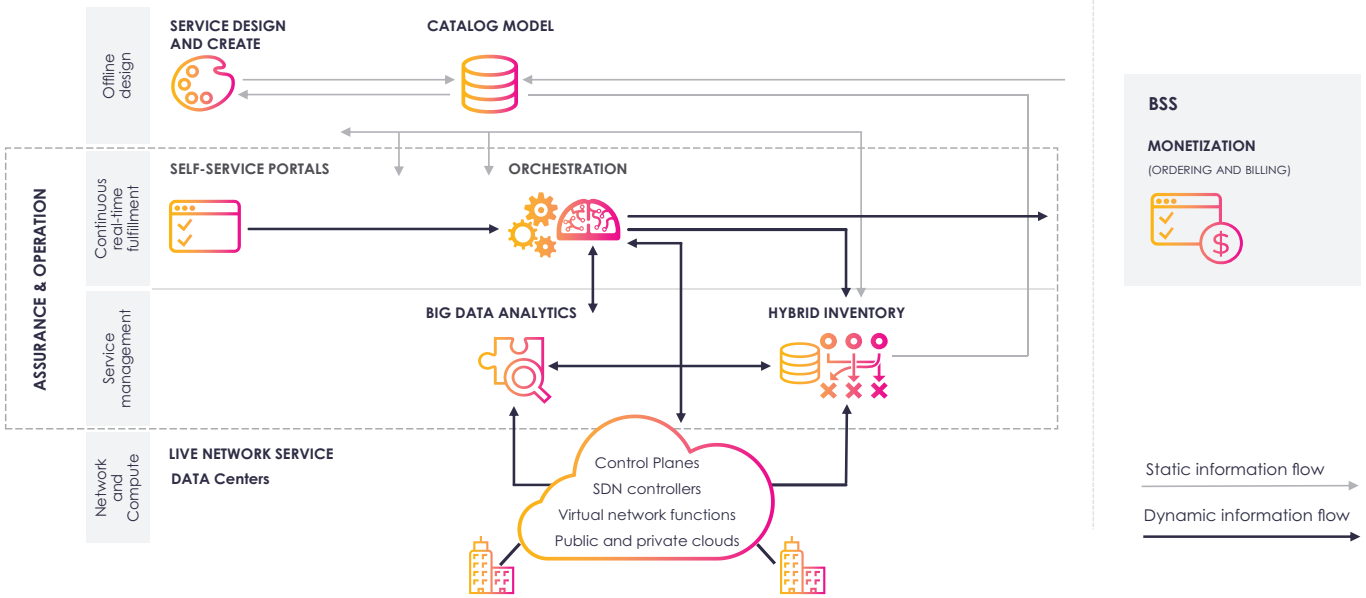
Hybrid Inventory: a catalyst for faster, more accurate SD-WAN service fulfillment

Access to accurate network data is critical for designing and pricing large multi-branch orders, and to ensure low-fallout fulfillment. Accurate network data is also critical for driving lights-out fulfillment of self-service SMB orders. The inventory system can supply configure price quote (CPQ) systems with important data about service availability at each branch location so accurate quotes can be produced faster.

Network data comes into play again at the order fulfillment stage. An SD-WAN order may need to be deployed across a hybrid mix of both legacy physical network functions (PNFs) and virtual network functions (VNFs). Completion of the order can require turn-up of 5G network slices, FTTP connections, and vCPE instances. This requires coordinated activation of the correct physical, logical and virtualized network components which can be provided by a hybrid inventory.

A hybrid-ready inventory will have data describing both physical and logical network resources and virtualized network resources, with an open API for northbound and southbound systems. This API provides centralized access to end-to-end, cross-domain network data for MANO components such as the NFV orchestrator, VNF manager, and cloud management platforms. These MANO components leverage the inventory data for service fulfillment design decisions.

As the order is completed, the orchestration system updates the hybrid inventory with the fulfilled service



The role of the inventory system in hybrid service lifecycle management

instance data, customer information, related VNF instances, and other network resources. The hybrid inventory automatically tracks the physical and logical network topology, virtual infrastructure and service function layers, and their interrelationships. A graphical user interface can provide operations staff with a near real-time view of the end-to-end network including live transaction insights of the service order as an SD-WAN instance is fulfilled.

Empowering SD-WAN service assurance

The capabilities of service assurance systems to perform root cause analysis are significantly enhanced by integration with a hybrid inventory system. Root-cause analysis of network faults or service degradation, can be performed by lights-out auto-healing functions or manually by operations staff. Both depend on near real-time access to accurate, end-to-end network data, including the virtualized network overlay, logical and physical underlay, and the interrelationships between them. Such information is available from an advanced, hybrid inventory, thereby enabling near real-time insights into network and service level functionality.

For example, an SD-WAN service fault may manifest itself as degraded performance of a supported software application such as a VoIP service at the customer premises. This could be caused by a discrepancy between the upstream and downstream packet delay at an SD-WAN branch site. The root cause of the delay may not be apparent at first, without a deeper insight into traffic flows and VNF configuration at the cloud edge.

An inventory system that has live status views of the whole SD-WAN service, a complete, real-time 'service tree' of a virtual service instance can be displayed. The service tree composition is presented as a hierarchical relationship of all associated service functions (SFs), physical and logical network resources, virtual network functions (VNFs) and their underlying physical servers. This invaluable insight provides an instant view of the current status and performance of the impacted SD-WAN service and its components, both virtual and physical.

The live status view of the virtual (resource) service function can reveal specific information such as excessive traffic delay in one direction which can lead to the discovery of incorrectly applied forward/reverse policies at the gateway service function, and other issues. By tying together policy, configuration and performance data from multiple sources within the inventory system, the root cause of specific service and network performance problems can quickly be identified.

In addition, underlying physical network infrastructure faults such as fiber, radio, or router problems can also impact SD-WAN services. The hybrid inventory has the virtualized, logical and physical data to enable the correlation to be made between the overlay and underlay networks. Once the underlay fault, such as a fiber problem, has been isolated, manual intervention to repair that fault can be initiated.

The service tree can also be a source of critical information to Virtual Test Agent (VTA) controllers and to service assurance systems performing lights-out fault resolution and service healing. Key capabilities in virtualized networks are auto-scaling, self-healing and improved capacity utilization. These capabilities enable a far more dynamic service, with service components shifting among network and computing resources (for example, a shift of capacity during the evening from corporate firewalls to consumer set-top-boxes). The end result is that the service can easily be running on a different set of resources than at the time it was originally fulfilled. For this reason, it is critical that the service topology be "live" – meaning that it's mapping to the resource inventory is constantly being updated each and every time these changes are made.

Summary

SD-WAN offers a number of key advantages over traditional WAN technology. It helps reduce network infrastructure costs and enables a more flexible and secure cloud based network that is more readily adapted for future services.

However, unlocking the promise of SD-WAN depends on service fulfillment and service assurance systems having near real-time access to accurate data about the current configuration and operational status of all network components, including both virtualized and non-virtualized elements. An advanced, hybrid-ready inventory system provides this data, enabling north-bound systems to obtain the network information they need in real-time from a single source. For that reason, a hybrid inventory is an essential operations tool for SD-WAN, facilitating automated, zero-fallout service fulfillment, as well as far more effective service assurance.