



CLOUDIFY

The Open Road to vCPE and SD-WAN Transformation

Delivering, managing, and adding new network services
efficiently with management and orchestration

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Introduction

With the development of cloud services, SaaS, and software-defined networks, more and more traffic is being forced over the public internet, and people and enterprises are increasingly dependent on staying connected. Because of this, organizations have been pushed to extend their network to more people, places, and locations than ever before.

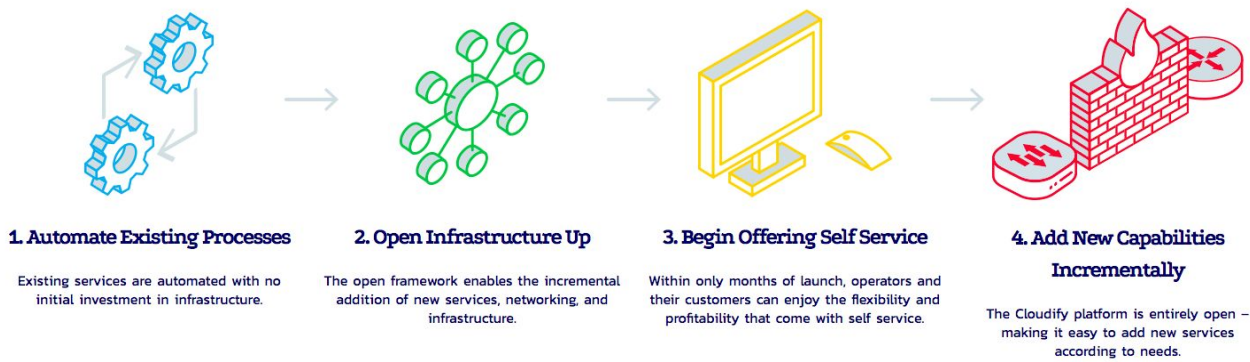
Given this situation, enterprise WAN architecture must change significantly in order to support these additional needs. We have seen leased lines and frame relay networks, both relevant in the past, the currently predominant fully meshed MPLS and WAN services, and the newest hybrid WAN services based on MPLS and the internet. But it is clear is that these legacy WAN solutions, based on wired connections and dedicated hardware resources, cannot answer to the growing needs for fast reaction times, scalability, and efficiency. Nor are these solutions cost effective and able to support a number of different network services. Enter software-defined WAN: the resolution to network challenges enterprises presently face.

The development of virtual network functions (VNFs) also offers many possibilities for service providers to deliver an innovative and cost-effective way of managing services. As with WAN, customer premises equipment (CPE), the most important component for delivering service to end users, has experienced an evolution as well. And this evolution can be seen in the use of virtual CPE, deployed in cloud or on premises, as a part of a faster and more scalable solution for companies today.

Combining [SD-WAN](#) and [virtual CPE](#) opens up even further opportunities for organizations to transform their WAN solutions and for service providers to increase their revenue streams. This trend also transforms how service is delivered to end users by utilizing their own cloud.

The road to virtual CPE

Traditionally, the most essential part of a service-delivery model that provides any service to an end user is customer premises equipment (CPE). Over the years, CPE has shown a lot of weakness in deployment, managing, and service evolution since every CPE has been used for a dedicated service maintained by different systems and configured in most cases on-premises. Because of this, the ability to innovate delivered services was highly dependant on the hardware and software deployed via the CPE device on the end user's premises. At the same time, there was added complexity and cost for the service provider due to having to manage and maintain separate CPEs for the many different client systems deployed along with increased time to market for delivering service. This delivery model is time consuming since every CPE needs to be shipped to the end user's location and configured manually, meaning that a skilled professional must be on site as the customer may not be aware of how to do this.



The essential virtual: vCPE

But in today's competitive environment, in which there is an ever-increasing demand for efficiency, speed, and flexibility, a service delivery model must evolve and follow the growth in virtualization and cloud capabilities. A solution can be found in the use of virtual customer premises equipment (vCPE). This concept brings the possibility for service providers to keep some of the networking and service-related function, allowing them the ability to roll out service faster and without the need for a CPE upgrade, change, or on-premise reconfiguration. The new [vCPE](#) model allows service providers to manage and maintain end-user network infrastructure from a centralized location and thus provide network service on demand.



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With the migration toward virtual CPE as one of the top use cases of NFV, service providers can benefit from [SDN-NFV](#) architecture and the deployment of their own cloud offering software-defined WAN in combination with vCPE. This reduces operational costs and gives them the opportunity to grow and increase their revenue streams. The deployment of vCPE also simplifies the configuration, operation, troubleshooting, and maintenance of services to end users as well as eliminates the need for deploying expensive proprietary CPEs.

Swapping of traditional CPE for vCPE enables service providers to offer and orchestrate personalized services that can be delivered instantly and provisioned automatically. This also allows end users to manage, demand, and maintain their service from a self-service portal, which leads to faster service deployment or any service change that may be needed. Of course, the extent to which all of these benefits can be achieved depends on how the service provider's cloud architecture is developed and the level of automation and orchestration they are able to implement.

SD-WAN tech in brief

The Benefits

SD-WAN (software-defined WAN) is a fairly new technology that combines software-defined networks (SDN) and a virtual network function (VNF) in order to deliver a cloud or on-premise WAN solution for an enterprise or different end users. By implementing this innovative solution, network resources are virtualized and decoupled from dedicated hardware giving the possibility of having accelerated service delivered in one wide area network. It also allows for high flexibility and scalability, a big plus for any future need for network growth and expansion.

SD-WAN follows the fundamental principles of SDN, meaning there is a separation of control and the data plane, with a deployed controller as the “brain” of the network and multiple edge routers to deliver on-demand services to the customer at multiple sites. Service orchestration, a very important part of SD-WAN architecture, gives the possibility for service automation and the use of different policies in order to react to any network needs in a timely way. These policies can be applied to each function or to a group of functions in terms of performance requirements, security, or business priority. With the full programmability of SD-WAN, enterprises are able to promptly respond to a network needs, quickly set up service, or extend a network to a new location.

At the same time, by leveraging its programmability, SD-WAN can significantly reduce operational costs for companies, making provisioning of the service simpler and “pre-configured.” In addition, via the use of common hardware for different network functions, the virtualization layer, and the combined use of on-premise and cloud resources, enterprises can achieve significant reductions in capex costs as well.

The transition

Moving from traditional WAN to SD-WAN does bring certain security requirements due to moving from a centralized to a distributed model that connects many different locations and from private clouds to public ones with direct access to the Internet. This means that connection between all locations must be encrypted, which, in turn, requires security policies that need to be integrated into the solution while maintaining programmability, automation, and

the performance of SD-WAN. Since SD-WAN is a developing technology, it can also be considered in a hybrid design. Such a solution can integrate traditional WAN architecture to allow for a slower transition to full SD-WAN, giving enterprises time to adopt the new technology and properly transform their organization in order to fully profit from it.

Because of its design and the use of virtualized network function that can be sliced on demand, SD-WAN allows companies to have a service provider deliver and manage their SD-WAN network rather than own and operate it themselves. In many cases, the deployment of SD-WAN is executed in combination with the deployment of virtual customer premises equipment (vCPE), driven by a company's need to be innovative and efficient without sacrificing business continuity.

Virtual CPE deployment (including SD-WAN)

With the development of software-defined networks and VNFs, technologies that should increase flexibility and cost effectiveness, service providers are considering what new service they could offer to end users with the deployment of their own private cloud. On their side, enterprises are trying to find different ways of making their WAN solution become more efficient while also keeping up with new technologies and not losing any functionality.

As a logical answer to these co-existing needs, service providers are adopting vCPE and SD-WAN as two complementary technologies that can be offered to enterprises and different end users as a combined service. Via these two solutions, service providers can deploy complete software-defined solutions to end users, including routing and VPN service, over a virtualized CPE implementing software-defined networks to enable connectivity to an end user's branches and different locations. Service orchestration can also add a high level of automation and thus simplify the service lifecycle, enabling service providers to have control over different locations, and deploy VNFs if needed to answer an end user's needs.



Models of deployment

There are different models for deployment of virtual CPE: a centralized, distributed, or hybrid solution.

Centralized

Deploying vCPE in a centralized model means that most network functions are abstracted from on-premises equipment and deployed in a service provider's cloud, requiring the end user to have only a connection to a service provider where all services are deployed and delivered. A centralized solution makes service delivery and maintenance simpler for the provider, allowing end users to simply order service on demand or even provision it itself through a self-service portal. This is the best way for service providers to offer managed services and have end-to-end control over service deployed.

Distributed

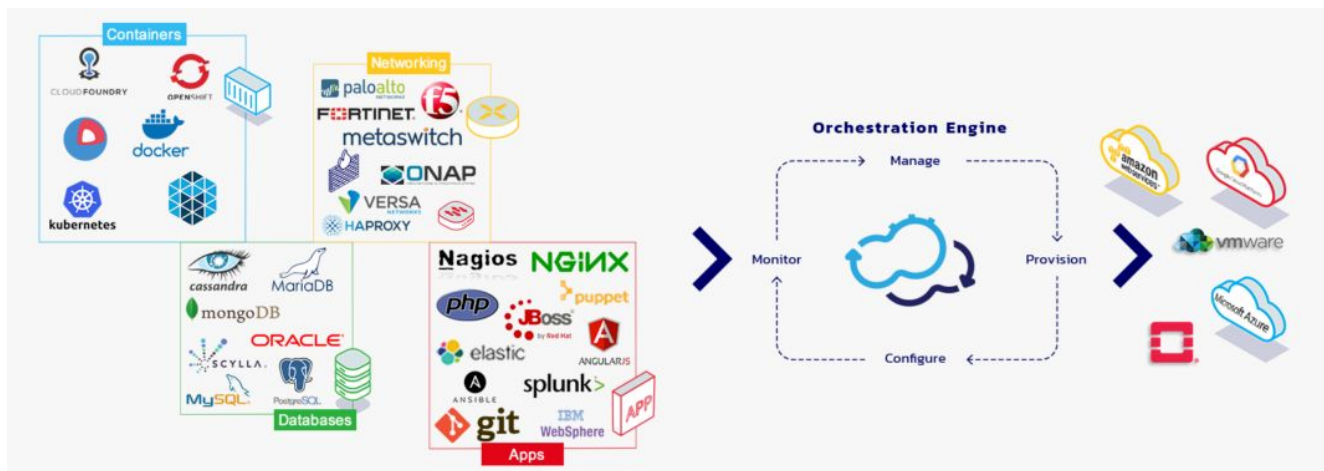
On the other hand, a distributed model requires some hardware deployment on the end user's premises that can handle deployment of a virtual network function needed for the end user as well as provide WAN functionalities, additional security, and IPsec tunnels to the service provider's cloud. In this way, enterprise customers can deploy VNFs and scale their networks to support business requirements and connect multiple locations at the same time. With the use of a distributed model, end users achieve more security and control over VNFs as well as the ability to deploy VNF distributed over multiple locations but still connected to a service provider's cloud.

Hybrid

Hybrid solutions combine a centralized and distributed deployment, giving the possibility of managing and deploying service either centrally with the service provider or on premise at the end user's location and based on the end user's needs. Using a hybrid cloud benefits all parties since the deployment of network functions can be performed based on network conditions, service policies, and business requirements but can also support a company's need to connect its private cloud to the service provider's public cloud.

Management and orchestration

No matter the form of deployment, the most important part of any solution is the role of [Management and Orchestration](#) as a central place where all policies, [service chaining](#), automation, and programming are performed. With its ability to control all network resources, service providers, and end users, Management and Orchestration gives the capability to manage and scale the network based on requirements from both sides. Orchestration is also where service-modification requests from the self-service portal arrive and where such requests are processed and on-demand service is sliced. Network function forwarding capabilities and allocation of network resources across all end-to-end locations, as required by the end user and provided by service providers, should be configured on an Orchestrator that controls software-defined WAN.



In order to cover the full scope of one WAN solution together with different network functions, the Orchestrator should support multiple network functions and be vendor agnostic. Using an Orchestrator is one of the key enablers to control multiple VNFs and WAN functions through multiple-cloud deployment. And it is key for the automation and service life cycle that are seen as the main reasons for deploying software-defined networks due to the benefits they achieve in cost reductions and fast reaction times to different events in the network.

The future lies in SD-WAN and vCPE

Software-defined networks and virtual CPE together enable service providers to increase profitability and establish new revenue streams by providing a new way of delivering and managing services as well as offering new services in a cloud environment. By choosing the right architecture for an enterprise and with careful planning, vCPE and software-defined WAN can support a variety of services. And combining these with VNFs and a self-service portal creates an ecosystem in which any service can be easily deployed and time to market for network services can be significantly decreased from months to days or even hours.

By offering software-defined WAN in combination with virtual CPE, service providers can satisfy a client's networking needs and desire to outsource their network services as well as make them future proof. Cloud services and virtualized network functions are seen as a good solution to building a cost-efficient and scalable enterprise network that can easily adapt and answer to any number of challenges.

The key areas of focus for any service provider are to make its own cloud, based on software-defined technologies and virtualization, capable of adopting and implementing software-defined networks and virtual network functions and deliver services in an innovative, fast, and cost-efficient way. And enterprises themselves need to transform how they operate their network and accept virtual CPEs as a technology that will support the delivery of scalable WAN networks and reduce the costs of maintaining WAN networks as well.

