

VIRTUAL CUSTOMER PREMISES EQUIPMENT: A TECHNOLOGY PARADIGM THAT PROMISES TO CHANGE THE NETWORKING INDUSTRY

The emerging concepts and technologies for implementing Customer Premises Equipment (CPE) are affecting the way customers, from enterprises to home users, connect to the carrier networks. Software Defined Networking (SDN) and Network Functions Virtualisation (NFV) are set to change the networking industry and, as part of that change, virtual Customer Premises Equipment (CPE) is an upcoming technology paradigm that promises to be beneficial for both customers and service providers. This white paper introduces the concept of vCPE in relation to the enterprise, comparing to the traditional CPE, and addresses three potential vCPE solutions.

Today, residential and enterprise environments are evolving rapidly due to an increasing number of devices that will be part of our lives in the near future. Upcoming technologies like Internet of Things (IoT) are going to have a huge impact on today's network deployments. Furthermore, the upcoming intelligent devices (mainly connected to the internet, the intelligence comes in from the cloud through applications) introduce the need of new services, in order to meet the customer's requirements and efficiently support both new and existing devices. This document aims to provide an overview of the traditional CPE, the problems organisations are facing and why there is a need to migrate to virtual CPE deployments, providing also three potential deployment approaches for review and consideration.

The traditional CPE cannot easily adapt and is not flexible enough to host the rapid introduction of new services. Instead, the equipment is getting more and more complex and harder to maintain. This is due to the complexity of manual configuration for each additional hardware device or for maintenance and re-configuration of the CPE. Virtual CPE on the other hand, is a very promising scenario that brings new benefits and opportunities on board, like Operational Expenditure (OpEx) and Capital Expenditure (CapEx) reduction and improved Time to Market (TTM) through faster introduction of new services.

EVOLUTION OF THE CPE

TRADITIONAL CPE. Today, most customers have devices such as smartphones, laptops, desktop PCs or even Smart TVs connected to the internet through their CSP (Communication Service Provider) of choice. The amount of devices that need to be connected to the internet is increasing continuously. For instance, more devices are going to be connected in the near future, like Bring Your Own Device (BYOD) concept, which will increase the number of devices that a single employee owns within an enterprise, and sensors that allow you to manage lighting, physical security, energy etc. CPE is the demarcation point, which connects the customer network site to the Service Provider's Network. According to the CPE architecture, in the customer network site several peripheral hardware devices need to be deployed, where services are being implemented. An example of this architecture can be seen in Figure 1. The CPE is already complex and the introduction of new services usually requires either the installation of additional peripheral devices, in order to deploy those services (e.g. firewall, load balancer, VPN etc.), or even to replace the existing CPE. Obviously, CPE complexity is not the answer, because the introduction of new services is complex and slow. Ultimately, maintaining such a huge amount of complex devices it is not a viable solution, because of high costs, effort etc. Definitely another approach is required in order to make a more efficient use of resources, as well as customers' and operators' life easier.

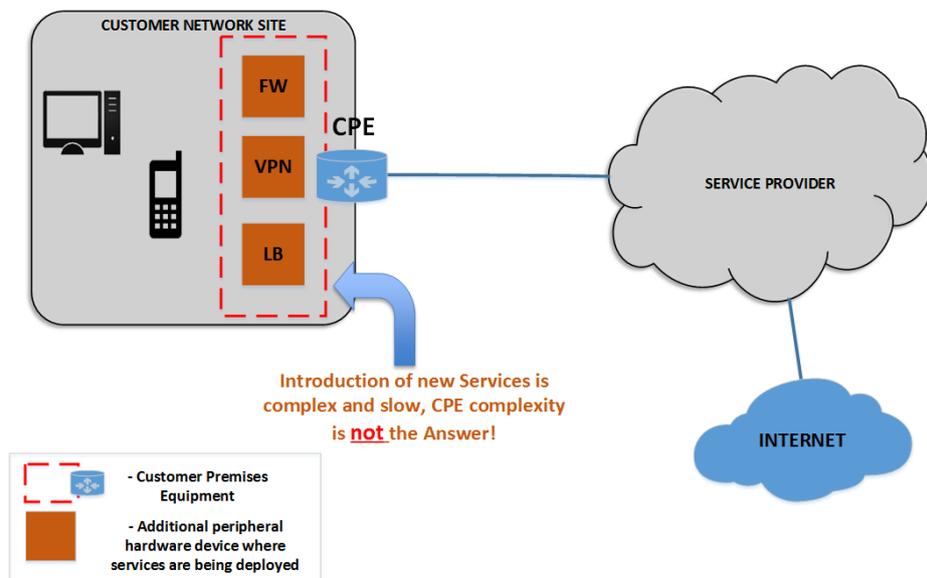


Figure 1: Traditional CPE Architecture

EVOLVED CPE - vCPE. Virtual CPE addresses the upcoming challenges effectively, by virtualising most of the CPE functions in the network. Virtual CPE aims to provide the minimum required hardware at the customer site and to move traditional CPE functions to the CSP network. Services are virtualised in the CSP site, virtual instances like Virtualised Network Functions (VNFs) are orchestrated by the NfV orchestrator and the overall network is controlled and maintained by the SDN controller, which applies the overall policy of the network. NfV and SDN provides an easier and efficient way to control the network resources according to the organisation needs through programmability. An example of the evolved architecture is illustrated in Figure 2.

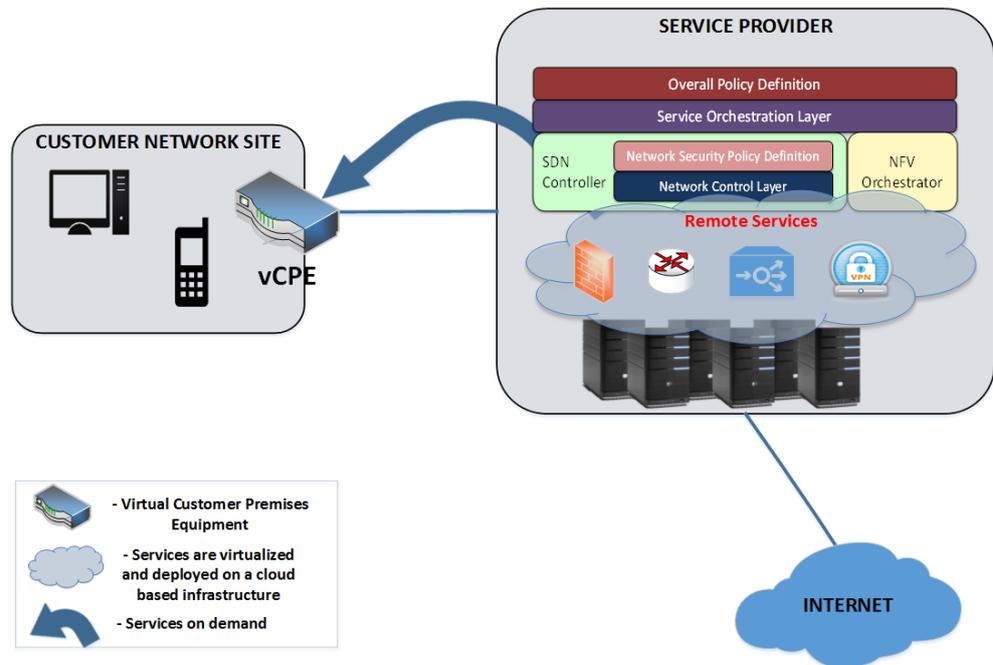


Figure 2: Evolved CPE - Virtual CPE

Virtual CPE paradigm provides dynamic services on demand and introduces new service models such as click-and-play, try-and-buy, pay-as-you-go etc. This enables a better user experience, through value added services such as parental control, customer network appliance management, WAN optimisation and security enhancement. With vCPE, deploying a new service or even turning down a service is not a great effort anymore. Furthermore, new service deployments require only licence provision to the user through software and there is no need to send a technician to the customer site in order to install additional peripheral devices and upgrade the already complex CPE.

VCPE POTENTIAL APPROACHES. There are 3 potential solutions in the vCPE use case. The first one is to virtualise all CPE functions into the CSP network site as it is depicted by the figure 2 above.

The other two solutions are, first to have distributed virtualisation of services between the customer network site and the CSP network site, and second, to have all the functions virtualised locally without any data centre involved, as depicted below in the figures 3 and 4.

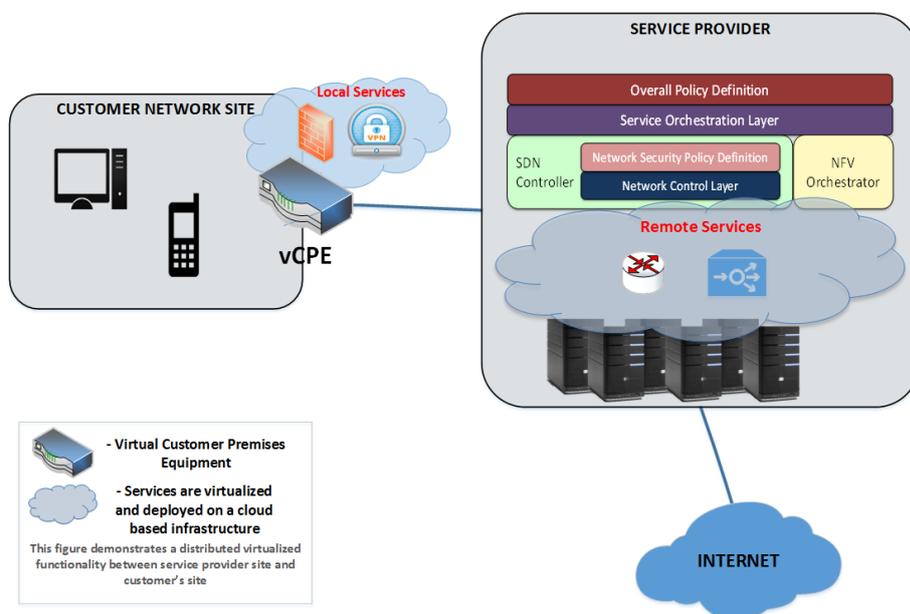


Figure 3: vCPE - Virtualised functions are distributed between the customer and the service provider site

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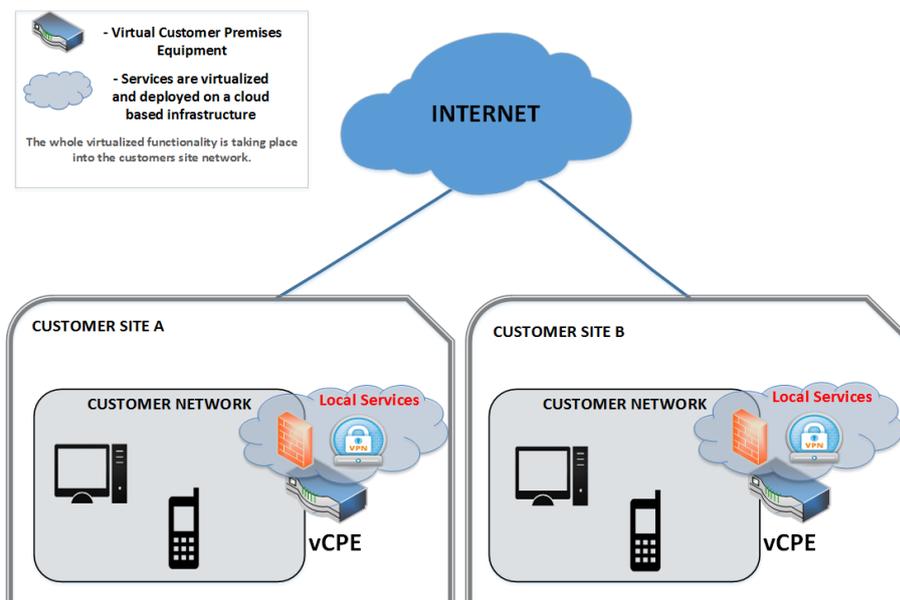


Figure 4: vCPE – All functions are virtualised locally at the customer site

The best solution is to have the services virtualised where it is most appropriate according to the organisation's needs, which may be based on performance, feasibility, security, policies, financial aspects, etc. For example, if an enterprise wants to keep some confidential documents within the company according to policies, in that case the virtualised functions have to be distributed between the enterprise and the CSP or even to locate all the virtualisation within the company locally, both solutions meet the policy requirements of the enterprise.

BENEFITS & OPPORTUNITIES

Based on the evolution of CPE and the adoption of vCPE a number of benefits and opportunities can be realised both by enterprises and service providers. The following list provides some examples.

- **CapEx reduction**
 - Less hardware footprint, which means cheaper CPE devices and no more need for additional hardware deployments, when new services have to be introduced.
- **Operational Benefits & OpEx reduction**
 - Customer self-service installation with simple instructions will reduce the deployment effort.
 - Easier support and maintenance through software, which will enable the service provider to support customers more efficiently, without all the efforts involved when dealing with legacy hardware-based CPE deployments.
 - Rapid introduction of new services easier and faster, instead of complex and slow.
- **Benefits to Enterprise**
 - Faster availability of new services, due to the ease of deployment as mentioned above.
 - Subscribe to services on demand and pay as you use, that means flexible services when you need it and as much as you use it.
 - There is no downtime for upgrade/failures, the customer continues to use the services if an upgrade happens.

CONCLUSIONS

The vCPE paradigm is very promising and aims to make both customer and CSP life easier. Current CPE deployments are getting more and more complex, and are no longer able to provide efficient and effective ways to deploy both new and existing services that will satisfy and meet customer's needs in the near future. This is where the concept of vCPE comes in with a solution to the problem and brings to the surface new opportunities for business and revenue.

Finally, in order to deploy vCPE implementations and realise the full benefits, it is important for an organisation to consider the most appropriate location for the virtualised functions, according to the customer's needs and requests, as well as considering feasibility, performance, costs and policies.

NET REPLY'S OFFERING

Through its distinct competencies, Net Reply assists clients in realising the benefits and dealing with the impacts of the disrupting technologies on their environments. Net Reply leverages real-world experience in SDN & NFV consulting for the TMT market, having worked with global Telco providers and established strong relationships with all major SDN vendors.

Through active collaboration with various vendors and , by forming partnerships with educational institutions, as well as performing internal research & development, Net Reply creates and supports innovative projects around new technologies, such as SDN & NFV.

Some of the more detailed offerings in the area of SDN & NFV include, but are not limited to, the following:

- SDN/NFV Requirements Definition
- Solutions Evaluation (including RoI, TCO)
- Architecture Design and Technical Consulting
- Security Assessments
- Proof of Concepts (PoCs) Design, Plan and Testing

Net Reply builds upon this knowledge and partners with its clients to define their strategy and identify the trajectory they should follow towards adopting these disruptive technologies, for future proofing their environments and their investments. Net Reply builds on the basis of understanding the customer requirements and selecting the optimal solution towards programmability, service agility, automation and openness in their networks, in a vendor agnostic way.



Net Reply is the Reply Group company specialising in Network Transformation. In a world where Software and Networks are converging, Net Reply provides a proven combination of software development, agile delivery and network expertise to help organisations simplify, automate and integrate Network service delivery.

Using advanced Network analytics Net Reply can help resolve the operations and security challenges of migrating to cloud environments, optimising infrastructure investment and protecting critical infrastructure.

Whether adopting new technologies or transforming the way you deliver Networking solutions, Net Reply can help you migrate, automate and secure your Network services.