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# Optimizing Profitability with Pure-Play NFV

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Network Functions Virtualization (NFV) is envisioned as a way to allow communications service providers (CSPs) to replace network appliances with software modules running on standard servers, which can save money in terms of CapEx and OpEx. However, the focus of NFV is now shifting to enabling CSPs to be more agile and to create innovative new services to increase revenue and profitability. According to industry consultant Tom Nolle of CIMI, there are trillions of dollars in revenue upside to be gained when providers create new services by exploiting service agility and network flexibility.

NFV is a great tool for achieving agility, but optimum deployment requires purposeful and consistent application of its first principle: software modules hosted on standard hardware. In early deployments, CSPs took shortcuts for expediency, and these shortcuts are limiting the long-term upside of virtualization. To avoid being trapped in a dead-end of shortcuts and expediency, CSPs should instead pursue pure-play virtualization and adhere to the original fundamentals of NFV.



## The basics of NFV

To form the basis of an optimized NFV network environment, CSPs have a couple of solid models from which to build: the smart phone and cloud computing revolutions. With the adoption of smart phones, we saw a single open appliance replacing a bevy of closed appliances (camera, watch, music player, etc.) with downloadable apps running on that smart phone.

With cloud computing and virtualization, software applications run on open servers, providing the ability to buy and sell computing and storage as a service.

The original ETSI NFV white paper envisaged combining these models to address a number of problems with today's network appliances (routers, firewalls, PBXs, gateways, etc.), such as cost, space, power and management. The authors defined NFV as an approach to bring the power of the cloud to address these problems.

Network Functions Virtualisation aims to address these problems by leveraging standard IT virtualisation technology to consolidate many network equipment types onto industry standard high volume servers, switches and storage, which could be located in Datacentres, Network Nodes and in the end user premises. We believe Network Functions Virtualisation is applicable to any data plane packet processing and control plane function in fixed and mobile network infrastructures.

In other words, NFV lets CSPs replace appliances with software virtualized network functions (VNFs) hosted on standard Commercial Off-The-Shelf (COTS) servers. These applications are loaded, configured and scaled dynamically to open up a new world of agility for operators.

While the reduction of appliances is great, even better are the opportunities for innovative new applications. Before the smartphone, who thought it possible to have an appliance identify a song that can then be purchased with a few clicks? CSPs expect similar benefits from NFV.

CSPs stand to realize significant profitability gains from the innovation opportunities provided by NFV, if they stick to the plan. However, they need to resist the temptation of shortcuts.

## Shortcuts limit benefits

One of the early applications for virtualization for CSPs is "virtual CPE," or "vCPE," which addresses the expense and complexity of placing multiple appliances at a customer site.

CSPs eliminate the need for appliances at a customer location by implementing VNFs in a PE router, placing only an Ethernet Access Device (EAD) at the service edge.

This approach yields benefits such as the reduction or elimination of equipment at the customer site and service agility through the use of software. However, if these software-based functions are being hosted on a closed and proprietary appliance, CSPs do not achieve the broader benefits of NFV, such as assembly of software VNF components from different suppliers and the cost advantages of COTS servers.

The need to provide layer 2 Carrier Ethernet functionality led to another shortcut. Most early VNFs are focused at layer 3 functions, such as routing, firewalls, voice applications, etc. However, most CSPs use Carrier Ethernet to deploy services at the edge of the network. Some suppliers combine a physical EAD with a compute engine, as shown in the following diagram.



This approach solves the layer 2 Carrier Ethernet access problem, but it deviates from the ideals of NFV. One limitation is that different EADs are required for different access speeds. Another is that the Carrier Ethernet functionality is implemented in hardware, and can't be moved to a cloud or data center for those applications.

How can CSPs address these applications while reaping the full benefits of NFV?

## Pure-play virtualization

The answer is pure-play virtualization, which is the implementation of all of the networking functions in software running on standard hardware. We can't virtualize fiber or copper access lines, so physical access is still needed along with the hosting server. However, all of the higher level functions can be implemented in software running on standard COTS servers, including the Carrier Ethernet functionality.

> *With pure-play virtualization, all higher-level networking and protocol functions are implemented in software, allowing them to be hosted on any COTS server.*

With pure-play virtualization, operators are able to be much more agile. That's because pure-play virtualization meets the first principle of NFV: software running on standard servers. In doing so, pure-play virtualization allows service providers to place virtualized functions wherever needed to meet the requirements of any given service.

## Use COTS servers for hosting



With pure-play virtualization, all higher-level networking and protocol functions are implemented in software, allowing them to be hosted on any COTS server. CSPs then can take advantage of Moore's Law improvements in cost and speed, and they can pick the appropriate server for any given application.

## Build services from best of breed VNFs

Pure-play virtualization decouples the hardware and software functions, so CSPs can choose VNFs based on the best cost and performance, and then assemble them to create innovative services. They are no longer tied to buying hardware and software from the same supplier.

## Place VNFs where needed

Is it better to distribute VNFs out to the service edge, or consolidate them in a cloud datacenter? The answer depends on the service.

Sometimes it makes sense to put all of VNFs in a cloud or CO to take advantage of economies of scale seen in data centers. At other times it makes sense to host VNFs at the customer site for security or latency. These options should be seen as complementary, not mutually exclusive.

Pure-play virtualization allows a CSP to put the resources where they are needed (centralized or distributed), based on the requirements of the customer and service and available resources.

## Pure-play enables service agility

NFV makes service delivery more agile with quicker response to meet a broader array of customer demands. How does pure-play virtualization achieve that agility? Through the following:

- **Mobility.** With pure-play virtualization, CSPs can move VNFs based on the demands of service. A customer might start with a centrally-hosted service. If later expansion calls for functionality at the edge, the CSP can migrate VNFs to the service edge. The service topology changes but the core VNFs and their management remains the same.
- **Resilience.** Availability and up-time are major concerns of CSPs as they move to virtualized services. With pure-play virtualization, CSPs can take advantage of system resiliency that comes from software running on open servers, like cloud or data-center resiliency.
- **On-Demand.** Free trial for software-based services is a proven marketing tool. Because the incremental cost of a free trial is very low, suppliers can aggressively offer customers the chance to be sure that a given application meets their needs. With pure-play virtualization, CSPs have the same ability to offer services to customers – without deploying a physical appliance to the service edge.
- **Scalability.** A huge advantage of converting network functions from appliances to VNFs is that they can scale up and down, based on demand and the underlying server. Scaling on demand enables all kinds of usage-based services, both for end users as well as for network infrastructure. Scaling based on the server provides future-proofing: the investment in operational integration of a VNF is preserved while the performance increases with new and more powerful hosting servers.

## Go virtual, all the way

The vision for NFV is to enable the use of standard and open compute servers to host a variety of mix and match software VNFs.

*To fully achieve the NFV vision means delivering these VNFs and services in a scalable, cloud-based manner to all parts of the network.*

To fully achieve the NFV vision means delivering these VNFs and services in a scalable, cloud-based manner to all parts of the network. That means keeping the value-added functions in software, including layer 2 Carrier Ethernet functionality. Doing so enables complete flexibility in delivery of services at any part of the network, and ensures that operators will be able to ride the technology curve of open servers. The result is a simultaneous lowering of costs and the enablement of new services, which combine to drive agility and profitability.