DIFFERENTIATE WITH DISTINCTION:

3 PRINCIPLES FOR
A NEW NETWORK SERVICES MODEL

A Whitepaper for Managed Hosting Providers
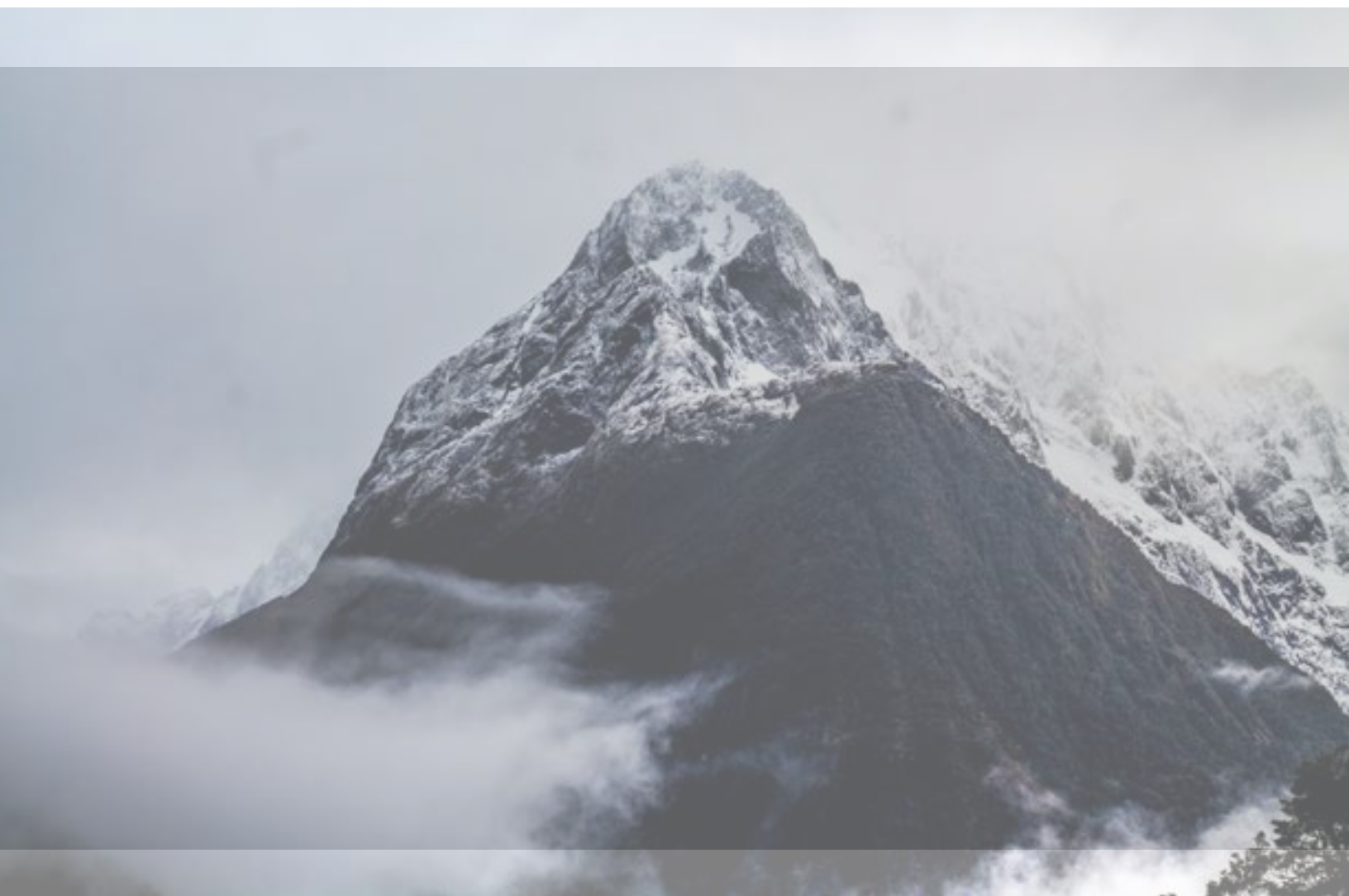
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Why Read This Whitepaper?

Organizations today are no longer building their IT Infrastructures. Instead, they are moving workloads off-premise. While 48 percent of large enterprises have handed off at least one workload to a hyperscale cloud, the majority of workloads are being migrated to traditional managed infrastructure providers due to security, performance and managed services.[1]

Consider the following[2]:

- By 2020, 60% of IT deployments will be off-premise

- Hosting, cloud and managed services are expected to see a 14% CAGR from 2016-2021

- Within the hosting, cloud and managed services universe, managed services are forecasted to have the greatest growth between 2016-2021, with a forecasted CAGR of 18.2%

The key to continued growth in the hosting provider business model is differentiation and profitability of managed services throughout the infrastructure stack.
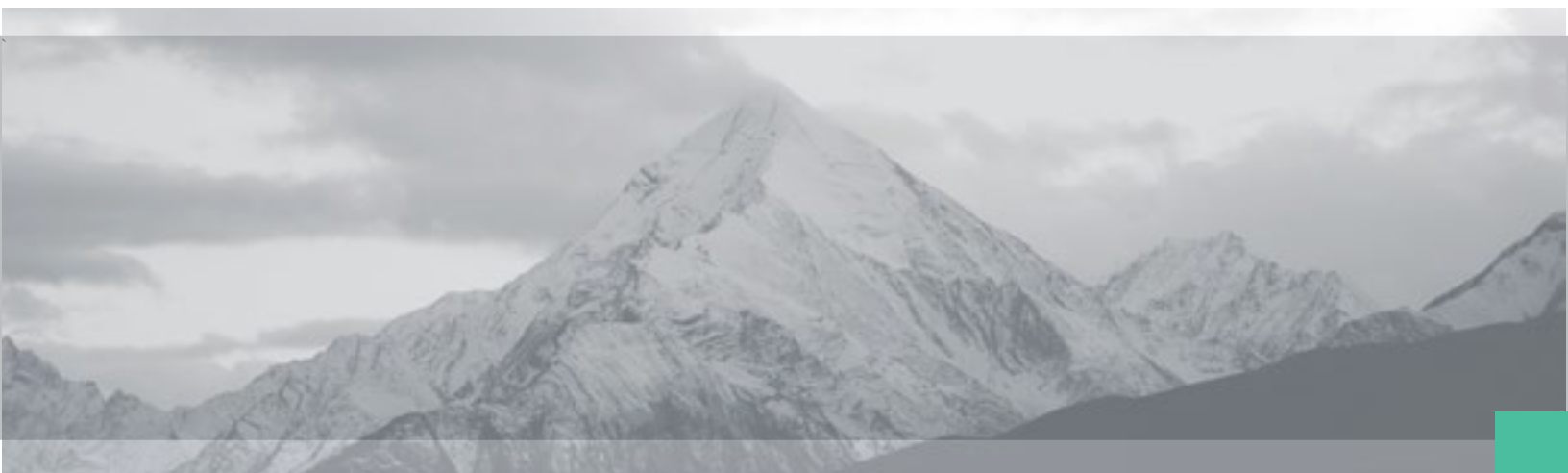

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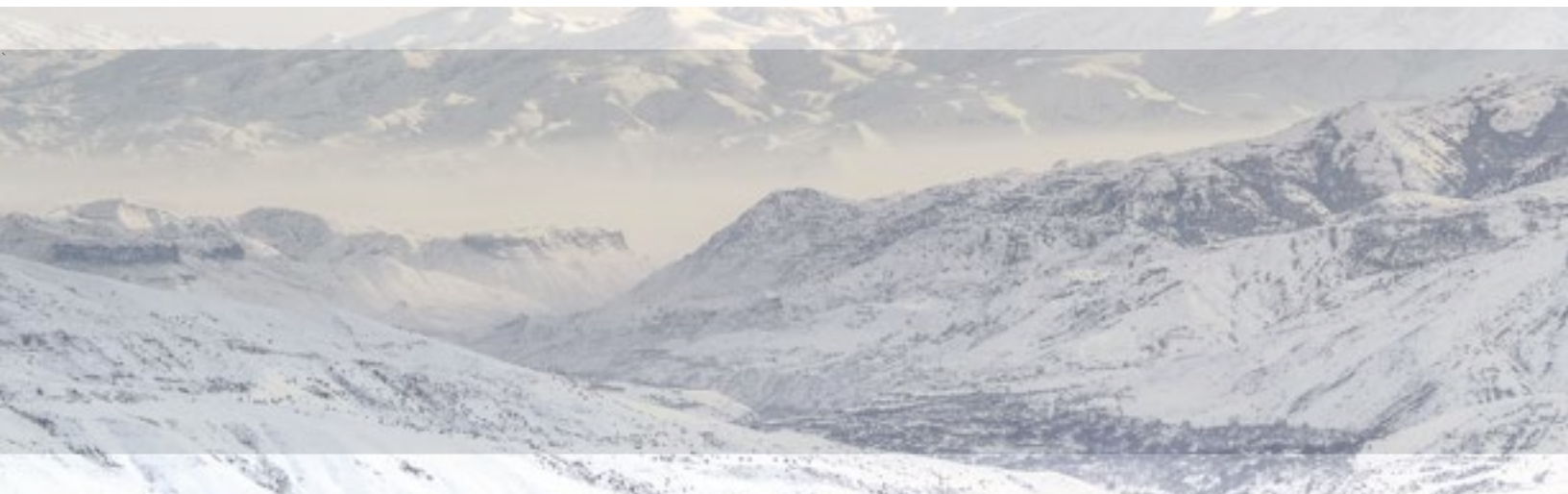
[1]Arul Elumalai, Irina Starikova and Sid Tandon. IT as a Service. McKinsey and Company, 2017
[2]451 Research. 2018 Trends in Cloud.

A New Network Services Model

Managed hosting providers need new tools to grow their revenue and own their market.

Managed hosting providers are under more pressure than ever to connect tenants securely to their applications and simply get them their data.

While this sounds easy, doing so requires overcoming growing complexity within data center environments.

Enterprise tenants have begun to investigate hyperscale clouds like Amazon Web Services to meet their IT demands through Infrastructure as a Service. But, these options come with user concerns around performance, security, financials, compatibility and employee knowledge gaps.

While technologies like Software Defined Storage and Compute as a Service have enabled hosting providers to transform the tenant experience throughout certain areas of infrastructure, networks, and specifically network functions have lagged behind. Even with modernizations like SDN and NFV, little has been done to address the root issues plaguing networks.

In order to grow their revenue and own their market, managed hosting providers need a new network services model focused on driving rapid innovation, productizing at scale and taking control of their network.

A network function is an add-on component to any network that can directly inspect, modify, and block or re-direct network traffic. Common examples are firewalls and load balancers.

A New Network Services Model

Hosting providers need to rethink their network service model to provide tenants with simple, secure and reliable access to their applications and data.

Network functions have created an operational bottleneck in the data center and introduced wrenches into the managed hosting provider business model, causing margins to decrease while operating expenses continue to rise.

To meet tenant demands, network services require a new approach that delivers on key three principles for success within the hosting provider business model.

The Three Principles for A New Network Services Model

1 **Rapid Innovation**

Deploy new services that grow with your business to maximize profits and differentiate from your competitors.

2 **Productize at Scale**

Manage multi-tenant offerings effortlessly with automated resource allocation and guaranteed Quality of Service.

3 **Take Control**

Command your hosting environment with unprecedented visibility, rich data APIs and high-levels of customization.

In an attempt to realize these business objectives, hosting providers have been forced to retrofit outdated solutions into their infrastructures. However, deploying multitudes of boxes and layers of software have only proven to further complicate data center networks and exasperate operational inefficiencies, so the same challenges remain.

Networks are Stuck in the Past

Whether physical or virtual, network functions are a bottleneck in the hosting provider business model, limiting profitability and revenue growth.

Network functions like firewalls, load balancers and intrusion detection systems were the original keys to managed network services.

At their inception, network functions provided valuable functionality such as improved security and performance.

Today however, providers are left struggling to offer managed network services in an efficient and cost-effective way.

Providers are left with a dilemma. They feel they need to offer managed network services to increase tenant satisfaction, but capital expenditures and management overhead drive down margins from network services.

The root cause of these struggles is the network function appliances, frequently referred to as middleboxes.

The middlebox model has become a chokepoint within the managed service environment, introducing challenges throughout the hosting provider business model.

Cost
Each network function requires a separate, expensive middlebox. Overprovisioning and backup requirements lead to significant capital outlays though the middleboxes may never reach full capacity.

Management Overhead
Network engineers spend over 20% of their time making middleboxes work optimally. Engineers spend time debugging and troubleshooting, instead of capitalizing on business growth opportunities.

Customer Frustrations
Today's enterprises want their IT infrastructure to move quickly and seamlessly. With middleboxes, this is impossible. Requests move slowly ultimately leading tenants to seek other options for their infrastructure.

"Networks are made up of an array of proprietary hardware devices. Launching a new service often means more devices, which means finding the space and power to accomodate these appliances.[6]"

[3]SDXCentral, "What is ETSI SIG NFV?" https://www.sdxcentral.com/nfv/definitions/etsi-isg-nfv/

NFV Has Failed to Deliver

NFV was designed to reduce the need for traditional, dedicated network devices. But layering software on a hardware appliance architecture has failed to address the root issues in networks.

More recently, there has been a move to virtual appliances with Network Functions Virtualization, or NFV. The main premise of NFV is that it can deliver network functionality via software running on industry-standard commercial off-the-shelf hardware.

The technology came with many promises of addressing the problems of traditional middleboxes. However, the only thing that changed with NFV was the method of delivery.

When the discrepancies between hardware are removed, middleboxes and VNFs look nearly identical.
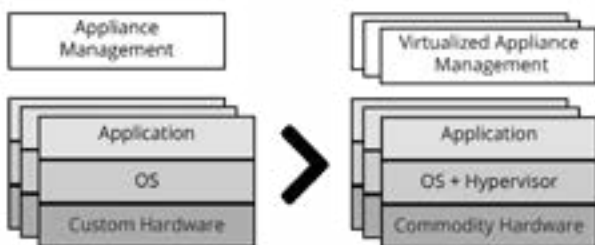
The promises of NFV have gone largely unrealized, and organizations of all kinds are struggling to implement virtualized solutions in their infrastructures.

Lee Doyle stated in TechTarget, "Of the organizations that have deployed NFV, the message is clear - NFV deployments are complex and time-consuming, and significant management and orchestration (MANO) challenges remain. Buyers are unsure of their long-term NFV architecture due to incompatible standards and vendor-specific options.[4]"

What NFV Promised	What NFV Delivered
Reduced capital expenses	Mixed results
Reduced operating expenses	Stagnant or increased operating expenses
Automation	Automation limited by inconsistency
Simplified management	Virtualized management issues

These struggles are further exemplified in data regarding NFV deployments as provided by Heavy Reading[5]:

- Timetables for identifying all of the functions to be virtualized by 2020 continue to slip. A year ago, 27% expected to have this done in 2016, but only 11% actually did.

- The timelines for getting all identified functions into production are slipping. In November 2016, 45% said their entire virtualization project would be complete by 2020. In April 2017, that percentage slipped to 38%. In November 2017, 30% expect it will be 2023 or later before completion, up from 25% who said the same in November 2016.

Providers need a new kind of approach. One that does not simply mimic the traditional appliances but instead completely redesigns network functions.

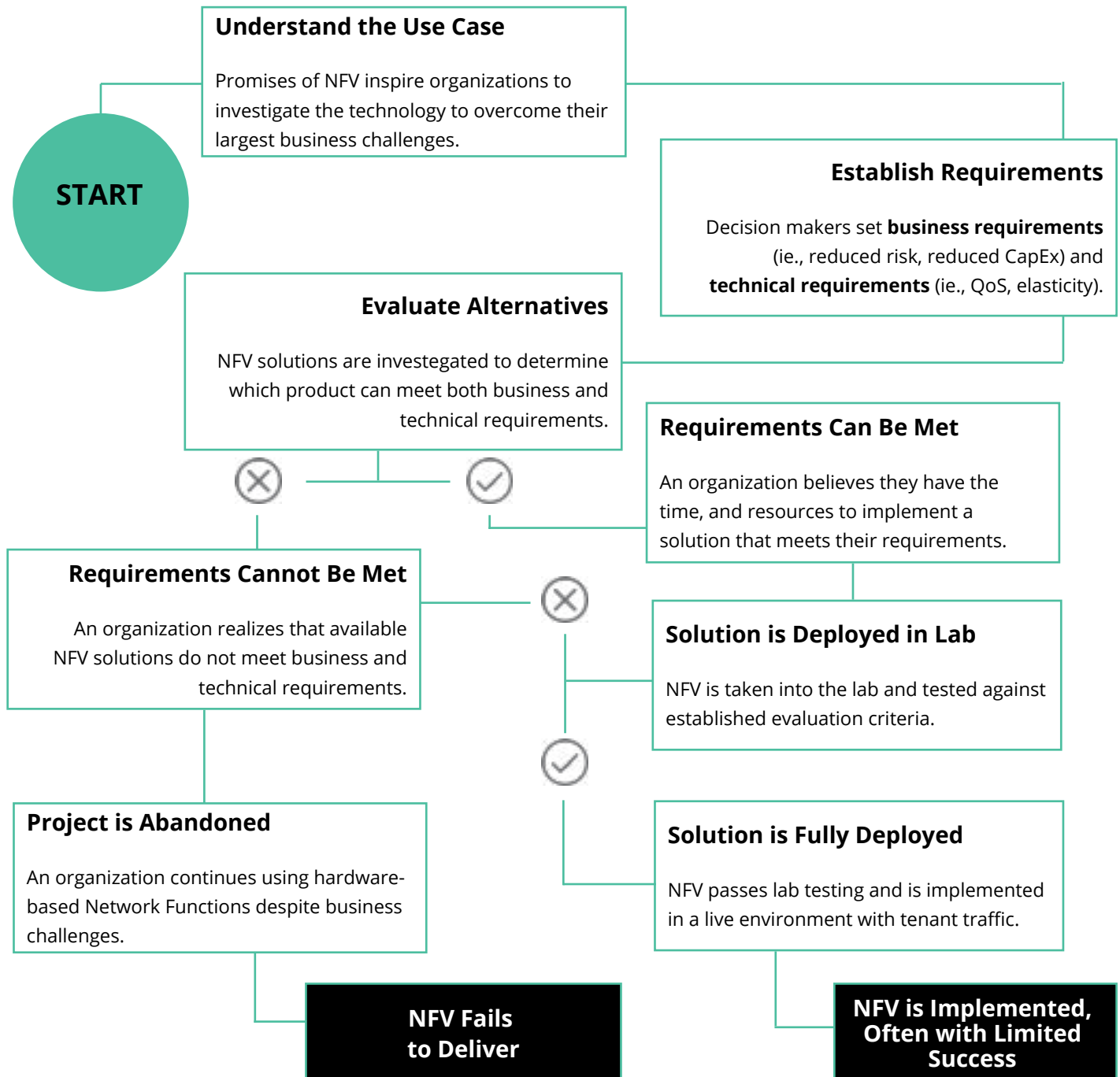[4]Lee Doyle. Where do NFV Deployments Stand Today?" TechTarget. https://searchsdn.techtarget.com/answer/Where-does-NFV-deployment-stand-today
[5] Roz Robero. Future of Virtualization: The Force (Finally) Awakens . Heavy Reading. http://www.heavyreading.com/details.asp?sku_id=3406&skuitem_itemid=1721

The Path of NFV Frustrations

START

Understand the Use Case

Promises of NFV inspire organizations to investigate the technology to overcome their largest business challenges.

Establish Requirements

Decision makers set **business requirements** (ie., reduced risk, reduced CapEx) and **technical requirements** (ie., QoS, elasticity).

Evaluate Alternatives

NFV solutions are investegated to determine which product can meet both business and technical requirements.

Requirements Can Be Met

An organization believes they have the time, and resources to implement a solution that meets their requirements.

Requirements Cannot Be Met

An organization realizes that available NFV solutions do not meet business and technical requirements.

Solution is Deployed in Lab

NFV is taken into the lab and tested against established evaluation criteria.

Project is Abandoned

An organization continues using hardware-based Network Functions despite business challenges.

Solution is Fully Deployed

NFV passes lab testing and is implemented in a live environment with tenant traffic.

NFV Fails to Deliver

NFV is Implemented, Often with Limited Success

Rearchitecting Network Functions

To achieve the new network services model, hardware cannot simply be mimicked with software - a new architecture needs to be developed.

The clear learning from NFV is that one cannot simply put layers of software and workarounds on top of a legacy design.

To truly realize a new network services model, network functions need to be re-architected.

Distributed Architecture Principles

Looking outside of networking, all modern large scale applications like scale out web services, rely on a distributed systems architecture to achieve both reliability and performance. But, this approach has historically been challenging to realize in network devices where millions of packets need to be processed every second.

In adopting this philosophy, network services can achieve reliability and flexibility previously unattainable.

Micro-service Based Approach

A distributed architecture approach is paired with concepts from service oriented architectures and micro-service based architectures.

The network functions are broken into more fine grained services (e.g., packet filtering, IPSec termination, etc.) which enables users to compose them together into a network processing application that fits their needs.

The Required Evolution of Network Function Architectures
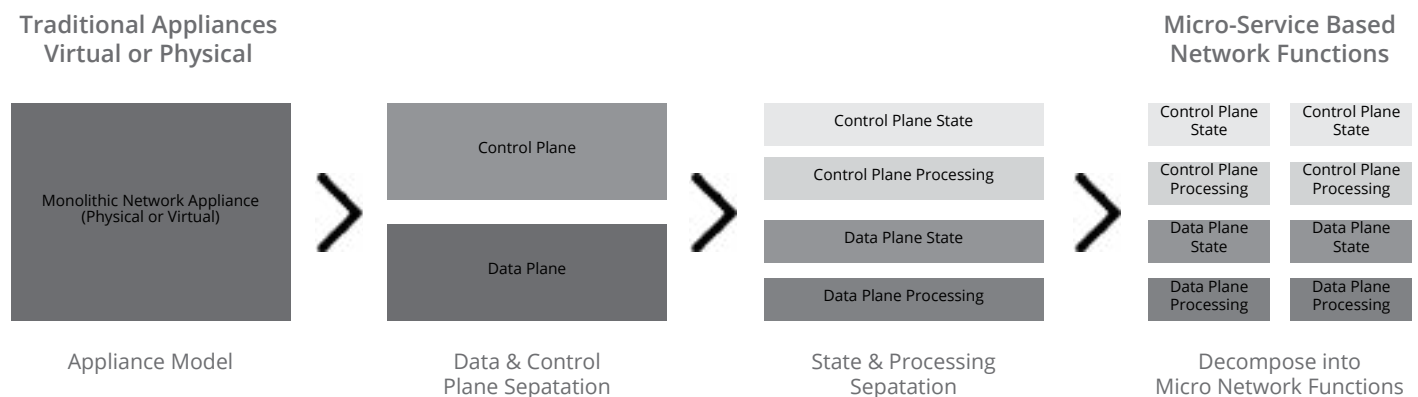
① Rapid Innovation

Deploy new services that grow your business to maximize profits and differentiate from your competitors.

Reduced Business Risk

Managed hosting providers are all too familiar with forklift upgrades - ripping and replacing one appliance with a larger one, to accommodate growing traffic and functionality requirements. The process is not as simple as removing a network appliance and replacing it with a newer option.

Instead, providers must look carefully at current resource utilization today and forecast future traffic needs.

This approach introduces unnecessary business risk into the managed hosting provider's business model. Large capital outlays are made to acquire a new device that may not ever reach full capacity.

In the new model, network services are redesigned for a scale out model, an approach commonly used in Compute and Storage. Providers can grow their infrastructure with tenant demand, minimizing risk.

Customized Network Function Chains

Network function chaining, is the idea of connecting separate network functions together to provide a suite of services; connecting a firewall, load balancer and intrusion detection system for example. Chaining is a key operating model for managed hosting providers.

But, since this model has been based on an appliance architecture, there have been limited ways to chain functions together in a streamlined, customizable fashion.

"Service chaining is not a new idea...The challenge is that hardwired service chains are difficult to deploy and change.[6]"

While NFV has given managed hosting providers the ability to chain together a greater variety of network functions, inconsistent standards and poor API qualities have presented new hurdles.

Hosting providers need to be able differentiate with distinction by creating completely customizable offerings for each tenant without sacrificing network performance.

When network functions are broken into fine grained micro-services (packet filtering, TCP reassembly) instead of monolithic appliances, providers can compose completely customized chains of services on a tenant by tenant basis.

Price Along the Demand Curve

The appliance approach has left providers with the inability to provide services based on true tenant throughput and pricing requirements. Instead, throughput is tiered on a generic box capacity such as a 100 megabit or 1 gigabit.

A new network services model gives providers the flexibility to provide tenants with throughputs based on historic consumption patterns or usage rates. The same approach can be used for billing tenants. Performance tiering and billing is no longer a provider concern.

[6]Gabriel Brown. "Service Chaining in Carrier Networks" Heavy Reading.

②Productize at Scale

Manage multitenant offerings effortlessly with efficient resource allocation and guaranteed Quality of Service

Per Tenant Quality of Service (QoS)

Current network functions are able to be divided into multitenant machines through virtual domains, partitioning part of the machine's bandwidth for each tenant. But, few have proper mechanisms in place to guarantee Quality of Service (or QoS) across tenants.

Instead, selfish tenants are able to consume a greater amount of bandwidth when needs increase rapidly - frequently referred to as a "noisy neighbor." As the noisy neighbor consumes bandwidth rapidly, other tenants network performance suffers and service level agreements (SLAs) can be jeopardized.

Resource consumption of each tenant needs to be controlled to guarantee QoS. This eliminates performance variance throughout a network function chain and allows service providers to allocate, manage and guarantee performance. Should a tenant need to increase bandwidth, real-time performance adjustments can be made via API.

Efficient Resource Allocation

Scale Out

Practical implementations of a new network services model require a distributed system architecture. Resources are delivered in a linear fashion and availability of a single instance is no longer a limiting factor. As traffic increases, x86 servers can be introduced to the system on a node by node basis.

Tenant Elasticity

In the new model, it is imperative that throughput can expand and contract without disruption or reconfiguration.

As demand on the system increase, resources are allocated automatically and tenants are redistributed throughout the available hosts resulting in better resilience, and availability.

"Major public cloud providers have been driving hard toward automation... The reason is simple: It improves both the bottom line and customer satisfaction.[7]"

Innate HA

Traditional approaches to failover management require appliance redundancy, either physical or virtual. This model is expensive, and presents operational challenges as management requirements are doubled.

This model is also susceptible to failure. Lack of state synchronization between machines can lead to network downtime as dynamic state is rebuilt.

In the new model, there is no disruption to the user in the event of failure. All tasks are automatically redistributed within the system without redundant backups or HA configurations. Workloads are migrated and balanced based on resource availability -- without operator intervention.

[7]Jasmine McTigue. "Private Cloud Automation," Network Computing.

③ Take Control

Command your hosting environment with unprecedented visibility, rich-data APIs and high levels of customization

APIs

Traditional vendors prioritize performance so heavily that customization and integration are afterthoughts to appliances.

As a result, one of the largest struggles for managed hosting providers today is the poor API qualities of existing solutions. Operators are left with a collection of disparate appliances that they are unable to orchestrate, customize or integrate.

"Traditional NFV and middlebox vendors are slow to adapt the open API model. Internal processes slow development and pressures from shareholders make the open model unfeasible.[8]"

Hosting providers need a network function offering with a strong API that enables deep integration, customization and supports the development of user-facing networking controls.

A rich-data API is the by product of a distributed systems architecture as it is used by each application within the system. This is passed on to end-users who are given a comprehensive API that exposes all functionality. Anything the user sees in a Web UI is observable via API call.

Tenant Self-Management

Today's tenants want to maintain their own environments, without relying on intervention from the provider.

Doing so requires that tenants are given telemetry into their system through a Web UI or tenant dashboard. It is crucial that this interface gives the user just the right amount of insight and control, without exposing information that is beyond the tenant's knowledge base.

Many providers are trying to create their own tenant dashboard given pressure from the hyperscalers. But given interoperability issues and the poor APIs VNFs provide, it has proven more challenging than expected.

Tenants need a simple-to-use dashboard that doesn't require extensive training, but is instead designed with modern UX principles. The right amount of control is given, while complexity is abrastacted when needed.

These benefits are passed onto the provider, as tenant requests and trouble tickets are decreased, and operators can spend their time moving the business forward.

[8]Glen Ragoonanan. "CSPs confirm Analysys Mason's NFV and SDN Forecasts." Analysys Mason

Differentiate with Distinction

Managed hosting providers can implement a new network services model and revolutionize their businesses.

UCLA men's basketball coach John Wooden once stated, "Failure itself is never fatal. But failure to change can and might be."

Those providers that will lead in the managed hosting provider segment have already begun to transform their architectures in order to innovate rapidly, productize at scale and take control. In doing so, they are already reaping benefits of increased margins and faster paths to new revenue.

Tenant demands do not have to be another burden on the hosting provider's business. Today's providers have the opportunity to meet these demands while positioning themselves for success.

The new network services model will give providers the ability to modernize their business model and successfully capitalize on the opportunity in the market.

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