Total Cost of Ownership Study

Virtualizing the Mobile Core

Sponsored by Affirmed Networks and VMWare

July 2015

The Time is Now for NFV. Immediate Cost Savings Creates Opportunity for Telcos

Architecture

1 Only one platform **vs.** 3 Three separate platforms to manage

Capex

68%

68% lower Cumulative CAPEX
1. No over-investment in capacity
2. Scale dimensions independently

Opex

67%

67% lower cumulative OPEX
1. Large environmental savings (power, cooling, and floor expense)
2. Service contract savings

Service Turn Up Time

6 months — Advanced NFV Solution

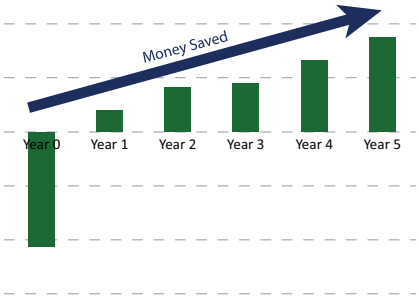
15 months — Appliance-based solution

Virtualization Makes You Money

Saving Money in the First Year

Every year you wait on moving to NFV, you incur at least twice as much expense to keep up with traffic demand. Moving to a virtualized solution let's you take back those savings.

Cash Flow



Cash flow impact of transitioning to NFV solution

Revenue

- Bring new services to market faster.
- Bring innovative and differentiated services to market by reducing the cost of creating and launching new services.
- Improve customer quality of experience with right-sized capacity in the network.

THE VIEW FROM THE TOP

For mobile network operators (MNOs), the decision to delay network virtualization efforts can be a costly one. Every year that MNOs delay the move to network functions virtualization (NFV) cost them millions of dollars in unnecessary capital and operating expenses.

In a five-year cost comparison between MNOs with traditional and virtualized network architectures, ACG found that:

- MNOs that transitioned to an NFV-based platform began saving money in the first year and realize an investment payback in 3 years.
- Adopting a virtualized Evolved Packet Core (EPC) solution reduced Capex by 68% and Opex by 67% on average;
- MNOs were able to turn up a virtualized network much more quickly (<6 months) than with traditional networks (15 months on average), resulting in quicker time to market and time to revenue

INTRODUCTION

Mobile network operators (MNOs) find themselves in the crosshairs of conflicting trends: the rise of mobile network traffic and the decline of mobile subscriber revenue. Simply put, mobile subscribers want more for less. ACG Research estimates that mobile network throughput will increase at a 50 percent compound annual growth rate (CAGR) over the next five years (source: "Forecast of Mobile Broadband Bandwidth Requirements," ACG Research). This growth will be driven by a greater demand for mobile data—particularly video—as well as a dramatic increase in machine-to-machine (M2M) traffic. In order to meet these demands, MNOs must add more services and network capacity while—and here is where the current conundrum exists—reducing their network costs.

AT&T's National wireless network, for example, has seen a 100,000% increase in data traffic from 2007-2014.

100,000% increase in data traffic on AT&T's wireless network from 2007-2014.

Two Paths to Network Growth

To increase network capacity/performance and accelerate service creation, MNOs have one of two choices:

- **The Traditional Approach**: This is the model that MNOs are most familiar with, requiring the addition of purpose-built, proprietary devices to the network such as System Architecture Evolution (SAE) gateways in order to add new functionality (e.g., content optimization) and extend network capacity.
- **The Virtualized Approach**: This is the model of the future, based on the recent introduction of network functions virtualization (NFV), which allows MNOs to add network functionality and capacity using software-based solutions that can be deployed on commercial-off-the-shelf (COTS) servers and managed in a virtualized environment for much higher efficiencies of scale and cost.

Nearly all MNOs plan to move to a virtualized approach eventually, but delaying the decision to move to NFV, even by just a couple of years, can have dire consequences on an MNO's bottom line. In other words, MNOs can't afford not to virtualize their networks as soon as possible.

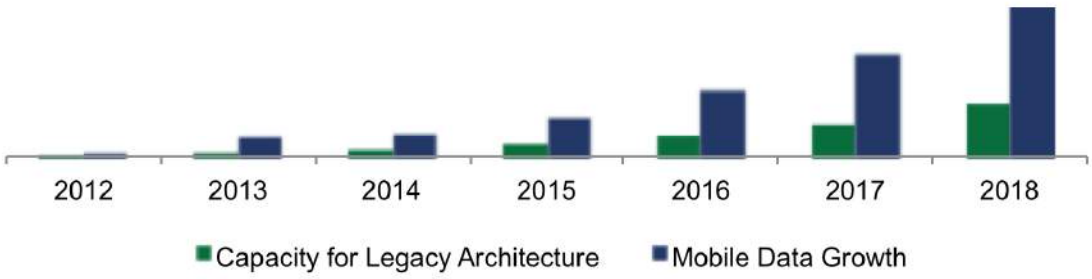


Figure 1: Mobile Data growth vs. Capacity of Legacy Architecture at fixed spend
Source: Affirmed Networks and Cisco VNI

Figure 1 shows the perils of following the Traditional Approach to network growth: adding more boxes to meet higher capacity demands means adding more cost to the network—an unsustainable long-term strategy as data growth continues to outpace CPU improvements. The Virtualized Approach offers a distinct advantage in this scenario by allowing MNOs to increase network capacity while reducing capital expenses (through generalized COTS hardware) and operating expenses (through virtualized, centralized management). In fact, NFV solutions were developed in direct response to what the industry perceived as the network requirements of the future: virtualization, centralization, consolidation, and rapid service creation. Deploying specialized network elements such as SAE gateways and policy servers on industry-standard servers that can be managed through a commercial hypervisor gives the Virtualized Approach a distinct advantage over the higher cost and complexity of the Traditional Approach to network growth.

Why Thinking Outside of the Box is Faster and Cheaper

Although hypervisors and virtualized machine environments have been around for years, the benefits of virtualization didn't originally extend to telecommunications network functions such as mobile core, routing or border security because x86-based servers originally couldn't support the required throughput. As a result, networking vendors continued to develop their own hardware appliances to meet these requirements. Today, however, the ongoing improvements in x86-based processors—under the principles of Moore's Law—have reached the point where common-off-the-shelf (COTS) servers are now more powerful and significantly cheaper than these proprietary hardware appliances (see *Figure 2*)

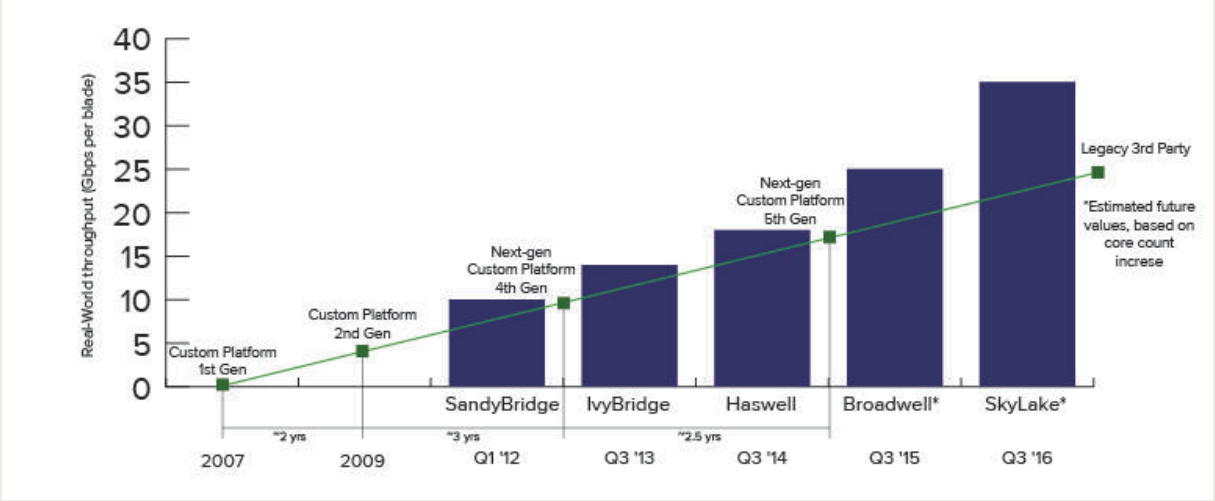


Figure 2: Improvements in COTS processor throughput vs. proprietary device throughput

The ability to replace costly, hardware-based network elements with standard Intel®-based processors running virtualized software immediately frees MNOs from the cost constraints of the past. And those cost savings and performance improvements stand to increase with time, as COTS servers typically double their performance every few years. Under the Traditional Approach, if MNOs want to increase element performance they need to upgrade the hardware and software together, often at the cost of $70,000 or more per element. Under the COTS model, MNOs can simply replace the underlying server for $10,000 or less to realize the same performance improvements.

NFV: Not a Wait-and-See Technology

Technology transformations within the telecommunications industry often occur slowly and incrementally; the gradual adoption of IP-based communications in mobile networks is a prime example of this. Yet the numbers behind NFV plainly suggest that the industry as a whole is moving quickly and inextricably to network virtualization:

- AT&T recently announced that it will migrate 75% of its customer-facing network to a virtual, software-controlled platform by 2020 (http://blogs.wsj.com/cio/2014/12/16/att-to-virtualize-75-of-its-network-by-2020/)
- China Mobile announced similar plans to move its global network to an NFV-based architecture (https://www.youtube.com/watch?v=IyIJO9RNCr4)

- Vodafone Spain recently built, tested, and launched its new MVNO service in only three months using a virtualized approach—4X times faster than a traditional MVNO service launch (http://www.lightreading.com/carrier-sdn/sdn-architectures/vodafone-builds-mvno-on-elephant-talk-sdn/d/d-id/713181)
- Leading NFV vendor Affirmed Networks reports more than 20 network operators have purchased virtualized mobile core technology for their networks, with another 40 operators in the testing and development phases. (http://www.lightreading.com/nfv/nfv-elements/affirmed-networks-ceo-digging-into-nfv/v/d-id/715983)

Traditional vs. Virtualized Networks: A Five-Year Total Cost of Ownership Study

The next five years will represent a critical period for MNOs as they must transform their networks to handle the rise in 3G/4G traffic and the imminence of full-scale, machine-to-machine (M2M) communications. The network transformation path they choose—Traditional or Virtualized—carries with it a high corresponding cost. In our study, we examined the cost of ownership associated with two key network initiatives for MNOs in the next several years:

1. The transformation of mobile core (i.e., Evolved Packet Core) and service (i.e., Gi LAN) functions to meet large-scale consumer broadband demand;
2. The transformation of mobile core functions (i.e., signaling/packet gateway) to support M2M communications.

An additional analysis was also conducted in comparing the deployment times of a traditional network and a virtualized network.

In a five-year cost comparison between networks that employed Traditional and Virtualized means to meet the expected demands for additional network capacity and functionality, ACG Research uncovered these key findings:

- Network operators cut their Capex spending more than half (68%) by choosing a Virtualized Approach for their Evolved Packet Core (EPC) solution;
- Moving to an NFV-based mobile core platform reduced MNOs' operating expenses by 67%;
- MNOs who moved to an NFV-based platform began saving money in year 1 with a payback of their investment in 3 years;
- MNOs that adopted a Virtualized Approach were able to turn up services much faster (<6 months) than MNOs that used a Traditional Approach (15 months).

As a natural byproduct of the time/cost savings identified in the report, ACG concludes that moving to an NFV-based platform can also help MNOs increase revenue by:

- Accelerating time-to-market for new services (+/- 10 months more time on the market);
- Reducing the cost of new service creation, which in turn makes the release of niche or customizable services more economically feasible and, in fact, could lead to significant competitive differentiation;
- Improving Quality of Experience as a result of right-sized capacity in the network.

Not All NFV Is Created Equal

Despite the consensus that network functions virtualization is the solution to MNOs' network and revenue challenges, not all virtualized solutions offer the same benefits or the same results. Some NFV solutions deliver greater benefits by extending the value of virtualization through enhanced capabilities. These capabilities include:

- **Dynamic capacity scaling**. The ability to flexibly scale network capacity up or down as network traffic increases/decreases leads to better network performance and fewer stranded resources. A virtualized gateway solution, for example, can scale independently across different dimensions (e.g., signaling, sessions, throughput) allowing operators to match their capacity needs to the call model of their application. Proprietary, hardware-based appliances cannot do this—which results in stranded capacity and additional Capex.
- **Geo-independence**. With an NFV architecture, MNOs can pool network resources centrally and provision them dynamically across geographies to reduce under/overcapacity in certain regions.
- **Clustered Architecture**. By consolidating the EPC functions into a single cluster, virtualized mobile cores can shift capacity by function as well (e.g., SAE GW, GI LAN services, Policy) to handle changing traffic demands more efficiently.
- **Built-In Load Balancing**. No external load balancer is required as internal load balancing VM is responsible for steering ingress and egress IP traffic.
- **N-Way Redundancy and Always-On Availability**. Virtualized platforms can provide multiple layers of redundancy and high availability by seamlessly shifting workloads in the event of a server failure or DoS attack directed to a particular server.
- **Collapsed EPC and Gi LAN Functionality**. Collapsing EPC and Gi LAN functions into a single software solution reduces the number of platforms deployed, overall complexity of the network, and time to create and launch new services. This applies to network functions that include the Mobile Management Entity (MME) Policy Control and Routing Function (PCRF), SAE Gateway, WiFi Gateway, and value-added services such as content filtering, web/video optimization and subscriber firewall to be delivered in the same system.
- **Service Chaining and Orchestration.** The ability to seamlessly connect and automate service flows increases both the kind of services that an MNO can deliver and the speed with which they can deliver them.
- **Support for Commercial Hypervisors and COTS Hardware.**

Getting the Most from the Platform

Advanced VNF capabilities are enhanced by intelligent NFV Infrastructure platforms. No VNF acts in isolation; a single service may consist of many VNFs and the operator needs to implement many services. This creates a need to support a multivendor VNF environment and operators should turn attention to production grade NFV platform characteristics including:

- Support for best of breed multivendor VNFs through strong multitenancy to guarantee performance at the both the service levels (EPC, VoLTE, M2M etc) and application levels (MME, PGW, PCRF etc).

- Protection against 'noisy neighbors' to maintain application performance.
- Automated policy-based workload relocation to recover redundancy in the event of planned move or hardware failure.
- Context-based application placement (affinity rules) to ensure application colocation or separation as required by the service blueprint.
- Strong monitoring and analytics to maintain overall platform performance and efficiency combined with platform automation and orchestration tools to support cloud platform operations at scale.

Pre-integrated platforms such as the VMware vCloud for NFV solution support production-grade capabilities today. Over time, similar capabilities are expected to be delivered through various open source initiatives and distributions.

TCO SCENARIO #1: Large-Scale Consumer Broadband Services

The study used the following definitions for the Virtualized and Traditional solution comparison:

- The Virtualized Solution was defined as a mobile core node that addressed multiple functions including:
    - Signaling Gateway (SGW)
    - Packet Gateway (PGW)
    - Policy and Charging Enforcement Function (PCEF)
    - Subscriber Firewall
    - Deep Packet Inspection (DPI)
    - Web and Video Content Management including caching, image compression, content filtering, TCP optimization, video pacing, header enrichment and gzip compression on text objects

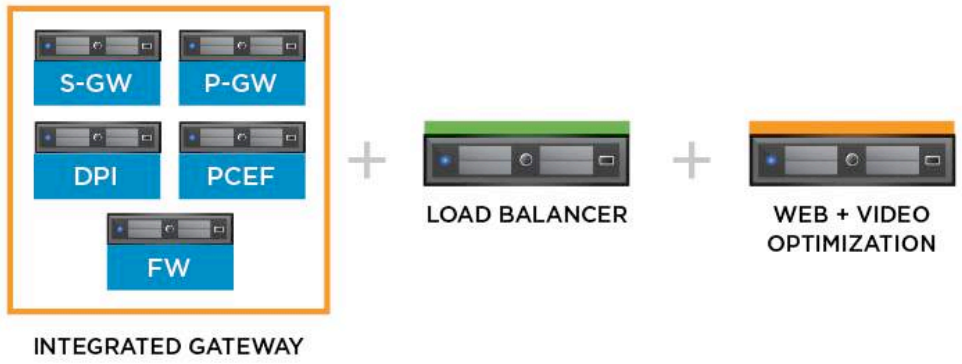
- The Traditional Solution was defined as a multivendor, best-of-breed solution featuring three unique appliances:
    - A mobile core platform hosting the SGW, PGW, DPI function and Subscriber Firewall
    - A load balancer with co-located PCEF functions
    - A content management platform for web and video services

The total cost of ownership for both solutions was calculated over a five-year period (2015 to 2019). Capital expense (Capex) was defined as the cost of the hardware for the mobile core platform and the software required for the various gateway, DPI and value added service functions. Operating expense (Opex) was defined as the recurring costs needed to deploy, operate, and maintain this hardware and software. ACG Research used best estimates of market prices in determining these costs.

In the case of the Traditional Solution, each appliance was sourced from a different vendor to reflect the current reality of most MNO mobile core networks. The solution also presumes three separate Element Management System (EMS) platforms. The deployment times presume standard implementation processes (procurement, testing, installation, training) as well as integration between the three different vendor platforms.

For the Advanced Virtualized solution, software is sourced from a single vendor, which is run on commercial hypervisor and COTS hardware.

Traditional Architecture



Advanced Virtualized Architecture

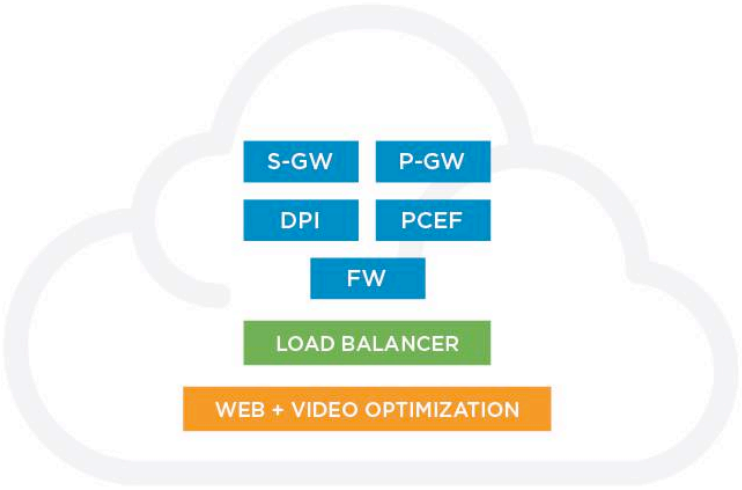


Figure 3

In this study, we looked at the total cost of ownership (TCO) for a network supporting millions of attached subscribers over the next five years (2015 through 2019). Table 1 is representative of a Tier 1 Mobile Operator call model and shows the assumptions for subscriber/traffic growth over that period; while attached subscribers are expected to grow by roughly one-third during that time, throughput is expected to double every two years.
(see Figure 4).

Consumer Broadband	2015	2016	2017	2018	2019
Attached Subscribers (000s)	3,000	3,194	3,411	3,654	3,927
Throughput (GPS)	30	45	68	107	171
Transactions per Second TPS	9,730	10,900	12,263	13,857	15,729

Table 1: Capacity Requirements for EPC (Single Node)

The primary driver behind the increased throughput is the gradual shift in consumer video viewing from televisions to mobile devices. Today, only five percent of video consumption was moved from TV to mobile devices, but that five percent will represent 59 percent of all broadband traffic in North America. In addition, attached subscriber capacity requirements, though nearing saturation will continue to grow 7% per year over the next five years. For this reason, Voice over LTE (VoLTE) and Voice over Wi-Fi (VoWiFi) initiatives remain critical to meeting future subscriber demand. Both VoLTE and VoWiFi will drive more traffic into the mobile core, and new network functions such as VoWiFi gateways in particular bear watching.

Beyond data traffic, MNOs can also expect to see an uptick in signaling traffic at the rate of 13% per year. This growth can be attributed mostly to the ongoing transition from 3G to 4G services, as 4G services produce more signaling traffic than 3G services.

The Results

In our cash-flow analysis, we compared the costs of adopting a virtualized mobile core in Year 1 versus the cost of operating a traditional mobile core solution over a five-year period.

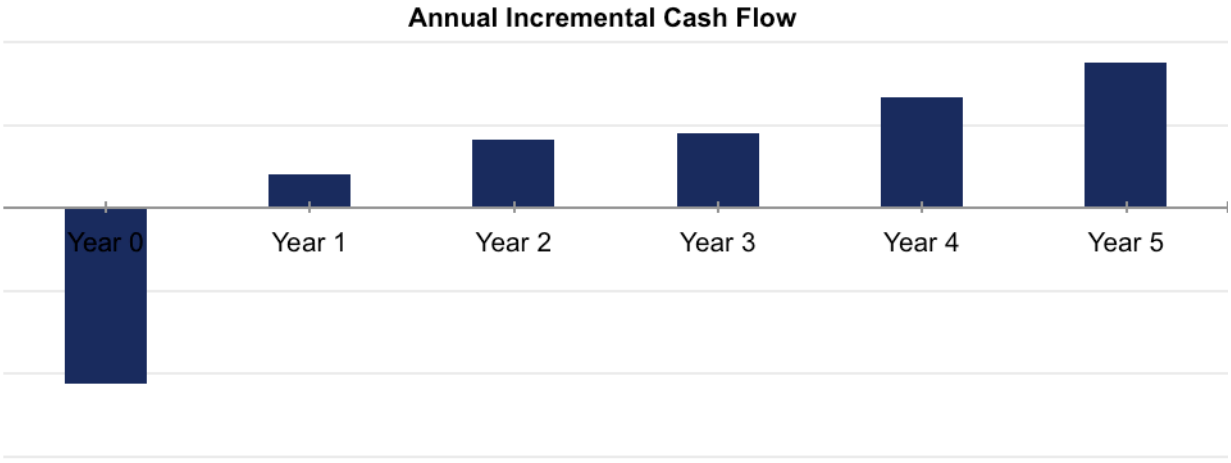


Figure 4: Cash-flow analysis of virtualized vs. traditional mobile core over five years

This analysis assumes that the existing traditional mobile core installation is a sunk cost, so its cost is ignored. Figure 4 illustrates the cost of deploying the virtual solution and the savings going forward of serving the anticipated traffic demands using a virtualized mobile core architecture instead of a traditional architecture.

An NFV architecture yields significant savings (through Capex and Opex reduction), in large part because of its cost-efficient scalability, which enables MNOs to rapidly recover their initial investment because of the immediate savings produced – put conversely this is the cash flow (cost) impact of a delaying the move to NFV. The cumulative impact on cash flow is shown in Figure 5.

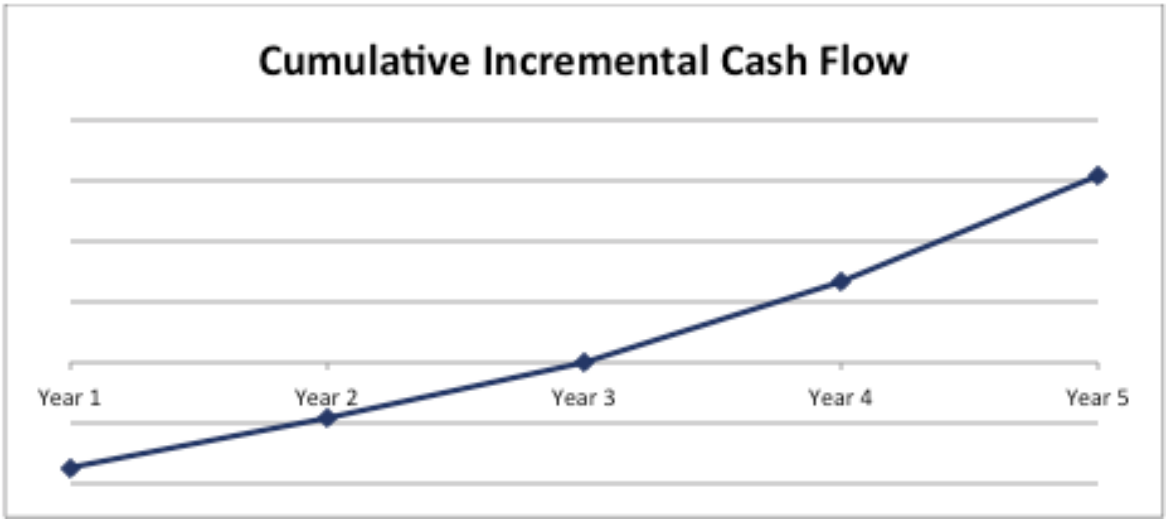


Figure 5: Cumulative Incremental Cash Flow, Payback of less than 3 years.

The transition to a Virtualized solution produces an ROI of 30 percent and the transition reaches a break-even point within 3 years.

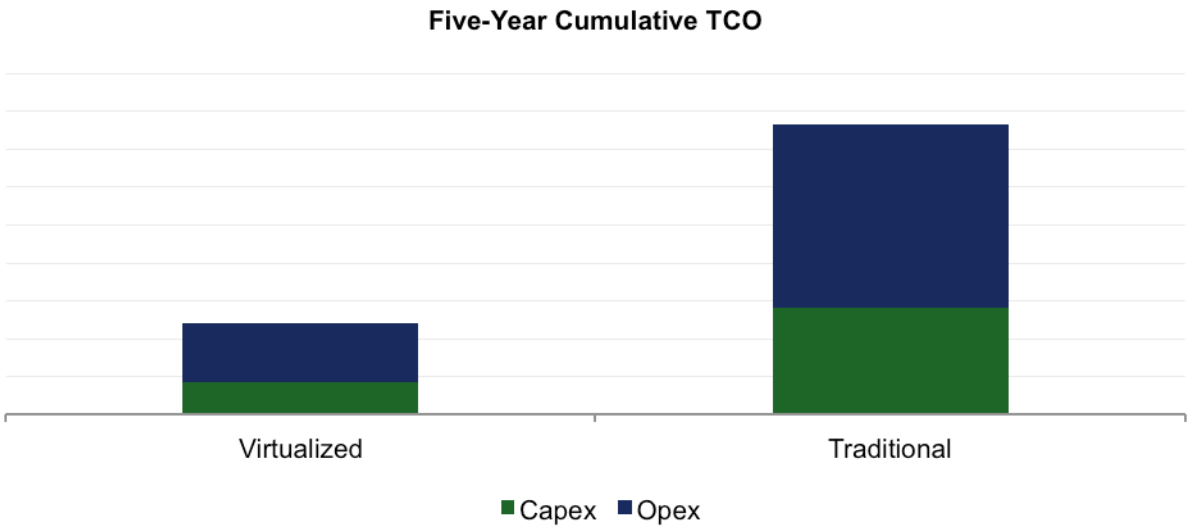


Figure 6: Five-Year cumulative TCO comparison

As Figure 6 illustrates, the five-year cumulative TCO of the Virtualized solution is 67 percent lower than that of the Traditional solution. Virtualized Capex is 68 percent lower, and Virtualized Opex is 67 percent lower than the Traditional solution. There are two primary sources of the cost savings. 1) The Virtualized solution's use of x86-based COTS hardware versus the Traditional solution's use of proprietary processing blades; and 2) The Virtualized solution's greater service flexibility and much faster service deployment capability. They combine to significantly improve the Virtualized solution's asset utilization as compared to the Traditional solution (See Sidebar). Secondary Capex efficiencies include better resource utilization derived from the flexibility of the Virtual solution's pooled resource architecture and its use of a single platform versus the three different hardware appliances required in a typical, traditional model.

How the Guessing Game Costs MNOs Millions

Capacity planning—predicting how much network capacity you'll need in the future—is a challenge that every network operator faces. The further you need to plan out, however, the less accurate and more costly it becomes. Because virtualized deployments are considerably shorter than traditional network deployments (six months versus 15+ months), MNOs can make more accurate predictions and carry less excess capacity during the turn-up phase.

Carrying excess capacity has a real impact on an MNO's bottom line. For our study, we presumed 50 percent annual growth in traffic from a base point of 30 Gbps capacity, with the understanding that MNOs would need full capacity on the day the network went into production. In six months, the virtualized network would require a capacity of 37 Gbps, meaning that 7 Gbps of excess capacity would be carried for six months. With a 15 month deployment time, the traditional network would require a capacity of 48 Gbps, resulting in 18 Gbps of excess capacity. This is more than 2.5 times the excess capacity of the Virtualized solution.

Capacity predictions also become more error-prone as forecasts grow longer. For example, the forecasting error when projecting 15 months out is more than four times that of a six month projection. Planners, therefore, must provision significant additional capacity for the Traditional solution compared to the Virtualized solution to protect the network against possible capacity shortages.

Figure 7

Compared to the Virtualized solution, the Traditional solution, consequently, incurs an additional eight percent of Capex to accommodate its long deployment interval and another eight percent of Capex to accommodate its increased forecasting error. This brings the total Capex savings of a virtualized approach to 69 percent (see Figure 6).

Operational Costs: A Side-by-Side Comparison

Traditionally, the annual cost of vendor service contracts is the single largest operational expense for MNOs. By contrast, service contracts for virtualized systems cost 64 percent less on average than those for traditional, proprietary devices. Because service contracts are closely correlated to hardware and software—often calculated as a percentage of hardware/software costs and licenses—MNOs can expect to see a corresponding savings in service contract costs as hardware/software costs go down.

Environmental expenses—power, cooling, equipment housing—also play a significant part in overall network operations costs. These expenses are directly tied to hardware; the bigger the box (and the more of them), the higher the power, cooling, and housing costs. With a virtualized solution, the combination of hardware consolidation and smaller, x86-based servers can reduce these environmental costs by 90 percent (see Figure 10).

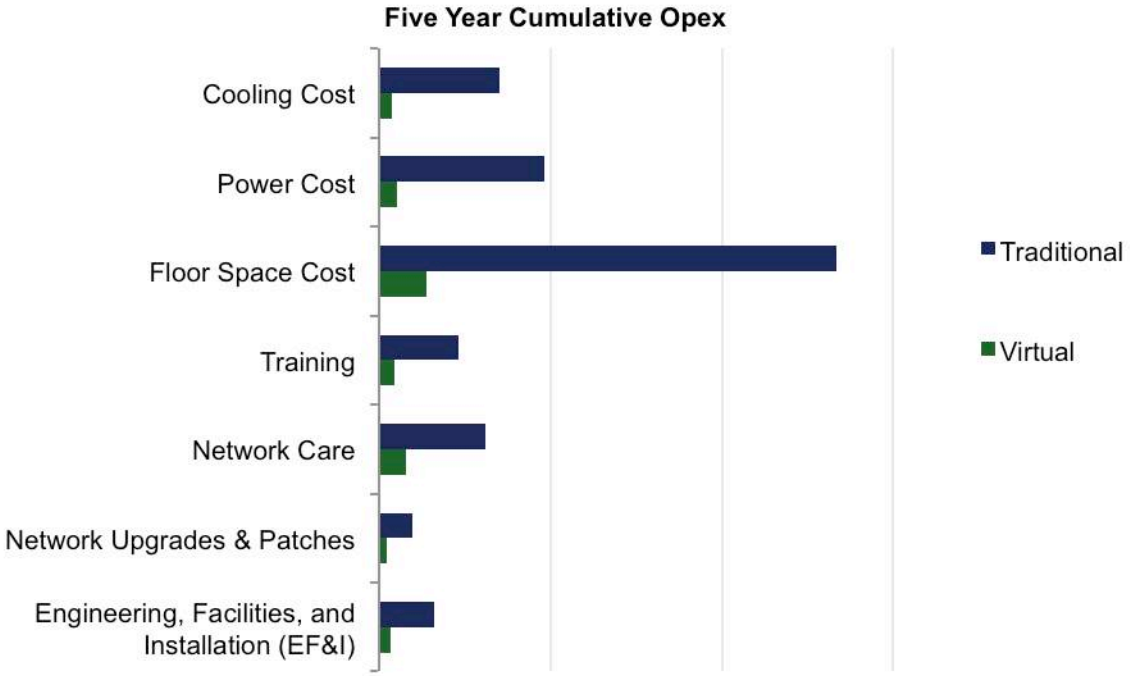


Figure 8: Five-year cumulative Opex costs for traditional vs. virtualized networks

A third factor driving down the operational cost of a virtualized solution is a reduction in systems management because of hardware/vendor consolidation and integrated service chaining/orchestration capabilities.

Final Results

Figure 11 illustrates the cumulative TCO—both Capex and operational savings combined—of a Virtualized and Traditional network approach to serving large-scale consumer broadband subscribers over the next five years.

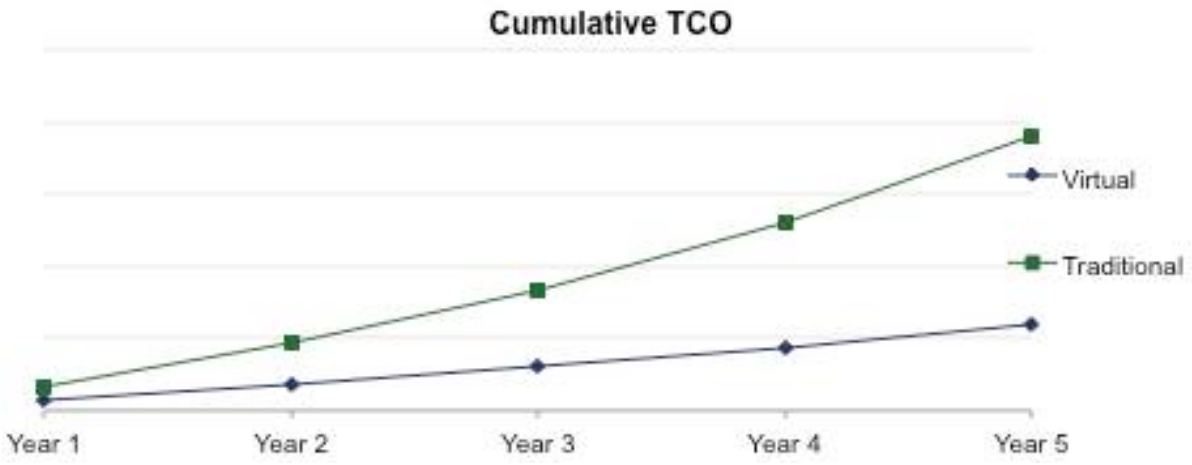


Figure 9: Cumulative TCO for large-scale consumer broadband networks. 67% Lower TCO for Virtualized Network

An NFV approach produces a 61% TCO savings in the first year compared with a traditional network approach, widening to 67 percent by Year 5. The steadily increasing cost advantage of virtualization is driven by its improved efficiency as network traffic scales.

TCO SCENARIO #2: Machine-to-Machine (M2M) Communications

M2M traffic in aggregate is expected to rise significantly over the next five years, during which time the number of attached M2M subscribers, throughput, and transactions per second (TPS) will more than triple (see Table 2). In this scenario, we look at the cost of deploying the requisite Signaling and Packet Gateway (SGW/PGW/DPI) functionality for M2M traffic using both a Traditional and Virtualized approach, with a view into both solutions' total cost of ownership over the next five years. Because M2M functional requirements differ from those of a large-scale consumer broadband network, our study focused on the costs surrounding the SGW/PGW and DPI functions as needed, specific to the anticipated number of attached subscribers and signaling requirements.

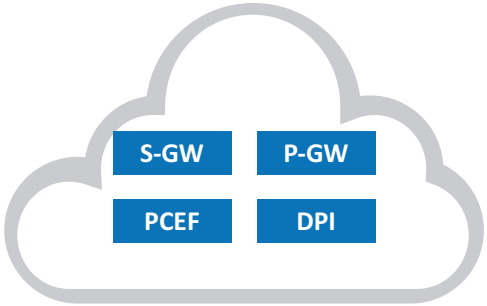
M2M	2015	2016	2017	2018	2019
Attached Subscribers (000s)	2,500	3,375	4,556	6,151	8,304
Throughput (GPS)	8	11	15	21	28
Transactions per Second TPS	5,801	7,831	10,571	14,271	19,266

Table 2: Capacity requirements for M2M applications

M2M Traditional Architecture

INTEGRATED GATEWAY

M2M Advanced Virtualized Architecture



M2M Scenario Study Assumptions

All M2M subscribers will be served by 4G technology (however a 3G/4G traffic mix does not materially affect the analysis). The average throughput per subscriber and the number of signaling events per subscriber are projected to remain constant during the five-year period. ACG Research estimates market prices for all hardware and software. Both the Virtualized and Traditional networks are understood to offer comparable SGW/PGW functions. This analysis assumes a green field implementation for M2M, which is typical in many operator deployments. Table 2 is representative of a typical Tier 1 Mobile Operator call model.

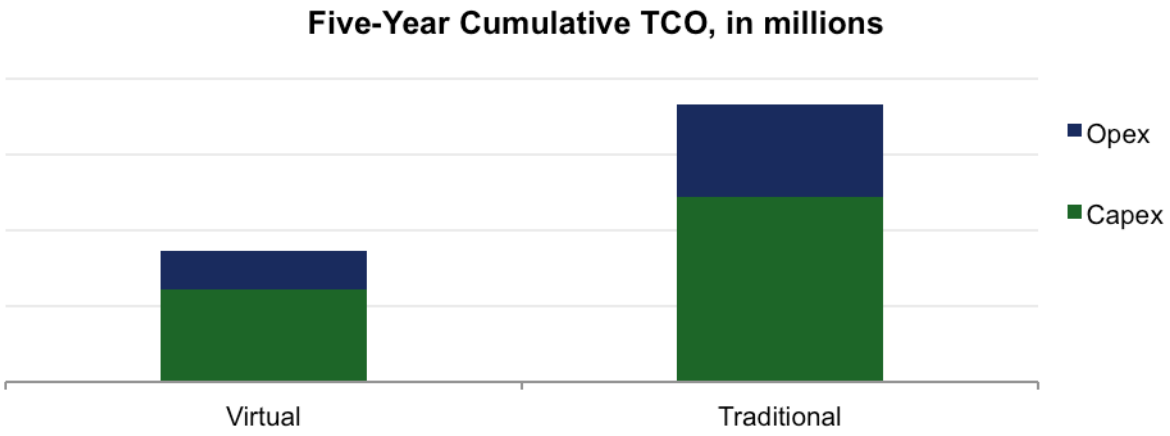


Figure 10: Cumulative Capex and Opex savings for Transition to Virtualized Solution

TCO Comparison:

Figure 10 shows the CAPEX and OPEX savings comparison of the Virtual architecture versus the Traditional. The Virtualized approach demonstrates a 50 percent savings in capital expenses and a 60 percent savings in operational expenses for a cumulative TCO of 53 percent lower than the Traditional approach.

The primary sources of the savings are the cost advantages that x86 servers (Virtualized) have over blade-based systems (Traditional) and the higher asset utilization of the Virtualized solution caused by its shorter deployment time: six months for Virtualized compared with 15 months for Traditional. Operational savings are primarily driven from service contracts which are closely correlated to CAPEX (hardware and software) as well as environment expenses. Service contracts for the virtualized system is 60% less than that of the traditional solution. Increased energy efficiency and streamlined service orchestration also factor into the savings that a Virtualized solution can offer.

The TCO advantage of a Virtualized solution grows steadily over the five year period (see *Figure 11*).

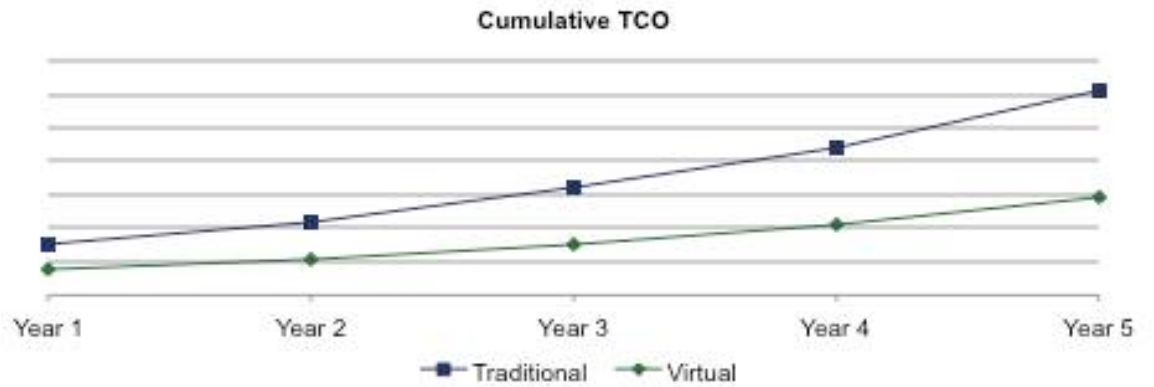


Figure 11: Cumulative TCO comparison for M2M use case. 53% Lower TCO for Virtualized Network.

The figure illustrates the need to move immediately to a Virtualized solution in that the cost penalty increases exponentially with the length of the delay.

SUPPLEMENTAL SCENARIO: Service Deployment Time

Intense competition from over-the-top (OTT) providers and increased consolidation within the telecommunications industry has created an environment where service differentiation and the creation of new revenue-generating services are imperative to the MNO's sustainability. These services must be developed at a minimal cost and quickly introduced into market in order to provide MNOs with a true competitive advantage.

NFV technology has the potential to reduce the time required to introduce new services, add network capacity, and modify service features. The associated economic benefits are equal to or greater than the network scaling benefits analyzed in the previous sections. Through collapsed functionality of the packet core, service chaining capabilities, and service orchestration, service creation in an NFV environment can have a significant impact on a service provider's bottom line.

In the following supplemental scenario, we compare the deployment time for the earlier large-scale consumer broadband use case in both the Virtualized and Traditional solutions. Table 3 is representative of a Tier 1 Mobile Operator project plan and defines the high-level tasks of the service creation process as considered in this study.

Task	Definition
Contract for Systems	Develop equipment contracts and prepare purchase orders for lab hardware, production systems, and services
Design Service	Define functional requirements; develop systems and infrastructure specifications including high- and low-level designs
Deploy Test Lab	Deploy test lab infrastructure, order and install hardware, install and configure EMSes, install and configure EPC software, and perform end-to-end lab integration
Establish Site 1	Establish Site 1 readiness, order and install hardware, install and configure EMSes, install and configure EPC software, and perform end-to-end integration
Establish MNO Operational Readiness	Integrate back office, billing, operations support and end-to-end; perform operational readiness testing

Table 3: Definition of high-level service creation tasks

Final Results

In a side-by-side comparison, the Virtualized approach clearly showed itself to be faster in terms of service deployment (see Table 4 and Table 5 below).

ID	Task Name	Duration		3rd Quarter			4th Quarter			1st Quarter			2nd Quarter			3rd Quarter		
			Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	Contract for systems	40 days																
2	Design of Service	48 days																
3	Deploy test lab	113 days																
4	Establish Site 1	143 days																
5	Establish MNO operational readingness	3 mons																

Table 4: Service creation time using a Traditional approach

ID	Task Name	Duration	3rd Quarter			4th Quarter			1st Quarter			2nd Quarter			3rd Quarter	
			Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
1	Contract for systems	21 days														
2	Design of Service	28 days														
3	Deploy test lab	57 days														
4	Establish Site 1	50 days														
5	Establish MNO operational readingness	1 mon														

Table 5: Service creation time using a Virtualized approach

In many cases, Virtualization cut the service deployment time in half (or more). Service orchestration (a unique feature of the Virtualized solution), fewer manual processes, and collapsed functionality gave NFV a distinct advantage over the Traditional approach in our findings. All totaled, the Virtualized service creation process required six months, while the Traditional service creation process required 15 months. Table 6 describes the source of the time-savings for each service creation task.

Task	Source of Time Savings
Contract for Systems	One virtualized mobile core virtualized solution hosted on standard data center infrastructure versus procurement of three purpose-built appliances from three different vendors.
Design Service	The Virtualized solution employs templates to create functional requirements specification; PMO employs a 200 page text document. Design for collapsed virtualized functions hosted on standard data center infrastructure is much simpler than that required for the interconnection of three separate appliances with separate EMSes.
Deploy Test Lab	Deployment of physical infrastructure and hardware is much simpler for standard data center servers than three separate network appliances. The virtualized service orchestration automates the installation and configuration of the EMS and all mobile functions. PMO requires manual tasks for three different platforms. The Virtualized solution makes end-to-end integration simple because of automation and orchestration.
Establish Site 1	Deployment of physical infrastructure and hardware is much simpler for standard data center servers than three separate network appliances. Virtualized Solution uses templates established in test lab deployment to automate the configuration and integration tasks.
Establish MNO Operational Readiness	The Orchestration and Automation capabilities and the use templates established earlier in the project take much of the work out of this task. The PMO's lack of templates and an orchestration system make this one of the most difficult service creation tasks.

Table 6: Sources of service creation process time-savings

Conclusion

For MNOs, the cost of delaying a move to virtualization is clear: it will delay service creation/revenue and much-needed measures to significantly reduce capital and operational expenses as network operators ramp up for the surge in mobile data and M2M traffic. By moving to an NFV-based solution now, ACG Research believes that MNOs can realize their ROI within the couple of years of deployment and greater savings over the next five years including:

- 67 percent lower TCO for large-scale consumer broadband services;
- 53 percent lower TCO for M2M services;
- Nearly two-thirds shorter service creation times.

These savings, however, are predicated on a robust NFV solution that offers critical capabilities such as a function-clustering architecture, dynamic capacity scaling, collapsed functionality, service function chaining, and service orchestration.

About ACG Research

ACG Research is an analyst and consulting firm that focuses in the networking and telecom industry. We are boutique firm; our smaller size allows our analysts, who have advanced academic degrees and extensive business experience, to focus on all sectors of the telecom industry. This approach enables us to deliver a more customized consulting experience for our clients around the globe.

Using disciplined methodology, we provide our clients with best-in-class quantitative market sizing, business case analysis and custom consulting projects and research. www.acgcc.com

About Affirmed Networks

Affirmed Networks is the leader in virtualized Mobile Networks with over 20 customers and 40 trials underway. Provides a complete, consolidated vEPC solution that runs together on a single, virtual hardware instance for better performance, scalability, and cost featuring fully virtualized instances of: SGSN, MME/SGSN to support 2G,3G,4G, LTE and VoLTE; GGSN, SGW, PGW; WiFi Access functions: ePDG, TWAG/TWAP; Policy Control functions: PCRF, OCS, PCEF; and more.

It is the only vEPC solution to support Dynamic Capacity Scaling. Operators can configure KPI's in the system to trigger the SGSN/MME or GGSN/S-GW/P-GW/VAS VNF's to add/remove Virtual Machines automatically in the operator's data-center. It also collapses in one solution DPI and all the multi-VAS functionality required by mobile operators to provide high quality and secured mobile Internet services such as content optimization, adaptation and caching, content filtering, parental control, and malware/phishing protection or NAT/ subscriber FW. Services can be easily and quickly stitched in to a workflow for each individual end-users as a service chain. For more information, please visit www.affirmednetworks.com

About VMWare

VMware is a global leader in cloud infrastructure and business mobility. Built on VMware's industry-leading virtualization technology, our solutions deliver a brave new model of IT that is fluid, instant and more secure. Customers can innovate faster by rapidly developing, automatically delivering and more safely consuming any application. With 2014 revenues of $6 billion, VMware has more than 500,000 customers and 75,000 partners. The company is headquartered in Silicon Valley with offices throughout the world and can be found online at www.vmware.com