White Paper

# Economic Benefits of Virtualized Evolved Packet Core

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## IDC OPINION

Mobile network operators (MNOs) worldwide are actively transitioning their virtualization strategy from trials to a more concrete software-controlled programmable environment. The objectives are clear – increase network utilization, realize cost efficiencies, adopt simpler pay-as-you-use purchase models for network functions, and enable new service opportunities with an increased level of agility and simplicity. When it comes to network virtualization, tier 1 MNOs are undertaking networkwide transformation projects first and then offering services. On the other hand, tier 2 and tier 3 MNOs are initially targeting specific geography needs-driven use cases to test and adopt a virtualized Evolved Packet Core (vEPC) architecture in their network.

Given the important role EPC plays in ensuring a guaranteed delivery of service with the best possible quality of experience (QoE), it is only appropriate that MNOs see the immediate opportunity to apply network function virtualization (NFV) framework principles to EPC network functions. As the mobile network undergoes transformation and service delivery mechanisms mature, it is imperative for MNOs to understand, identify, and measure the economic benefits of virtualization, and that is the focus of this IDC study. Some of the findings are:

- Virtualizing the entire set of EPC functions is shown to enable the mobile network infrastructure to operate at a higher utilization rate of up to 87%, thereby directly resulting in opex cost efficiencies of up to 25%. Furthermore, the study shows that factors such as the extent of network virtualization and control/user plane separation-driven architectures can result in potential opex cost savings in the range of 20– 40% over a five-year period.
- MNOs are increasingly interested in achieving 5G readiness in their mobile networks by leveraging control and user plane separation benefits, mobile edge computing principles, and network automation. IDC study shows that introducing a distributed vEPC architecture on top of an existing virtualized network will augment opex cost efficiencies by up to 35% achieved by way of reducing backhaul costs and Internet interconnect costs, avoiding network resource idle time, and effectively deploying resources to handle diverse network traffic behaviors.
- A flexible orchestration layer can reduce services time to market (TTM) by simplifying critical capabilities of staging, deployment, automation, interoperability, tuning, and optimization, as well as the pervasive availability of EPC network functions. This IDC study in particular found a promising 67% reduction in TTM to launch new services such as MVNO, private mobile network, IoT use cases, and VoLTE.

## IN THIS WHITE PAPER

This IDC white paper presents the opportunities and challenges facing mobile network operators as they address a shifting competitive landscape brought on by Internet companies that introduce a nontraditional flavor to competition. This will necessitate MNOs to transform their networks, operations, and services and move to an increasingly elastic network that is powered by network function virtualization principles and one that will allow MNOs to make their mobile packet core 5G ready.

## SITUATION OVERVIEW

While virtualization has long transformed information technology (IT) storage and server environments, communication technology (CT) networks have been seen as the bottleneck and last mile to innovation. MNOs must increasingly pay attention to virtualizing their networks; virtualization is needed to improve agility. The worlds of IT and CT must start collaborating in the most nondisruptive, seamless manner.

### The Return on Assets Problem

One of the biggest business problems is to leverage the large capex investment that has gone into the network and having to do that using traditional, somewhat out-of-date operational strategies. Because telecommunications carriers are facing anemic growth in revenue from both fixed-line and mobile telecommunications services, they are strongly inclined to accelerating efforts to reduce the capex and opex of their telecommunications equipment. NFV principles bring the promise of helping MNOs realize the greatest possible return on assets in the least amount of time utilizing smart opex strategies.

MNOs are constantly seeking ways to leverage their network assets to deliver more of the right traffic more quickly and more cost effectively than the competition. Business value drives network change, yet the network is not changing fast enough. Today's network environments contain siloed, purpose-built hardware. These components are burdensome to deploy, maintain, and expand for new services. As the network must respond to traffic demands, the burden is evermore shifted on to the network planning department. Traditionally, they have adopted the strategy of deploying excess capacity within a network. Addressing resource underutilization, increasing network elasticity, and removing excess backhaul resources are new mandates for the network planners. Although NFV brings a huge amount of elasticity or flexibility, making a siloed transformation limits the capabilities of the network even with increased capacity. MNOs need to break barriers by increasing capacity in an ICT ecosystem or a "platform" approach.

Achieving operational efficiencies from innovative network architecture will require a rethink that on the one hand includes people, process, tools, and methodologies and on the other hand includes a consideration of how the network will be planned, designed, run, and managed to support future business objectives. Needless to say, it is imperative for network transformation projects to yield operational cost efficiencies in multiple variable cost items mentioned previously, resulting in a realization of increased cost savings.

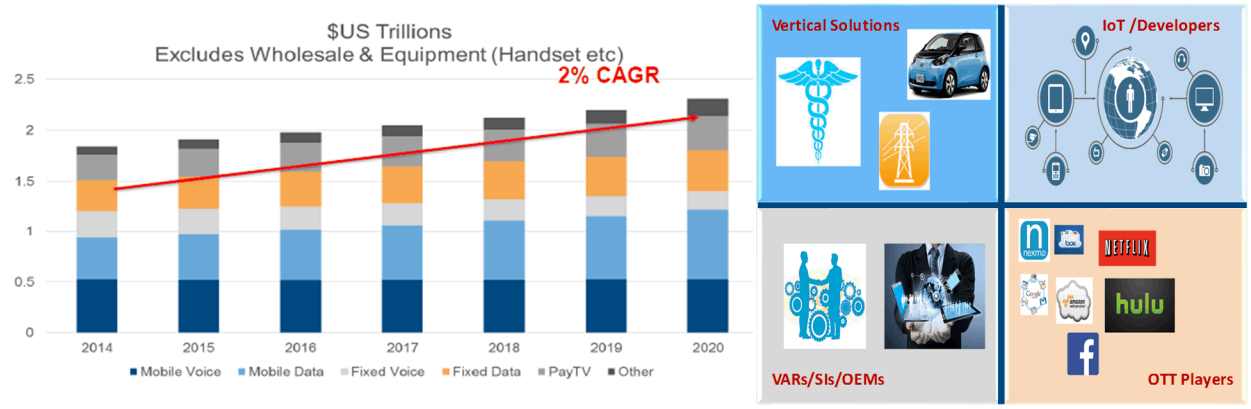
## FUTURE OUTLOOK

IDC estimates that although the ICT industry spending is projected to grow from $1.3 trillion in 2014 to $2.2 trillion in 2020, the revenue from voice and data services will experience slow growth at a rate of

2% (see Figure 1). Without disruptive services or expanding to adjacent industries, revenue opportunity for MNOs and vendors is fairly stagnant.

## FIGURE 1

**Telecommunications Industry Spending and Growth Targets, 2014-2020**




Source: IDC, March 2016

In a growing "mobile first" economy, wireless infrastructure is the lynchpin for all adjacent industry verticals such as industrial Internet, automotive, and IoT-based value-added services. MNOs seek newer revenue streams from these adjacent industries. IDC believes that network virtualization will allow MNOs to deliver innovative services at low-cost points and high speeds.

## 5G Implications on the Mobile Packet Core

In a 5G ecosystem, among the various technology and business considerations and the resulting transformation mandate, the radio and mobile packet core part of the network will be the most widely impacted. Specifically within the mobile packet core, important factors include:

- Control and user plane separation-driven architecture that drives opex cost efficiencies
- Intelligent network slicing mechanisms that can handle traffic pattern-driven idle network capacity situations and can leverage the same infrastructure to offer network-on-demand-based diverse set of services, including private networks
- Automated service orchestration capability to serve fluctuating consumer behavior and to self-heal so as to ensure the highest quality of experience

### *Technology Drivers*

#### Sources of Flexible Network Demand

There is a flood of new traffic types in the network from cloud-based Web 2.0 over-the-top (OTT) service providers, such as Facebook, WhatsApp, and Netflix, that offer diverse rich media and audio and video content, such as gaming videos and sports (e.g., NFL on ESPN). The types of services expected by the consumer are expanding, and to complicate this further, the consumer wants anytime, anywhere access to information.

In addition, short-term bursts in network demand arise from both predictable events, such as rock concerts and sporting events, and unpredictable events — natural disasters and terrorism. Following a temporary surge, demand subsides and the network can go back to its normal state — hence the need for flexible, elastic networks.

Beyond the technology and business requirements from mobile consumers, reliable connectivity and mobility are priorities for industry verticals. There is an onslaught of demand from adjacent industries such as banking, healthcare, automotive, transportation, retail, and media and entertainment, providing a unique opportunity for mobile operators to capture more value with industry-verticalized services in an increasingly connected world.

This rich set of traffic workloads can bring new revenue streams to MNOs but increases the demand on network infrastructure. The challenge facing operators is how to provide a consistent, high-quality experience across all these situations and for all types of content without excessive capital and operational expense.

## *Content Delivery*

The mobile Internet business encompasses:

- Content providers (OTTs such as Netflix)
- Content delivery networks (Akamai)
- Network equipment vendors (Cisco, Nokia, etc.), and off-the-shelf (OTS) vendors (Dell, HPE, Lenovo)
- Mobile network operators (China Mobile, Vodafone, Verizon, etc.)
- Enterprise verticals

Mobile technologies and standards have evolved from 2G to 3G to 4G/LTE and will soon evolve to 5G. As a result, network environments have become an onerous combination of routers, switches, and servers from different vendors. A single MNO may have multiple vendors for different functions in the network; there even may be multiple vendors for the same function. Variety of service offerings (VoIP, VoLTE) and differences in vendor implementations drive interoperability and integration costs. Managing such diversity of network equipment creates a drag on business processes. It is increasingly important to MNOs that vendor solutions are as open as possible in their architecture.

## *Network Orchestration*

Operators are looking to move away from the complexities of this proliferation of purpose-built hardware toward the promise of virtualization. As they look toward buying new hardware or software, MNOs will select orchestration systems that are versatile in handling a landscape of network functions that are multivendor in nature. Network orchestration software runs on commercial server platforms and enables integration with legacy OSS platforms, shifting workloads, management, policy-based security, and compliance. Formerly siloed, purpose-built equipment evolves into virtual functions and orchestration software that runs on standard hardware. The market buying dynamics are such that tier 1s with more ICT resources than their tier 2 or tier 3 counterparts continue to have a larger proportion of homegrown virtualization components and a lesser proportion of external vendor solution elements. However, the opex overheads incurred in maintaining and running homegrown solutions will eventually tilt the cost argument and decision criteria in favor of external vendor solutions.

As the demand for interoperability drives vendors to openness, it commoditizes certain functionalities. Even critical standards-based functions within EPC – MME, PGW, and SGW – in their NFV avatars will need to be interoperable. Operators can take advantage of this to reduce costs, both capex and opex, with the option of purchasing components *à la carte* over bundled solutions.

### *Services Orchestration*

As network functions move from purpose-built hardware to pure software components, service orchestration gains significant importance for its ability to combine various network functions together to build new customer offers. Service orchestration includes software, also running on commercial server platforms, which organizes network elements and functions into services. These services are dependent upon network functions.

NFV makes packet core functions elastic, flexible, and scalable enough to smartly handle large network workloads, whether planned or unplanned. The inroads into the mobile network achieved by NFV and SDN principles have given birth to a new function in the mobile network called dynamic service function chaining (SFC), allowing a paradigm shift in the way MNOs can proactively optimize and tune their network relative to the demands on the network. With this paradigm shift, the interoperability between these neighboring functions will expand the operators' opportunity within the mobile Internet business value chain.

### *Business Opportunities from Virtualization*

The slow growth of revenue from voice and data services can be addressed only when providers bring relevant services enhancing users' lifestyles, thus expanding customer lifetime value. A flexible network, which can be intelligent enough to know which users are in what parts of the network and know their expected behaviors (as allowed by their permissions), can expand the market.

As discussed previously, managing a diversity of network equipment creates a drag on the business. While virtualization can help address this, businesses must still extract value from currently deployed assets, which may have years of remaining lifetime. This is a challenge for the operations team and/or the network planning team. This is where it becomes critical for vendors to deliver as a trusted partner, designing network functions in such a way that operators can still leverage legacy assets.

As the mobile Internet ecosystem matures, vendors in this space will face increasing commoditization and margin pressures. Vendors will have to seek ways to deepen relationships, grow customer share, and develop new annuity streams. IDC expects to see vendors capitalize upon the opportunity to reinvent themselves in the era of the 3rd Platform using the four pillars of mobility, cloud, big data analytics, and social.

## Expected Business Benefits

In this study, IDC interviewed tier 1 and tier 2 operators across the globe to understand factors that influence economic benefits of virtualization in mobile networks. Findings from these interviews were then fed into an economic model built using factors such as number of subscribers, average data usage, service areas categorized by subscriber density, and operational costs that include backhaul, Internet interconnect, facilities, and labor. The model also includes optimization activities, such as network assurance, service assurance, and traffic optimization.

Further, the model was built to simulate the impact of virtualizing various components of a mobile network with special focus on the packet core. This includes virtualizing networking fabric (such as

routers, switches, and application delivery controllers), EPC functions, service orchestration functions (such as provisioning, activation, and fulfilment), network optimization functions, and network monitoring functions.

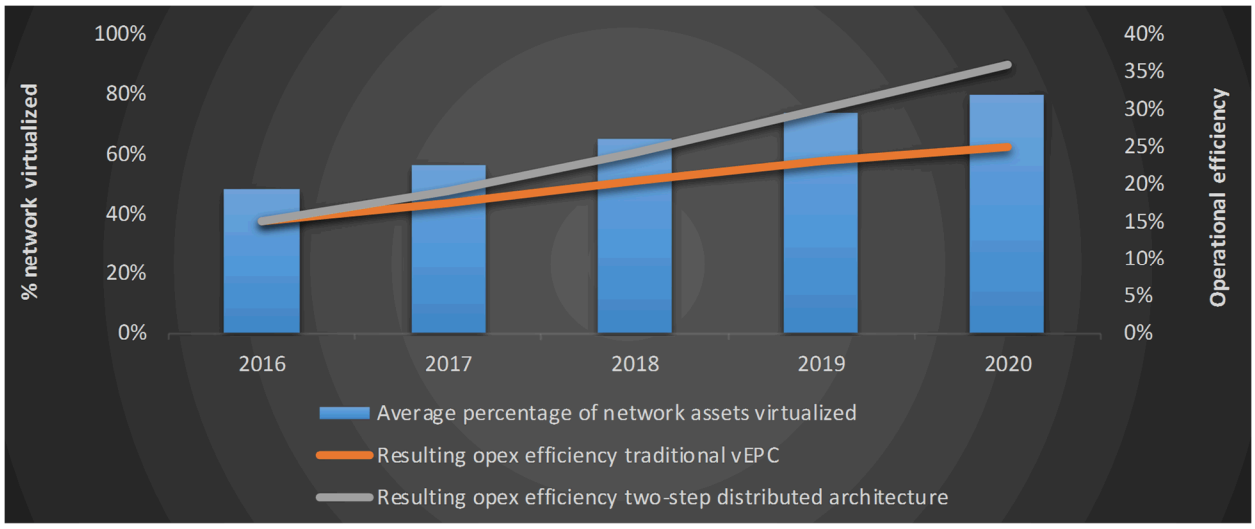
Finally, the model was run for two specific scenarios: a traditional vEPC approach, wherein the network functions are virtualized, even though they continue to run in a localized environment serving the local traffic needs, and a two-step distributed architecture scenario, wherein a distributed architecture is introduced in the second year of operations. A distributed architecture was assumed to be based on a 5G-ready approach of separating control and user plane traffic across geographically distributed datacenters.

There is yet another aggressive alternative – let's call it the flash cut approach – wherein, MNOs will start rolling out vEPC in a distributed architecture from day one. This approach offers opex cost efficiencies of around 41% (by 2020), translating into a 38% five-year cost savings scenario. However, IDC believes that this alternative is inherently unrealistic for a MNO regardless of its tier status because this new technology and the operational practices to support it will require time to prepare for deployment, and as such, this scenario is not discussed in this white paper.

This study considers a varied level of virtualization across network assets that include the networking fabric, EPC network functions, orchestration functions, network optimization, and network assurance components. In Figure 2, EPC constitutes a major part of the percentage of network assets virtualized. Introducing a distributed architecture-based vEPC along with a high percentage of asset virtualization is found to potentially achieve a favorable 36% level of operational efficiencies.

## FIGURE 2

### Virtualized Assets' Cost Efficiency, 2016-2020




Source: IDC, 2016

The results showed that when an MNO adopts a traditional approach of virtualizing network functions including the EPC functions without any changes to the network architecture, it introduces opex cost

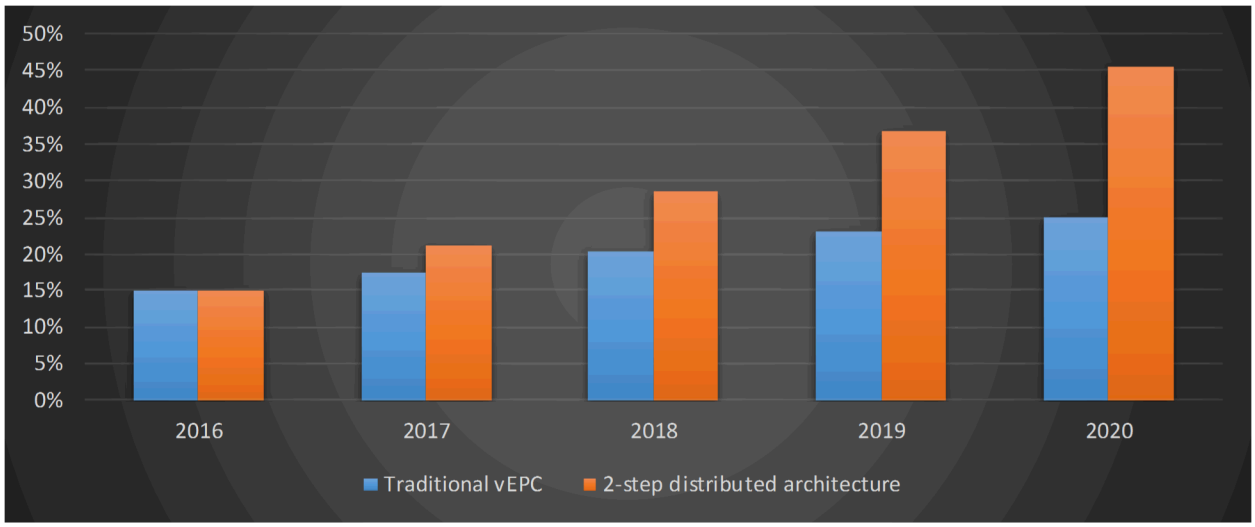
efficiencies of around 25% after five years, resulting in a cumulative opex cost savings of up to 20% over a five-year period.

The second approach involves control and user plane separation of EPC functions, centralizing control plane traffic and distributing user plane functions closer to the service area. When an MNO introduces this new architecture in addition to virtualizing the existing network, the model indicates a bump in opex cost efficiency to reach around 36% after five years, translating into a cumulative opex cost savings increase of around 30% over a five-year period.

Figure 3 compares cost efficiencies and the resulting cost savings that are realized using the two approaches mentioned previously.

## FIGURE 3

### YoY Savings in Opex Component, 2016–2020

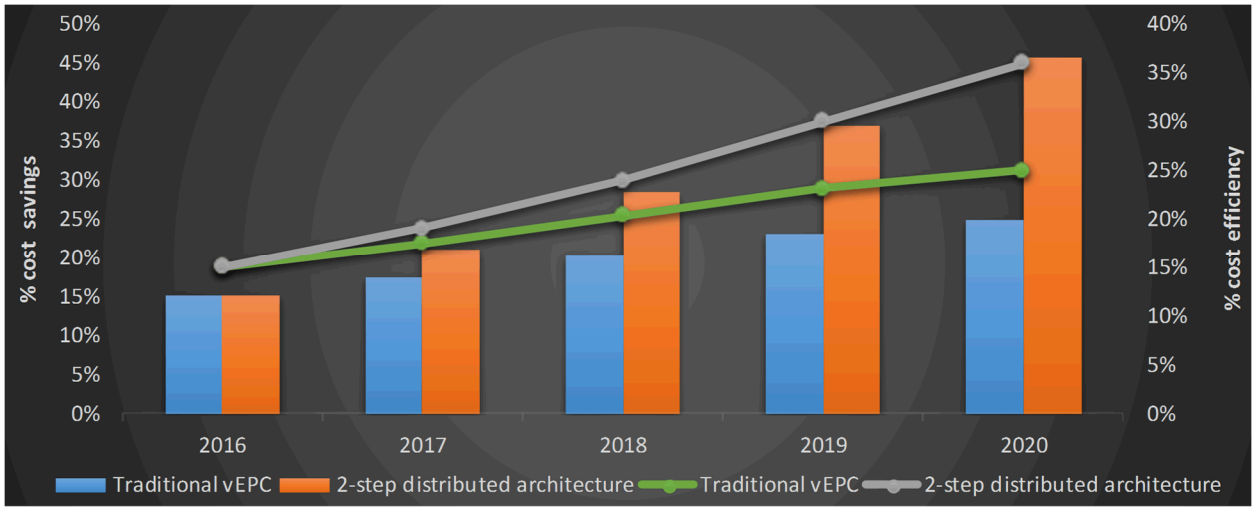



Source: IDC, 2016

Although both scenarios discussed thus far will drive the utilization of the same resources to now serve multiple services, this study finds that the traditional vEPC architecture will find it hard to yield savings beyond a certain point, in this case the 20% mark. On the other hand, as shown in Figure 4, introducing the distributed architecture from 2017 onward increases the utilization of network resources to effect a 36% cost efficiency.

## FIGURE 4

### Opex Cost Efficiency and Resulting Savings Comparison, 2016-2020

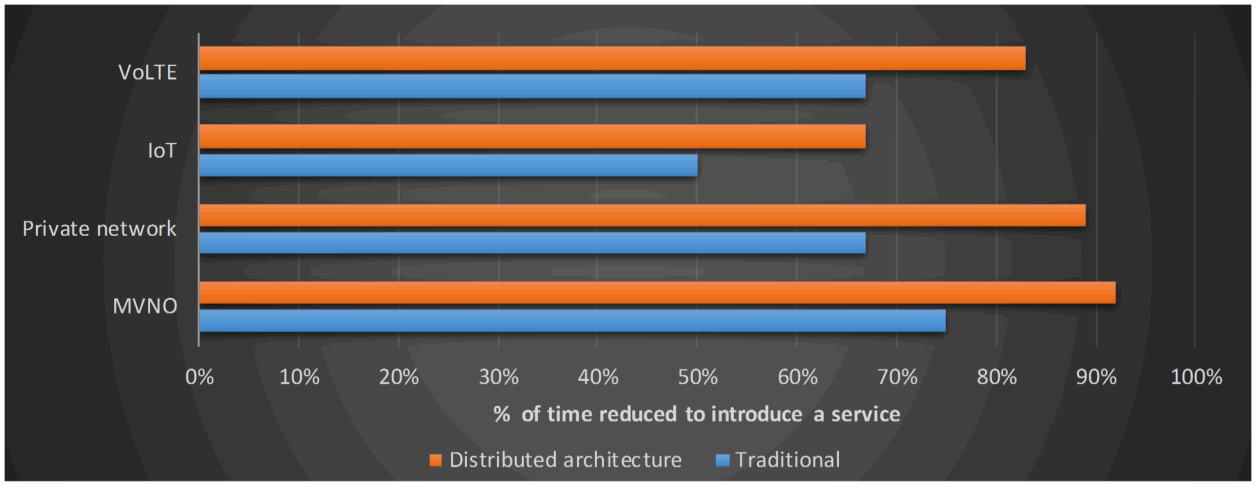



Source: IDC, 2016

Time to market and agility are probably the most important factors that will be closely monitored by the C-suite. It used to take six months to launch a mobile service. Now, with virtualization, launching a service can take just three to four days. Ideally, the operators want to drive that down to a matter of hours. Most of the operators believe that if they virtualize 50-70% of their networks, then they can launch five or six services within the same time window as launching one takes now. Figure 5 indicates the reduction in the time it takes to launch a service in traditional vEPC network versus distributed vEPC network.

## FIGURE 5

### Time-to-Market Efficiency




Source: IDC, 2016

The telecom industry is challenged by a consolidating industry and lower ARPU for the mobile subscriber segment. Declining ASPs and intense competition are leading to lower revenue opportunities for mobile infrastructure equipment. NFV has begun to disrupt the market as value migrates from hardware to software. The integration of network, storage, and compute can bring efficiency of resources and personnel.

## CHALLENGES/OPPORTUNITIES

- **Mindset:** Move from a risk-averse mindset to a more proactive approach, where services are rolled out with the ability to rapidly scale if successful and safely terminate if not. This includes adopting an IT-like sandbox approach – where applications can fail fast and fail safely in isolation and unlock a speedier TTM. This also requires a redefinition of KPIs to measure the progress of networkwide virtualization projects as well as the success of services introduced via a virtual EPC.
- **Orchestration:** Orchestrate traffic across pockets of virtualization silos, maintain QoE levels, and do all this in a cost-efficient manner. Cut across traditional silos to achieve a unified process in service design, provisioning, and management. This includes the operational challenge to migrate through a period of dual infrastructure (virtualized and nonvirtualized) for the same EPC functions.

## CONCLUSION

There is substantial evidence that the orientation of MNOs toward NFV is now a global trend. An EPC network based on NFV principles and more importantly an innovative distributed architecture scheme ushers in a set of smart innovative opex strategies that can extract savings of nontrivial nature from the current and future capex investments. Being late to the party will mean MNOs being less competitive in the global market, and it will have a significant negative effect on mobile Internet value chain. Furthermore, vEPC holds the promise of opening doors for newer business models where MNOs can proactively work with OTT players and industry verticals to create mutually beneficial business value.

## About IDC

International Data Corporation (IDC) is the premier global provider of market intelligence, advisory services, and events for the information technology, telecommunications and consumer technology markets. IDC helps IT professionals, business executives, and the investment community make fact-based decisions on technology purchases and business strategy. More than 1,100 IDC analysts provide global, regional, and local expertise on technology and industry opportunities and trends in over 110 countries worldwide. For 50 years, IDC has provided strategic insights to help our clients achieve their key business objectives. IDC is a subsidiary of IDG, the world's leading technology media, research, and events company.

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