

Making the leap

33 live deployments which prove how NFV has crossed the chasm

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SYNOPSIS

Since coming to prominence in 2012, the ways in which operators stand to gain from implementing solutions based around network functions virtualization have been well-publicised. After the initial wave of excitement around NFV subsided and the hard work began on making it a tangible reality, the industry is now at the stage where real use-case scenarios have been tested extensively in a range of proof-of-concept trials and rollouts have begun in a significant number of operator networks. So what are operators looking to gain from live deployments of virtualized network infrastructure? Have there been any early results to determine the future value of NFV to telecoms companies? Finally, where can NFV go in the future if it achieves its full potential?

This paper will review the successes made by leading service providers in early production adoption of NFV technologies in 2015. It will identify specific deployments of NFV use cases; include feedback from the carriers about the learning they gained from early adoption, and benefits that they expect to gain as the technology matures. The paper will conclude with an appendix containing 33 live use-case service provider deployments of NFV technology, proving its real-world applicability going into 2016.

MAKING THE LEAP

One of the fabled principles of marketing for high-tech industries suggests the existence of a metaphorical chasm which emerges when a new technology begins to take off. Said chasm arrives after an early phase of prosperous growth and rapid uptake of an exciting new product or principle, but before its broader adoption from a wider, larger and dominant market.

Geoffrey A. Moore, a highly-respected technology marketing expert theorised that this gap, this chasm, is where a number of technology principles and tech start-ups fail. Moore said that the tech-savvy few lead the uptake of new products and ideas, to give a product or technology some semblance of market traction in its early days of development. This may see two or three years of comfortable or even impressive growth, yet when uptake by the wider market is needed for more universal success there is a lack of accessibility, continuity or appetite for the lesser tech-savvy majority.

In figure 1, cited from Moore's book "Crossing the Chasm", we can see the psychographic market segments for technology uptake. "Innovators" and "Early Adopters" fuel early growth of a new principle or invention – generally profiled as tech-hungry consumers of new ideas and products with technology playing a central role in both their working and personal life. They're traditionally open to new ideas, new concepts and new products without the need of having been exposed to heavy marketing campaigns or recommendations from those close to them.

These two represent easily identified market segments which would be the natural primary target markets for tech start-ups or emerging technological philosophies. Where this aforementioned chasm exists, which can stop a principle or young company in its tracks, is in between the early adopters and the psychographic market which follows it, also known as the "Early Majority".

Typically, the early majority is a more selective bunch, which is neither as dependent upon, nor as interested in, grabbing the latest and greatest tech as the early adopters and innovators are. They do, however, share the ability to engage with technology as our earlier psychographics demonstrate with aplomb. The early majority must be convinced that the move to a new technology is right for them, traditionally driven by a strong sense of pragmatism. In the business world, a clearly defined and quantifiable benefit or return on investment has to be demonstrable, and usually with references or recommendations from peers in tow.

Usually, hesitation from the early majority arises as a result of the nature of the product and how it integrates itself into existing routines, infrastructures, practises or behaviours. This depends on whether the products or technologies in question are of a continuous or discontinuous nature. Moore defined and differentiated the two in the following passage from "Crossing the Chasm":

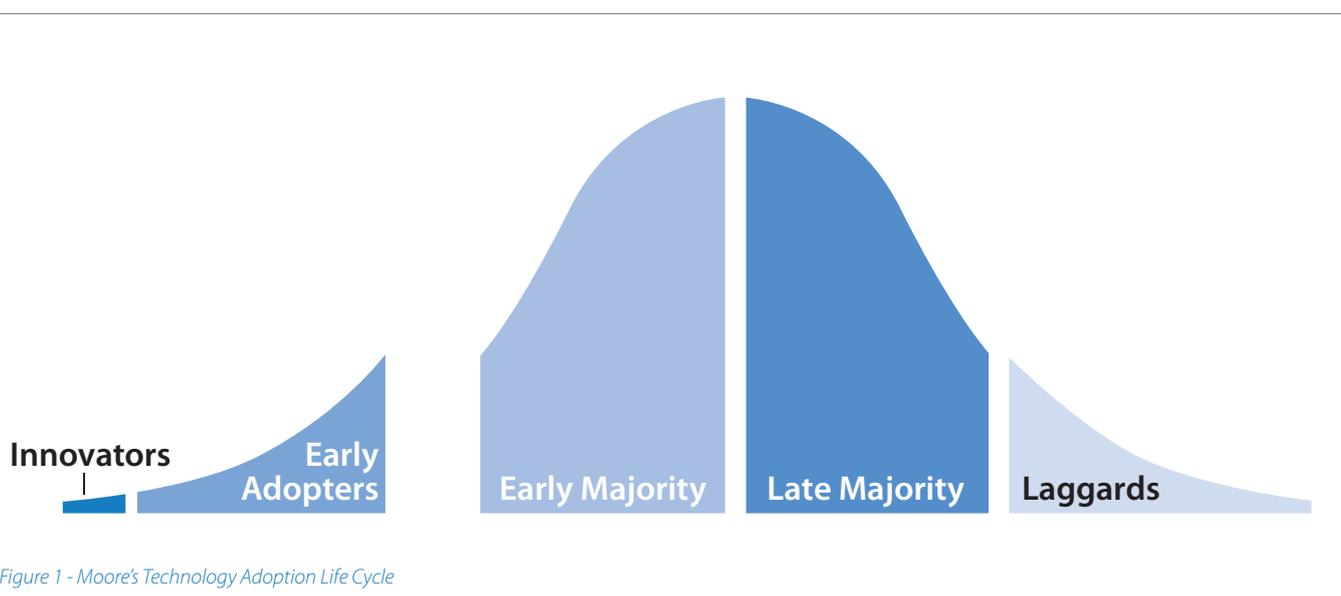


Figure 1 - Moore's Technology Adoption Life Cycle

“It turns out our attitude toward technology adoption becomes significant... any time we are introduced to products that require us to change our current mode of behaviour or to modify other products and services we rely on. In academic terms, such change-sensitive products are called *discontinuous or disruptive innovations*. The contrasting term, *continuous or sustaining innovations*, refers to the normal upgrading of products that does not require us to change behaviour.”

The nature of this change is integral to the successful uptake of new technology and practises. This factor, combined with tangible return on investment, can be seen as the springboard from which a technology leaps across this metaphorical chasm which claims the livelihood of so many new technologies and start-ups.

How would this model look, were we to apply one of the most attention-sapping technological principles in the telecoms industry? Let's apply network functions virtualization to this technology adoption lifecycle model; it would be fair to say that the virtualization tech is metaphorically stood on the precipice between the early adopters and the early majority.

STARING INTO THE CHASM, OR LEAPING OVER IT?

It's been three years since the first ETSI NFV ISG whitepaper was released, in which 13 of the world's major tier 1 operators outlined their desires to see a variety of hardware-based network functions consolidated onto high volume industry

standard servers. In the intervening years the many virtues of NFV implementation have been eulogised countless times and best practise for its plethora of use-cases is still in the process of being developed, with multiple standards bodies or forums/fora dedicated to the advancement of various NFV practices.

For clarity, the 13 originators of the NFV movement were: AT&T, BT, CenturyLink, China Mobile, Colt, Deutsche Telekom, KDDI, NTT, Orange, Telecom Italia, Telefónica, Telstra and Verizon.

The first whitepaper announcing NFV was released in October 2012, and defined the challenge and solutions facing NFV as the following:

“Network Operators’ networks are populated with a large and increasing variety of proprietary hardware appliances. To launch a new network service often requires yet another variety and finding the space and power to accommodate these boxes is becoming increasingly difficult; compounded by the increasing costs of energy, capital investment challenges and the rarity of skills

necessary to design, integrate and operate increasingly complex hardware-based appliances. Moreover, hardware-based appliances rapidly reach end of life, requiring much of the procure-design-integrate-deploy cycle to be repeated with little or no revenue benefit. Worse, hardware lifecycles are becoming shorter as technology and services innovation accelerates, inhibiting the roll out of new revenue earning network services and constraining innovation in an increasingly network-centric connected world.

“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.”

Tying the technology adoption lifecycle model to NFV, we'd probably say that these 13 companies would be the innovators, closely followed by companies like

the 13 originators of the NFV movement were: AT&T, BT, CenturyLink, China Mobile, Colt, Deutsche Telekom, KDDI, NTT, Orange, Telecom Italia, Telefónica, Telstra and Verizon

SK Telecom, Telekom Austria, Vodafone and early adopters who weren't part of the original formation but have pressed on with live rollouts nonetheless.

There's an awful lot that the rest of the industry can learn from the pioneers of NFV, those who have invested intensely into the heavy lifting required to get a new initiative off the ground. NFV, though, is slightly different to other new and shiny technologies, in large because it's been an industry-wide collaborative effort. In rare instances have the majority of stakeholders in an industry worked in such a cooperative way, with multiple companies considered competitors working closely on proof of concept trials and in working groups associated with NFV.

This new philosophy to networking in telecoms has brought with it a wave of anticipation and excitement around its potential to deliver overwhelming efficiency and cost gains – and of course, the opportunity for industry vendors to develop a new generation of infrastructure solutions in this virtualized paradigm.

2015 has seen a deluge of operator activity where the pioneers of the industry have taken the metaphorical leap across the aforementioned chasm. NFV has been sufficiently proven in the field meaning that, for a lot of people, the risk has been sufficiently diminished – it's gone from a presentation slide to a commercial reality. The pioneers have demonstrated that it really can work and, importantly, the decision makers didn't get fired in the process.

All of a sudden, there's a new-found sense of urgency and everything that has been discussed and developed over the past three years needs to be done now. The operators who have made the jump and survived now have a quantifiable business advantage over their peers, owing to the fact that they're making the most of the new technologies at their disposal.

So, who has made the leap this year? Which operators have launched live NFV services, and what have they done? The rest of this paper will be dedicated to highlighting these pioneers; we'll review three specific cases from AT&T, Orange and SK Telecom, discussing how they've begun rolling out live NFV-based services. 2015, however, has seen a raft of live deployments from operators around the world, and the appendices of this paper will detail a comprehensive directory of all 33 of 2015's live rollouts.

AT&T publicly stated its intentions of utilising NFV to develop "Domain 2.0", its next generation infrastructure capable of delivering on-demand network services

AT&T:

One of the earliest public announcements of proposed NFV rollouts came from AT&T. In 2013 the US carrier publicly stated its intentions of utilising NFV, combined with software defined networking (SDN) and cloud technologies to develop "Domain 2.0", its next generation infrastructure capable of delivering on-demand network services while also managing the inevitable boom in traffic from internet of things and cellular data services beyond 4G LTE.

The carrier is also a key contributor and influencer in various industry groups driving the development of NFV. Its employees preside over both the ETSI NFV ISG and the Open Platform for NFV group at the Linux Foundation; while the telco has also been heavily involved with the development of standards and proof of concept trials.

In October 2015, AT&T announced it is actively developing a virtual customer premises equipment (vCPE) solution for its enterprise customers, effectively rendering the physical router redundant.

"We're working... to enhance our Managed Internet Service on Demand, so customers don't need a router at their location. With the support of their technology, customers will experience faster installations and more dynamic control of their network service," said Roman Pacewicz, senior VP for AT&T's Marketing and Global Strategy.

AT&T has also said its vCPE plans will give customers the ability to choose network functions they want to utilise without the need for additional hardware being delivered, installed and configured – a service delivery process which can often take months instead of days or hours.



ORANGE

Another of the signatories on the first NFV whitepaper released in October 2012, Orange has been another active contributor to the development of the technology and its associated standardisation. In early 2015 Orange publically discussed the operator's forthcoming NFV-based service delivery product targeted at small and medium business owners.

After collaborating with a number of industry suppliers on developing an SDN-driven architecture with virtualized network functions (VNFs) chained together over the top through a management and orchestration platform, Orange's easyconnect service offerings provide customers with a self-care portal for selecting and deploying network services, such as an IP-VPN, firewalling and web-content filtering.

While the original service requires physical hardware for customers to be able to access the self-service portal; Orange is in the process of demonstrating the potential of virtualizing the customer premises equipment as an enterprise service. At the OPNFV Summit in November 2015, the telco demonstrated a vCPE based on common off the shelf hardware (COTS) while delivering cloud-managed network services in both on-premise hardware and in cloud-based virtual environments.

Telecoms.com spoke to Orange's Noel Foret, who explained some of the NFV philosophies at the operator. They said the technology is there, but it's now about the mind-sets of employees and management.

"We see it more in terms of interest from the business than the technology. There are a lot more things to do before it is official, and there is a lot of change in our processes. So it is not the technology that could help that because we are speaking about transformation, the technology is the catalyst. We see that there'll be a new way of performing business by implementing NFV.

"A lot of things are changing the deployment of NFV and SDN. Over the last year we've heard a lot of open-source, transformation and DevOps – so even if we had a specific solution in mind it has to be reshuffled because the way of working has changed and is still changing. It's not only a skill problem; it's a company-wide problem with mind-sets.

"Within Orange we are informing people of the dramatic changes we are about to witness with the softwarisation of the network, through cloud, SDN and NFV which provides us with the means of gaining flexibility. We've had a lot of evangelisation, but in order to make the management and employees adhere to the change we need more education. The technology is there, this is not a technical problem anymore, it's about the business leaders going feet first into the technology and having the drive and courage to do so.



SK TELECOM

Despite not being one of the original signatories on the NFV whitepaper back in 2012, SK Telecom went public in 2015 with the work it is doing on virtualizing the evolved packet core, the core network for LTE.

With aspirations of 5G rollouts by as early as 2018, in February it stated that it will be rolling out the vEPC to enable more agile and accommodating performance for internet of things (IoT) data traffic management. SK said that by utilising the scalable distribution capabilities of NFV, IoT-originated data of varying sizes is able to be managed with greater network efficiency. SK's head of network division, Jong-bong Lee, said at the time:

"SK Telecom is preparing for the IoT era through active business collaboration. Through the application of virtualised network technologies, we are confident that we can deliver a truly consistent and innovative network as well as superior service quality."

Come August, SK followed through on its promise by announcing the live deployment of its vEPC with an eye on being next-generation ready. By rolling out the vEPC function based on standardised server hardware, and with network functions and infrastructure managers sitting on top of the NFVI (NFV infrastructure), SK says it can now automatically and intelligently manage its legacy LTE core network while readying it for IoT and new levels of video data streaming.

SK is now able to dynamically allocate various computing, memory and storage resources as necessary based on each function's requirements in real-time. "The result is that the network gains a high degree of scalability and improved efficiency in resource usage," said a partner of SK at the time of the announcement.

It is this scalability and efficiency gain that reflects the original principles of NFV, and SK is demonstrating that the well-marketed virtues are indeed achievable and not just a mirage in the desert.



CONCLUSIONS

We've examined three case studies from three different continents representing three of the world's largest service providers approaching NFV from different angles for differing reasons. We've seen that AT&T is transforming its network architecture from top to bottom, tagging everything today as legacy and starting afresh with Domain 2.0. It is utilising NFV extensively alongside SDN to create an agile and elastic network capable of providing its clients with on-demand enterprise services; but it's also looking at creating an upgraded network with the ability to manage traffic generated by LTE data consumption and the next generation of cellular services.

Orange, meanwhile, has deployed NFV for its "easyconnect" business services subsidiary. It has rolled out virtualized customer premises equipment, making redundant the need for additional hardware and routers on-premises when delivering new services. As oft seems the case with NFV after sophisticated management and orchestration implementation, Orange has developed a self-service capability for its customers, which can deploy on-demand various network features like firewalling, IP-VPN and web-content filtering.

SK, meanwhile, is utilising NFV as a big factor in its slog towards 5G. Given its ambitious time-frame on delivering 5G services in time for the 2018 Winter Olympic Games, it is unsurprising to see the telco among the first in the world to go live with NFV. In this instance, it has virtualized its LTE core network, to allow significant efficiency and resource gains throughout its infrastructure, providing compute, memory and storage resources in real-time on an ad-hoc basis.

What these three case studies demonstrate is that there is now a level of tangibility to NFV; after years of talk, proof of concept trials and hyperbole around its potential, the industry is starting to see benefits.

The most logical conclusion to draw from this is that NFV is no longer the prophecy of a vague, utopian, virtualized future; it is here, and the early adopters are getting a head start on the majority.

The following 33 cases should prove how far NFV came in 2015 and how fulfilment of NFV's potential is more about pressing ahead from a business angle than a technological one.

APPENDIX: The 33 service provider rollouts of 2015 – who's made the leap?

The following list reveals, in chronological order, the 33 live use-cases of NFV by global service providers in 2015. The companies involved range from original signatories of the NFV whitepaper in 2012 (the "innovators"), to operators who have moved early to adopt NFV tech as soon as possible (the "early adopters").

Click on the project name for further information.

23 January 2015 - [vEPC deployment by Vodafone Spain](#)

5 February 2015 - [vEPC deployment by SK Telecom for IoT readiness](#)

20 February 2015 - [Four NFV deployments by Telekom Austria: vEPC, vIMS, vSBC & vVoLTE Application Server](#)

2 March 2015 - [Deutsche Telekom commercially deploy pan-European IP network with cloud VPN](#)

12 March 2015 - [Century Link commercially deploy Cyan's Blue Planet NFV orchestrator](#)

16 March 2015 - [LG U+ announced vEPC launch with Affirmed Networks](#)

18 March 2015 - [vSMB deployment by Orange](#)

7 April 2015 - [Two NFV-based VoLTE deployments by Vodafone Germany based on IMS Telephony Application Server \(TAS\), Application Gateway \(AGW\) and Media Resource Function \(MRF\)](#)

27 April 2015 - [VoLTE deployment by Telefonica Germany](#)

13 May 2015 - [vE-CPE commercial deployment by KT](#)

18 May 2015 - [vEPC deployment by ASPIDER-NGI](#)

27 May 2015 - [Three vRNC deployments by Etisalat](#)

16 June 2015 - [AT&T NFV-based MVNO service commercial Deployment](#)

22 July 2015 - [Three NFV uses for VoLTE by Vodafone Italy – including vIMS](#)

1 September 2015 - [Verizon introduces SDN security feature](#)

8 September 2015 - [Verizon launches SDN managed service with Cisco](#)

22 September 2015 - [SK Telecom deploys Samsung's vIMS & vEPC](#)

22 September 2015 - [China Mobile partners with Huawei to pilot deployment of the cloud-based core network](#)

24 September 2015 - [Bayonette Partners With ALTEN Calsoft Labs to Develop vCPE Solution Based on Linux Containers](#)

30 September 2015 - [AT&T and Brocade Join Forces to Extend Network on Demand Platform](#)

30 September 2015 - [AT&T Expands Network On Demand with Juniper Networks](#)

30 September 2015 - [AT&T Launches Managed Internet on Demand](#)

14 October 2015 - [Colt deploys DCNet as a Service \(DCNetaaS\)](#)

20 October 2015 - [CenturyLink Announces Virtualization Plans](#)

09 December 2015 - [BT Accelerates "Cloud of Clouds" With New Hosted Riverbed Service](#)



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