Whitepaper prepared for:

Hewlett Packard Enterprise

The impact of telco cloud transformation and hybrid network management on CSPs' operations

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1. Executive summary

1.1 Introduction

Analysys Mason has been commissioned by Hewlett Packard Enterprise (HPE) to prepare a whitepaper analysing the operational changes that network virtualisation will demand of communications service providers (CSPs). Virtual and hybrid next-generation networks (vNGN) must be properly operated and maintained to meet CSPs' business objectives for service innovation in the digital economy. In particular, this report analyses the impact that telco cloud transformation – specifically network function virtualisation (NFV) and software-defined networking (SDN) – is likely to have on various elements of CSPs' operations lifecycle.[1]

The main impacts that telco cloud transformation will have on CSPs, including the impact on their operations, are illustrated in Figure 1.

Figure 1: Various impacts that telco cloud transformation will have on CSPs [Source: Analysys Mason, 2016]
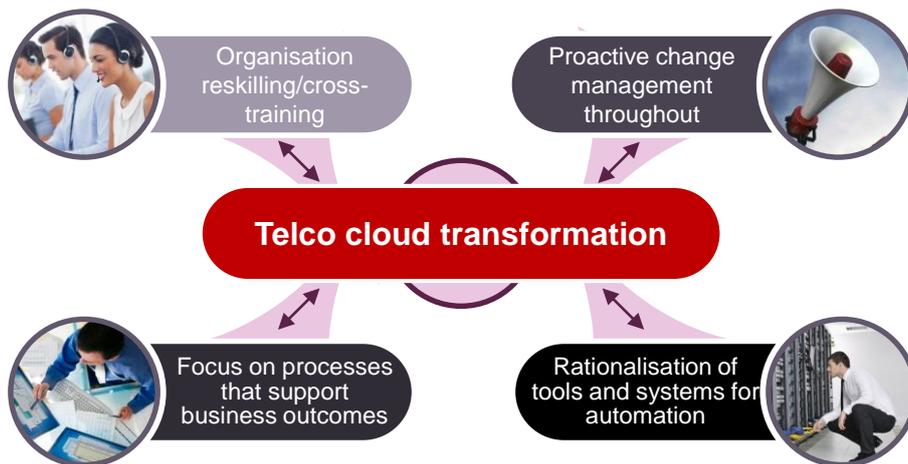
We expect that most CSPs will implement the NFV/SDN telco cloud transformation (referred to as 'telco cloud transformation' in the rest of this report) in three distinct phases, which we refer to as *virtualisation* (phase 1), *orchestration* (phase 2) and *cloud native* (phase 3). Most of the changes to CSP operations will happen in the orchestration phase, which typically starts in year 2 of the transformation and is likely to last more than five years.

Many benefits that CSPs expect to reap from telco cloud transformation will only materialise over time, as they progress through the three phases. Indeed, we believe that CSPs are likely to experience years of more-complex operational challenges than those they are facing today before they enter the 'virtual nirvana' in phase 3 of the transformation. However, CSPs will have to overcome many challenges in phase 2 to eventually reap the benefits of the digital future in terms of better service agility, support for an expanded set of digital services and better cost structures. CSPs must be aware that things could become *much worse* before getting *much better* as they implement the telco cloud transformation.

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[1] To produce this report we conducted in-depth research, including telephone interviews with several leading CSPs in the domain of network virtualisation.

1.2 Telco cloud's impact on CSPs' operations will be extensive but not immediate

Overall, telco cloud transformation will have a very significant impact on CSP operations, but that impact will not be immediate and its scope and nature will vary widely across different CSPs and markets. Furthermore, not all elements of CSPs' network virtualisation operations lifecycle will be affected equally and at the same time. This report focuses on the impact that telco cloud transformation will have on service creation, order management, procurement and purchasing, provisioning and acceptance testing, and troubleshooting and maintenance. We put most emphasis on the changes that will happen in the orchestration phase, while CSPs are running hybrid networks, because this is when CSPs' operations will undergo the most extensive changes.

► *Service creation*

For service creation processes to become more agile, the current practice of 'versioning' and 'requirement freezes' must fade away in favour of a continuous and highly automated service creation process based on templates and information models. However, through much of the orchestration phase, service creation will continue to involve a mixture of automated and manual activities, dependent very much on the operational specifics of particular use cases.

► *Order management*

Classic order management (along with inventory management systems) will evolve to, or be replaced by, more-sophisticated service orchestration capabilities. Order management has relied on static catalogues in the past, but that will change once NFV/SDN is implemented. A more-automated fulfilment process will provide immediate benefits, including more-direct customer control over ordering, and better integration with service assurance systems will shorten acceptance test intervals and reduce time to cash.

► *Procurement and purchasing*

The impact of telco cloud transformation on procurement and purchasing must be considered separately, as the impacts will be of varying magnitude and will follow different schedules. With a proper onboarding process, VNF (virtual network function) purchasing will change from weeks or months to minutes as early as phase 1, but procurement may remain a lengthy process for a long time, due to regulatory imperatives and the complexity of ensuring compatibility and compliance of virtual with legacy infrastructure. CSPs must start revamping request for proposal (RFP) processes early on in the orchestration phase, and must develop ways to test and certify compatibility with their telco cloud platform.

► *Provisioning and acceptance testing*

As CSPs complete their transformation into digital service providers in phase 3, provisioning and acceptance testing will become simpler and quicker. Both processes will evolve from distinct, time-consuming operations (within service fulfilment and service assurance, respectively), to automated, closed-loop activities as part of service turn-up.. Provisioning will be automated based on policy and performance requirements detailed in the service description, while acceptance testing will likely be integrated with VNF onboarding processes. While most CSPs expect the order-to-cash flow-through to be fully automated in phase 3 (cloud native), getting to the point of complete, automated flow-through provisioning will be challenging in the hybrid world.

► *Troubleshooting and maintenance*

CSPs, and particularly large ones, will invest in dynamic and converged end-to-end service fulfilment (SF) and service assurance (SA) systems and processes. We expect this unification process to be finalised only in the later stages of phase 2.

1.3 Summary of recommendations

Based on the key findings of our research, we have the following recommendations for CSPs:

- **CSPs should target one or two 'quick wins' that will help them gain revenue, give the staff experience managing the transformation and refine process and organisational changes.** The hybrid or orchestration phase will be particularly challenging for CSPs. In order to accelerate this phase and generate tangible business benefits early in the transformation, these 'quick wins' should be identified during phase 1.

- **CSPs must actively manage the telco cloud transformation from the start to meet clear business objectives.** They should develop most likely scenarios and per-service business cases during phase 1, so that they can focus on features/services that will provide immediate benefits for CSPs and their customers and help set the priorities for the major operational transformations of phase 2.

- **CSPs should focus on transforming processes that directly support business outcomes in phase 2.** The three critical processes that support business outcomes are service creation, service fulfilment and service assurance. Successful transformation will require pragmatic, long-term and customer-centric approaches to systems and tools rationalisation, critical process re-engineering, and organisational reskilling and cross-training. CSP change management must be incremental and supported by proactive, ongoing engagement and communication with employees.

2. Telco cloud operations will have a major impact, but the transformation will take a number of years

If CSPs want to increase their relevance and transform into digital service providers, it is critical for them to use virtualisation techniques from IT to rethink how communications networks are built and managed.[2] However, CSPs' success in the digital economy depends on them deploying a flexible and agile architecture that can dynamically and holistically manage physical and virtual resources to support service innovation at scale. We expect that most CSPs will implement the telco cloud transformation in three distinct phases – which we refer to as *virtualisation*, *orchestration* and *cloud native* (see Figure 2).[3]

Figure 2: Key phases and estimated timeframes for virtualisation of a hypothetical CSP (a leader in telco cloud transformation)[4] [Source: Analysys Mason, 2016]

► *Phase 1 – virtualisation*

Phase 1, which we refer to as the 'virtualisation' phase, refers to roughly the first two years of a CSP's telco cloud transformation. During this phase, CSP virtualisation efforts are limited to dealing with VNFs as standalone functions running on commercial off-the-shelf (COTS) hardware, and trialling different approaches to onboarding and managing VNFs. In this phase, CSPs should also develop business cases and define and quantify desired business outcomes in parallel with their technology trials. While it will not be easy to calculate return on investment (RoI) and total cost of ownership (TCO) for NFV/SDN transformations, it will be an essential step in helping CSPs to prioritise business and operations outcomes that can generate incremental revenue, and to plan properly for success in phase 2.

With a few exceptions, most CSPs will expect operational support from vendors during this phase, including custom development and systems integration, but also possibly business and technology consulting and managed services or hosting.

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2   See more at: http://www.analysysmason.com/About-Us/News/Newsletter/NFV-SDN-digital-economy-Jan2015/#05%20January%202015.

3   Note that various industry players use variations on Analysys Mason's three-phase telco cloud timeline. HPE, for example, breaks the timeline into four phases it calls 'decouplling', virtualisation', 'cloudifying' and 'decomposition'. We view the decomposition as an aspect of our phases 2 and 3.

4   Several most advanced CSPs started phase 1 in 2013 and entered the orchestration phase last year. However, most other CSPs were still in phase 1 when this report was being written.

In phase 1, even the most aggressively transforming CSPs will focus on testing and deploying the underlying infrastructure, rather than orchestrating VNFs.[5] For most CSPs, the telco cloud transformation will have a minimal impact on operations in this phase. Some smaller CSPs will rely fully on vendors to handle the changes in operations; others will operate small network operations center-like (NOC-like) teams to deal with a few VNFs initially; a few large CSPs (e.g. Deutsche Telekom, AT&T) will create larger separate teams to manage phase 1. Standardisation of VNF onboarding is the key task that CSPs must complete in order to proceed to phase 2 of the transformation – orchestration.

► *Phase 2 – orchestration*

Phase 2 of the transformation, orchestration, will require at least five years to complete because it is much more complex than phase 1. In this phase, the number of VNFs will increase substantially and will no longer be limited to low-risk functions. CSPs will begin orchestrating VNFs in service chains and significant organisation and operational changes will be required to reap the benefits of automation. The impact that the transformation has on operations will become much more pronounced in this phase, whose key goals are performance management, service assurance, and automation (of service creation, order fulfilment and network configuration, for example). This phase will be particularly challenging for CSPs as they will have to master the network management of hybrid physical/virtual, multi-domain (packet, optical, mobile; access and core; geographically distributed), multi-vendor networks. Managing change will be fundamental to phase 2.

► *Phase 3 – cloud native*

In phase 3, cloud-based networks will be the normal mode of operation; only in exceptional cases will CSPs base operations on physical functions. Many operational changes will have been done in phase 2. White boxes/disaggregated functions will be the goal, except where performance is critical and CSPs need purpose-built hardware (e.g. core IP/optical). All the main benefits of virtual transformation (service agility, automation, cost efficiency) will be realised in this phase.

In the remainder of this report, we analyse the impact that telco cloud transformation will have on CSP operations in all three phases, with particular emphasis on phase 2, as this is when we expect most of the major changes to CSP operations to take place. Synergy between people, processes and technologies enables agile services creation, monetisation and decommissioning which are the hallmarks that indicate a CSP has transitioned to phase 3.

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[5]   For example, TEF UNICA and AT&T AIC started with basic cloud infrastructure.

3. CSPs must change operational processes to support new business and operational objectives

3.1 The industry lacks consensus on telco cloud operations

CSPs know that they need a new approach to network operations in order to enable new digital economy services, but the industry has yet to agree on the best way to integrate physical–virtual function management, control and orchestration to support automation. CSPs' business and operational objectives, specifically those for improved service agility and enabling new digital economy revenue, should drive functional and technical requirements for the integration and automation of hybrid physical–virtual network resource management, control and orchestration. Existing service assurance, service fulfilment and network management systems and NFV orchestration and SDN control systems must interwork if networks are to scale and change on demand.

The way that CSPs transform their operations support systems (OSSs) on their journey to become digital service providers will depend on many variables, including what type of CSP they are, their virtualisation strategies, the breadth of domains in which they operate, and the speed at which they innovate. Each of these variables will contribute to the overall impact that NFV/SDN have on CSPs' operations.

We expect a range of scenarios to emerge during each of the three transformational phases. These scenarios will evolve through the phases, and particularly as more CSPs start tackling the operations support challenge in phase 2.[6]

To further industry dialogue on the OSS challenges that CSPs face in the context of virtualisation, this report analyses the possible impact of telco cloud transformation on various elements of CSPs' operations lifecycle, as illustrated in Figure 3. While we comment on the OSS changes that may happen throughout the transformation, much of our focus is on the 'orchestration' phase.
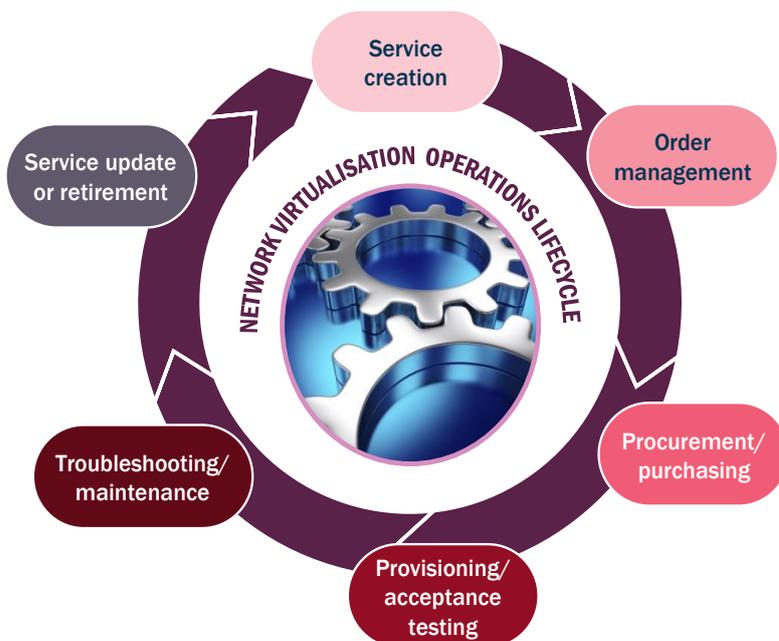
Figure 3: Elements in the lifecycle of network virtualisation operations [Source: Analysys Mason, 2016]

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6   At the time of preparing this whitepaper, only a handful of CSPs had reached Phase 2.

3.2 Service creation in the hybrid state: CSPs will see few benefits from next-generation service creation before the end of phase 2

The ultimate goal of virtualisation is for the entire service lifecycle to become more agile, including faster development of internal systems to support new services and reduced time to market for error-free services, regardless of whether they are based on owned network resources or devised in collaboration with third parties. For service-creation processes to become more agile, the current practice of 'versioning' and 'requirement freezes' must fade away in favour of a continuous and highly automated service-creation process based on templates and information models. However, through much of the orchestration phase, service creation will continue to involve a mixture of automated and manual activities, dependent very much on the operational specifics of particular use cases.

The most impactful changes to service creation will happen towards the end of phase 2 or early in phase 3, because: (1) until then, only a small portion of the infrastructure will be capable of being automated, and (2) much of the benefit will come from the ability to reuse and modify templates to create new services and variations on existing services to meet the needs of specific customer segments. The service descriptions are like 'recipes' that CSPs will create over time and compile into a centralised service catalogue ('cookbook').

> *"We are pushing to a data model-driven approach for service specifications. We want to specify models in YANG and have a full YANG approach to create service models, create test vectors, etc.* **But this is not in line with OSS vendors in the market today.** *The traditional players generate most of their revenue from professional services, including integration tasks. Most of the service revenues will go away if we can push our model through – we should be able to program our own service models, for example, not rely on vendors."*
> **Vice President in charge of telco cloud transformation at a large global operator**

When more infrastructure is virtual/remotely controllable and a central service catalogue has been built, agile service creation will expand to comprise everything from developing the initial idea to creating a service model, assigning the service parameters, testing the new service definition and then adding it to the catalogue. Ultimately, as illustrated in Figure 4, CSPs will have the option to modify services fairly easily and then expose new offers to customers, who can then choose to purchase them. CSPs that have multiple operations in different countries will benefit from standardised service offerings thanks to the centralised service catalogues.[7]

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[7] Every opco of a CSP with operations in multiple countries will have a variant of the same multi-tenant catalogue, to account for market differences.

**CSP creates new and modified services
from existing templates**

*Figure 4: Illustration of
the service-creation
process in a virtualised
environment, paired with
a user-controlled
ordering process
[Source: Analysys
Mason, 2016]*

Customer tries the new service, likes it, buys it

3.3 Order management and related service assurance in the hybrid state: CSPs will be able to automate the fulfilment process

Once a service 'recipe' has been added to the service catalogue 'cookbook', it is available to be ordered through the order-management capabilities of the service-fulfilment systems. Classic order- (and inventory-) management systems will evolve to, or be replaced by, more-sophisticated service-orchestration (SO) capabilities, which are the customer-facing, customer-centric order and inventory-management functions of service fulfilment. Service activation will be triggered by SO based on the service descriptions in the catalogue, but abstracted from the network resources via network orchestration.

CSPs can experiment with 'try before you buy' ordering options for customers and which they can enable in the early stages of the transformation. This is a way to allow customers to easily try out new features or services for a given time, after which they can decide whether or not to buy the service. Giving more control and self-service options to customers will improve customer satisfaction, while increasing revenue and lowering costs for CSPs.

The immediate benefits of giving customers direct control over ordering will be facilitated by a more-automated fulfilment process that is abstracted from, but coupled to, the network orchestrators that CSPs will implement in phase 2. Automated decomposition and translation of customer requirements abstracted from network resources will enable the network orchestration system to automatically pick the appropriate resources. Order management has relied on static catalogues in the past, but that will change once NFV/SDN is implemented. Figure 4 illustrates how a new service could be quickly created, tested, added to the catalogue and promoted to customers. A customer could then trial the service and, if satisfied, buy it (rather like mobile users try out and buy smartphone apps today).

We expect service fulfilment processes, including order management and activation systems, to merge with service assurance systems to create a dynamic end-to-end closed-loop system. Once a service order has been

fulfilled, it can be automatically tested through the integrated assurance system before it is activated. Creation of this integrated fulfilment and assurance operation will be a significant challenge in phase 2.

3.4 Procurement in the hybrid state: Tier 1 CSPs will drive major changes in procurement and purchasing

While the timescales for VNF purchasing can reduce from weeks or months to near real time[8] as early as phase 1, procurement is likely to remain a lengthy process even in phase 3, due to regulatory requirements that CSPs may face in all or part of the territories in which they operate.

RFP processes today tend to be protracted affairs during which multiple departments within a CSP collaborate to create an elaborate document with hundreds of pages of requirements and objectives; send the document to a list of vendors; shortlist several vendors based on their responses; then test a small number of solutions, first in the lab then in the field. Depending on the technology the CSP is purchasing, this process can take 24 months or more.

CSPs must revamp and streamline their RFP procurement processes, to enable them to compete against more-agile non-CSP rivals and to assure the compatibility and compliance of virtual with legacy infrastructure. The revamping process will gain urgency early on in the orchestration phase. Initially, the procurement process will become more complex, resulting in the emergence of a new type of partnership between CSPs and their primary vendors. During the telco cloud transformation (particularly in the hybrid state, i.e. phase 2), CSPs will have to buy both hardware and software while ensuring that different pieces of software work together without any glitches. CSPs will focus less on a vendor's paper RFP response and more on requiring certification of test results or proofs of concept which demonstrate the compability of a particular software function with the CSPs' infrastructure.

Those leading-edge CSPs which are now embarking on the orchestration phase face the worst of both worlds: our research indicates that they create a lengthy RFP as before, receive responses that run to hundreds of pages and then go through protracted proof-of-concept (PoC) and certification phases to test compatibility of the full vertical stack of software and end-to-end service chain, which may require custom development by one or more vendors.

> *"We are trialing a mix of classical RFP and asking for proof of concepts based on a given business use case. It is not yet working ideally because a lot of work is still needed after selection to ensure the chosen software is working."*
> **Director of technical and network strategy of a large global operator**

To address these issues and ultimately improve the procurement process, a few large CSPs are investing heavily in vendor-neutral integration platforms. More specifically, in order to avoid single-vendor lock-in, these CSPs are: actively involved in OPNFV, OSM and other open-source initiatives; participating in multi-vendor ecosystems led by suppliers (for example, HPE's OpenNFV or Intel's Network Builders); establishing their own ecosystems; or using a combination of these mechanisms. The goal is to create an integration platform based on telco-grade standardised building blocks while filling in gaps in open-source initiatives.

To gain experience in what the platform will need to do, the CSPs often focus first on specific use cases and end-to-end solutions that they can test and pre-validate via their ecosystems, as opposed to in open-source

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8 Assuming that VNFs are certified and onboarding of new VNFs is a straightforward process.

projects. An integration platform will be costly (and time consuming) to build, especially as it must account for a CSP's existing assets. Each CSP's platform must reflect its own unique needs while retaining some level of interoperability, including compliant interfaces at a minimum. Platform standardisation (covering functional modularity and interfaces, at the very least) will control costs and complexities for vendors, and therefore time and cost for CSPs. Systems integrators can help Tier 1 CSPs choose and implement 'best-of-breed' telco cloud architectures if they choose not to be their own prime integrators and take on the role of making sure the multi-vendor environment operates correctly.

Smaller CSPs, in contrast, will likely lack the resources needed to build customised integration platforms and act as their own systems integrators. A prime integrator will likely support all the necessary software and hardware for network virtualisation to ensure compatibility of all the constituent systems, but the CSP must choose an integrator wisely: the help the prime integrator provides to address the challenges of hybrid network management, ensure effective business outcomes and participate in risk-sharing must not come at the price of more vendor lock-in. Figure 5 illustrates the key advantages and disadvantages of the two approaches that Tier 1 CSPs and Tier 2/3 CSPs will follow in phases 2 and 3.

Figure 5: Procurement approaches of Tier 1[9] and Tier 2/3 CSPs in the orchestration and cloud native phases [Source: Analysys Mason, 2016]
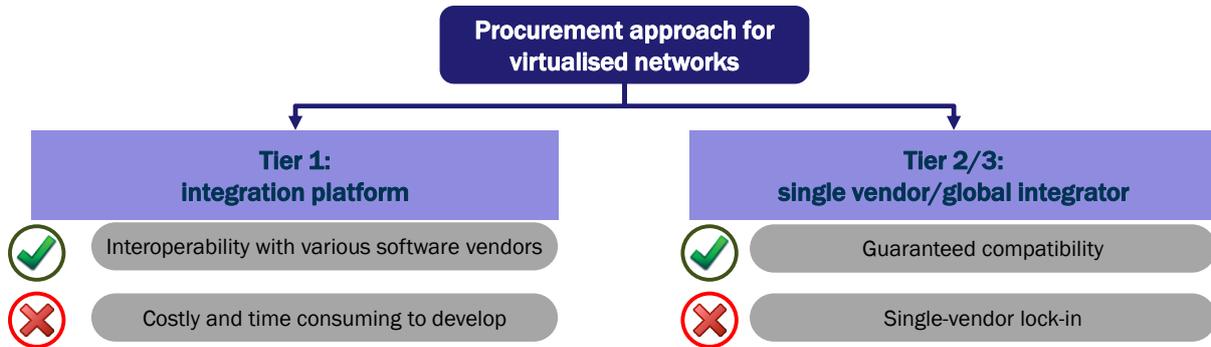
3.5 Provisioning and acceptance testing in the hybrid state: order-to-cash flow-through will not be fully automated before the cloud native phase

As CSPs fully transform into digital service providers in phase 3, both provisioning and acceptance testing will become simpler and quicker. These processes will move from distinct, time-consuming operations (within service fulfilment and service assurance, respectively) to automated, closed-loop activities as part of activation (see Section 3.6 for some discussion of the SF-SA linkage). Provisioning will be automated based on policy and performance requirements detailed in the service description, while acceptance testing, including security checks, will likely be done through the VNF onboarding processes and the service-creation test cycle.

While it is likely that order-to-cash flow-through for most CSPs will be fully automated in phase 3, getting to that point will be challenging in the phase 2 hybrid world (i.e. before the cloud native phase). Firstly, as with service creation, each use case is likely to involve a patchwork of network service components that will not integrate easily and allow flow-through (except for the minority of cases where a service is based exclusively on virtual elements). Furthermore, as mentioned in Section 3.3, CSPs today have multiple fulfilment and assurance systems, and these are not well synchronised; they do not draw from common inventory or policy rules. Service

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9   Please note: we are not saying that Tier 1 CSPs do not and will not work with integrators; it is just that integrators are likely to play a less central role in the approaches of Tier 1 CSPs than they will be for smaller CSPs. Similarly, smaller CSPs will rely more on prime integrators (some of which will also be solutions vendors), but this does not necessarily mean that the solutions adopted by smaller CSPs will be fully single-vendor.

assurance is likely to require a special focus on extensive, automated scale in/out and up/down testing. The need to rationalise and integrate SF and SA will be a complex task, but one that will lead to a significant pay-off in streamlined operations and customer experience benefits.

3.6 Troubleshooting and maintenance in the hybrid state: troubleshooting features are very basic today, and the challenges are only getting more complex

CSPs report that telco cloud troubleshooting features are very basic today, and the challenges are only getting more complex given the desire for multi-vendor software stacks. Standard application programming interfaces (APIs) will help, as will the vendor-neutral reference and integration platform that Tier 1 CSPs want to build. Such a platform will allow root-cause analysis to identify the faulty component and reduce vendor 'blame cycles', where each vendor blames the other for incorrect operation. It will be critical to have service assurance capabilities that are integrated with the fulfilment and management systems and can analyse service conditions in real time.

Network function virtualisation infrastructure (NFVI) assurance and (customer) service assurance will be among the key goals of phase 2 of the transformation. NFVI assurance efforts may be stalled due to tension between the CTO and CIO teams – it is unlikely that IT assurance tools like EMC Smarts will satisfy a CTO's reliability demands, and yet virtual infrastructure managers are limited in terms of the management of storage, computer and networking components. Many CSPs are likely to build specific infrastructure assurance tools in-house at this stage.

Some vendors are building service assurance capabilities into VNFs (for example, Affirmed Networks has done this for its vEPC VNFs) given the immature state of service assurance in orchestration platforms. However, such vendor-specific NFV-level solutions will likely become insufficient in phase 2, due to the increasing scale and complexity of NFV/SDN-based services and network components. Another approach to service assurance is for orchestration vendors to include third-party vendor vProbe systems in their VNF ecosystems. Regardless of the approach, telco cloud service assurance systems will take time to mature, in terms of performance and capability.

The desire to improve time-to-resolution processes and communication with the customer will be another driver for CSPs to integrate SF and SA systems and processes. We expect this unification process to be finalised only in later stages of phase 2.

4. Conclusions

Telco cloud transformation will have a profound impact on CSP operations. However, this transformation will not affect all elements of the network virtualisation operations lifecycle equally or simultaneously. Most changes to CSP operations will occur in the second phase of the transformation, but some of the benefits associated with these changes will happen only in the third phase.

- For *service creation* processes to become more agile, current practices must evolve into a continuous and highly automated service creation process based on templates and information models. However, through much of the orchestration phase, service creation will continue to be a mixture of automated and manual activities, dependent very much on operational specifics of particular use cases.

- Classic *order management* (along with inventory management systems) will evolve to, or be replaced by, more-sophisticated service orchestration capabilities. Order management has relied on static catalogues in the past, but that will change once NFV/SDN is implemented. A more-automated fulfilment process will provide immediate benefits, including more direct customer control over ordering; and better integration with service assurance systems will shorten acceptance test intervals and, therefore, reduce time to cash.

- The impact of CSPs' telco cloud transformation on *procurement and purchasing* must be considered separately, as the impacts will be of varying magnitude and will follow different schedules. With a proper onboarding process, VNF purchasing will change from weeks or months to minutes or hours as early as phase 1, but procurement may remain a lengthy process for a long time, due to regulatory imperatives and the complexity of ensuring compatibility and compliance of virtual infrastructure with legacy infrastructure. CSPs must start revamping RFP processes early on in the orchestration phase, and must develop ways to test and certify compatibility with their telco cloud platform.

- As CSPs complete their transformation into digital service providers in phase 3, *provisioning and acceptance testing* will become simpler and quicker. Both processes will move from distinct, time-consuming operations (within service fulfilment and service assurance, respectively), to automated, closed-loop activities as part of service turn-up. Provisioning will be automated based on policy and performance requirements detailed in the service description, while acceptance testing will likely be integrated with VNF onboarding processes. While most CSPs expect the order-to-cash flow-through to be fully automated in phase 3 (cloud native), getting to the point of complete, automated flow-through provisioning will be challenging in the hybrid world (i.e. before the cloud native phase).

- CSPs, and particularly large ones, will invest in *dynamic and converged end-to-end service fulfilment and service assurance* systems and processes. We expect this unification process to be finalised only in the later stages of phase 2.

Finally, if the transformation to digital service providers is to be successful for CSPs, the operational changes recommended in this whitepaper will have to be accompanied by significant changes to CSPs' organisations too. Tier 1 CSPs will take charge of their own organisational and process transformations for telco cloud, whereas many smaller Tier 2 and Tier 3 operators will engage vendors to provide them with the new skills and knowledge necessary for the transformation to succeed.

5. Recommendations

- **CSPs should target one or two 'quick wins' that will help them gain revenue, give the staff experience managing the transformation and refine process and organisational changes**. Telco cloud transformation will be a lengthy and expensive process, but the business benefits (service agility, revenue upside, cost efficiencies) will be substantial, with proper planning and change management. The hybrid or orchestration phase will be particularly challenging for CSPs. In order to accelerate this phase and generate tangible business benefits early in the transformation, these 'quick wins' should be identified during phase 1.

- **CSPs must actively manage the telco cloud transformation from the start to meet clear business objectives.** They should develop most likely scenarios and per-service business cases during phase 1, so that they can focus on features/services that will provide immediate benefits for CSPs and their customers and help set the priorities for the major operational transformations of phase 2. Our research indicates that many CSPs focus on technology-driven transformations in phase 1 and pay too little attention to anticipating and beginning to plan for the people and process changes that will be required for success in later stages. As a result, they will enter phase 2 less prepared for the complex changes required to manage hybrid networks than if they had made a more comprehensive assessment earlier. Active management by CSPs should include reassessing the transformation plan regularly; one CSP told Analysys Mason that it updates its plan every six months to ensure it remains relevant.

- **CSPs should focus on transforming processes that directly support business outcomes in phase 2: service creation, service fulfilment and service assurance.** Successful transformation will require pragmatic, long-term and customer-centric approaches to systems and tools rationalisation, process re-engineering, and organisational reskilling and cross-training. CSP change management must be incremental and supported by proactive, ongoing engagement and communication with employees. Transformation management should be more proactive and tuned to the realities of a microservices-based, orchestrated world where network services and applications are constantly evolving.

About the authors

Dana Cooperson (Research Director) is the research director for Analysys Mason's network-focused software research programmes. Her area of expertise is intelligent fixed and mobile network infrastructure. Her goal is to help customers strengthen their link in the communications value chain while evolving their business operations to benefit from, rather than be threatened by, shifts in the market. The key network infrastructure trends Dana focuses on include the integration of communications and IT assets and the drive towards software controlled, virtual networking.

Stela Bokun (Manager) is a Manager within the Telecoms Software research team at Analysys Mason, where she leads custom research for clients and contributes to a range of published research. Stela has been the project manager of a number of custom research engagements related to NFV/SDN that entailed interviews with CSPs. During the last year this has involved managing the following projects: 'The impact of NFV/SDN on network planning and design', 'The impact of NFV/SDN on managed services', 'The evolution of service operation centres (SOCs) and how NFV/SDN may affect it', 'White paper and business cases for NFV/SDN enabled video services delivery.'

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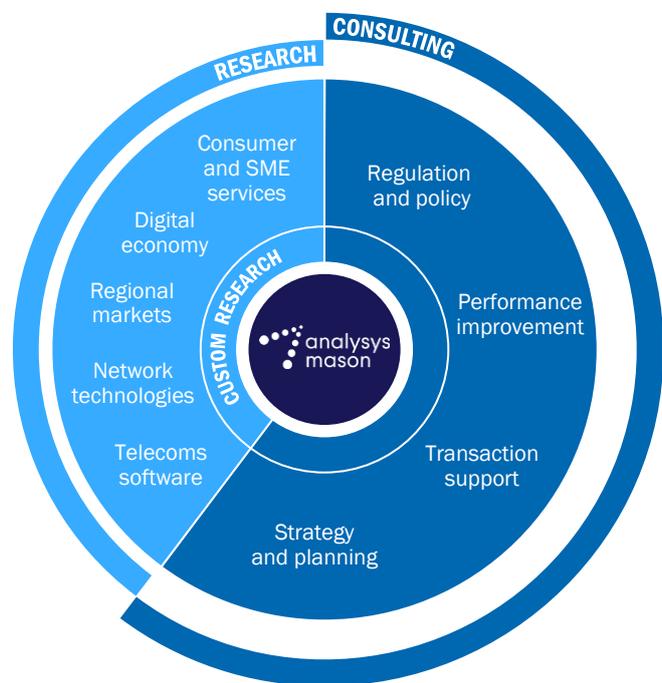
Research

- We analyse, track and forecast the different services accessed by consumers and enterprises, as well as the software, infrastructure and technology delivering those services.

- Research clients benefit from regular and timely intelligence in addition to direct access to our team of expert analysts.

- Our dedicated Custom Research team undertakes specialised and bespoke projects for clients.

For more information, please visit www.analysysmason.com/research.

Research from Analysys Mason

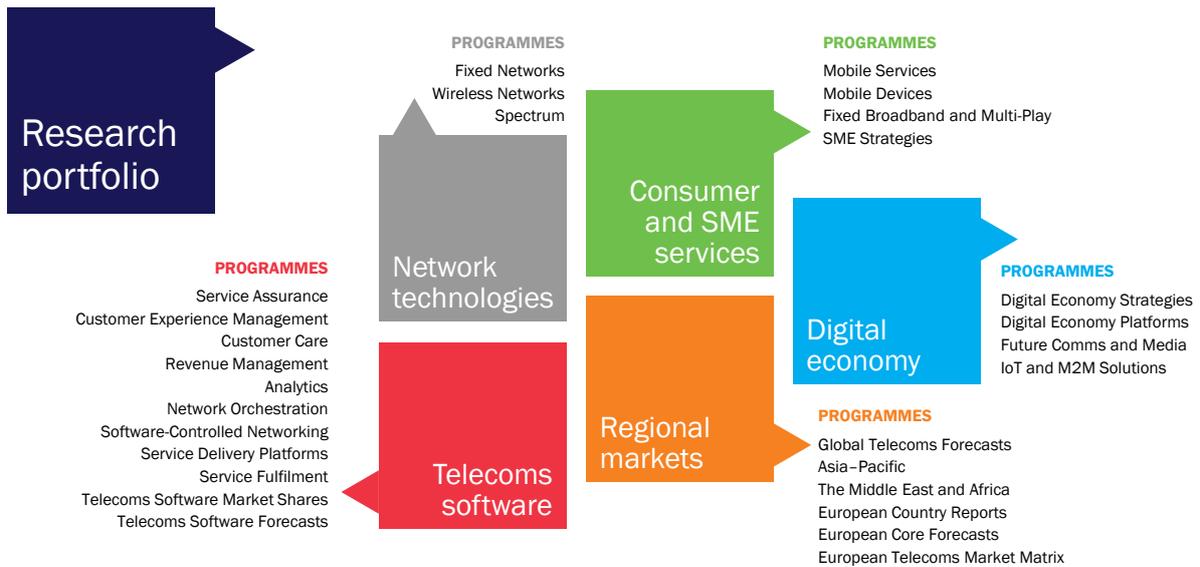**We provide dedicated coverage of developments in the telecoms, media and technology (TMT) sectors, through a range of research programmes that focus on different services and regions of the world**

The division consists of a specialised team of analysts, who provide dedicated coverage of TMT issues and trends. Our experts understand not only the complexities of the TMT sectors, but the unique challenges of companies, regulators and other stakeholders operating in such a dynamic industry.

Our subscription research programmes cover five key areas.

Research portfolio

PROGRAMMES
Fixed Networks
Wireless Networks
Spectrum

PROGRAMMES
Mobile Services
Mobile Devices
Fixed Broadband and Multi-Play
SME Strategies

Network technologies

Consumer and SME services

PROGRAMMES
Service Assurance
Customer Experience Management
Customer Care
Revenue Management
Analytics
Network Orchestration
Software-Controlled Networking
Service Delivery Platforms
Service Fulfilment
Telecoms Software Market Shares
Telecoms Software Forecasts

Digital economy

PROGRAMMES
Digital Economy Strategies
Digital Economy Platforms
Future Comms and Media
IoT and M2M Solutions

Telecoms software

Regional markets

PROGRAMMES
Global Telecoms Forecasts
Asia–Pacific
The Middle East and Africa
European Country Reports
European Core Forecasts
European Telecoms Market Matrix

Each subscription programme provides a combination of quantitative deliverables, including access to more than 3 million consumer and industry data points, as well as research articles and reports on emerging trends drawn from our library of research and consulting work.

Our custom research service offers in-depth, tailored analysis that addresses specific issues to meet your exact requirements

Alongside our standardised suite of research programmes, Analysys Mason also has a Custom Research team that undertakes specialised, bespoke research projects for clients. The dedicated team offers tailored investigations and answers complex questions on markets, competitors and services with customised industry intelligence and insights.
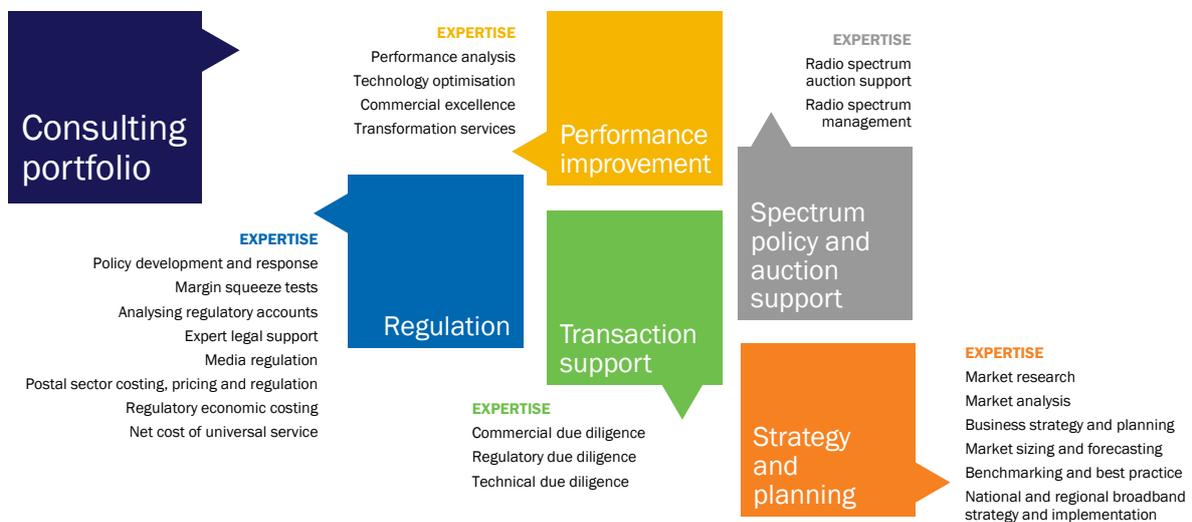
For more information about our research services, please visit www.analysysmason.com/research.

Consulting from Analysis Mason

For 30 years, our consultants have been bringing the benefits of applied intelligence to enable clients around the world to make the most of their opportunities

Our clients in the TMT sectors operate in dynamic markets where change is constant. We help shape their understanding of the future so they can thrive in these demanding conditions. To do that, we have developed rigorous methodologies that deliver real results for clients around the world.

Our focus is exclusively on TMT. We advise clients on regulatory matters, help shape spectrum policy and develop spectrum strategy, support multi-billion dollar investments, advise on operational performance and develop new business strategies. Such projects result in a depth of knowledge and a range of expertise that sets us apart.

EXPERTISE
Performance analysis
Technology optimisation
Commercial excellence
Transformation services

EXPERTISE
Radio spectrum auction support
Radio spectrum management

Consulting portfolio

Performance improvement

Spectrum policy and auction support

EXPERTISE
Policy development and response
Margin squeeze tests
Analysing regulatory accounts
Expert legal support
Media regulation
Postal sector costing, pricing and regulation
Regulatory economic costing
Net cost of universal service

Regulation

Transaction support

Strategy and planning

EXPERTISE
Commercial due diligence
Regulatory due diligence
Technical due diligence

EXPERTISE
Market research
Market analysis
Business strategy and planning
Market sizing and forecasting
Benchmarking and best practice
National and regional broadband strategy and implementation

We look beyond the obvious to understand a situation from a client's perspective. Most importantly, we never forget that the point of consultancy is to provide appropriate and practical solutions. We help clients solve their most pressing problems, enabling them to go farther, faster and achieve their commercial objectives.

For more information about our consulting services, please visit www.analysysmason.com/consulting.