



WHITE PAPER

AUTOMATION IS A JOURNEY, NOT A BIG BANG

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Contents

1. Executive summary	1
2. The imperative to start the network automation journey	2
2.1 Motivation for network automation	2
2.2 Challenges of network automation	3
3. Network automation is a stepwise journey	4
3.1 Network automation through NFV	4
3.2 Network automation through WAN SDN	6
3.3 Navigating network automation perils in a stepwise fashion	7
4. Benefits and best practice from CSPs on the network automation journey	9
4.1 Benefits of network automation achieved to date	9
4.2 Best practice for network automation	11
5. Recommendations	14
6. Introduction to Cisco Network Services Orchestrator (NSO)	15
About the authors	16
Analysys Mason's consulting and research are uniquely positioned	17
Research from Analysys Mason	18
Consulting from Analysys Mason	19
List of figures	
Figure 1: Step-by-step best practice for network automation	2
Figure 2: Deficiencies of typical network and service operations and payoff from automation	3
Figure 3: NFV approaches to achieve network automation	5
Figure 4: WAN SDN approaches to achieve network automation	6
Figure 5: The steps a CSP can take in its network automation journey	7
Figure 6: Analysys Mason's DNOP	8
Figure 7: Benefits of network automation reported	10
Figure 8: Step-by-step best practice for network automation	11
Figure 9: Architecture diagram of NSO	15

1 Executive summary

“Quite honestly, this is a lot of work with a steep learning curve. A big bang isn’t the answer – it is a journey, started with viable business cases rather than building future infrastructure.”

Enterprise-focused CSP from Developed Asia-Pacific

Modern approaches to network and operations automation focus on starting small with a specific service or infrastructure use case (for example Ethernet services automation or packet transport network automation). Approaches are based on an automation tool or set of tools that can expand the scale and scope of automation over time without huge, expensive bespoke transformation projects controlled by a single vendor incentivised to keep its expertise in-house.

Analysys Mason’s research into the automation journey, the benefits that undertaking such a journey can impart to communications service providers (CSPs), and best practices for capturing incremental benefits starting with the first step are based on interviews with a number of developed markets CSPs specifically for this study, as well as on CSP interviews and research we carry out regularly. In summary, our research indicates that:

- There is no one way to achieve network and service automation; each CSP will plot its own journey based on business priorities. It is essential that each CSP have a vision of where it is going with rough stops along the way so that the series of incremental steps build upon each other rather than in isolation from each other.
- Benefits should be realised with the first step and in increments thereafter. Benefits should not be contingent on completing an expensive, multi-year, multi-phased transformation process at some nebulous time in the future.

Key success factors for CSP network automation efforts are illustrated in Figure 1.



FIGURE 1: STEP-BY-STEP BEST PRACTICE FOR NETWORK AUTOMATION

[SOURCE: ANALYSYS MASON, 2019]

2 The imperative to start the network automation journey

Against a rapidly changing competitive landscape, epitomised by on-demand services and flexible pricing models, communications services providers (CSPs) need to carefully consider their distinctive approaches to digital transformation, of which network automation is a key pillar. In this section, we will discuss the context of why CSPs are embarking on network automation and challenges awaiting them throughout the journey.

2.1 Motivation for network automation

CSPs have been embracing automation throughout their operations for many years. Network automation has often been through bespoke, one-off projects strictly tied to a specific service or specific infrastructure.

The advent of smartphones enabled by 3G networks and expanded by 4G networks, however, ushered in a whole new digital economy paradigm built on applications and services that respond to requests in real-time. These early applications and services have transformed behaviours and expectations of humans and enterprises alike. Streaming services have altered the way humans consume TVs and films; enterprises

nowadays cannot effectively function without high-capacity connectivity as increasingly more business applications and workloads move to public clouds (SaaS/IaaS).¹ 5G network roll-outs will begin to enable new services in new realms such as edge computing and network slicing.

Incumbent media players are fighting back against global streaming video platforms, for instance the UK's BBC and ITV are joining forces to launch a streaming service that access the entire content libraries of both broadcasters. In a similar way, CSPs are embarking on their own digital transformation to achieve agility in business, service and operations, optimise cost for the delivery of services and compete more effectively in the digital economy.

Network automation that is systemic and based on open and standard interfaces – not bespoke, one-off or focused on a particular subset of services or infrastructure – is a key pillar of CSPs' digital transformation because it directly relates to CSPs' infrastructure and the provisioning of both traditional and new digital services. The inconvenient truth is that for a lot of CSPs,

<p>Deficiencies of current network and service operations</p>	<ul style="list-style-type: none"> • Heterogenous networks with an array of network assets each governed by disparate operations support systems • Too many manual processes and custom scripts • The operational processes around software systems are developed by stitching together the fractured systems, leading to poor automation and high mean time to resolve resource and service faults • Operations support software is designed for closed software architectures, deployed in domain-specific operational silos, creating a scattered IT estate. This prolongs software change cycles for the introduction of new services • The operations staff that use the software systems to perform their daily tasks may not have the skills to enhance or alter the software to suit changing needs • The operations organisation can be rigid and bureaucratic. For instance, there are usually three network operations tiers, each of which is organised around software and process silos linked through manual handoffs
<p>Payoff of automated network and service operations</p>	<ul style="list-style-type: none"> • Reduce manual errors • Replace unique processes for different vendor devices with a unified process for all • Launch and quickly iterate new services, grow new revenues • Provision existing services more quickly, shrink time to revenue • Give customers more control over their services • Improve customer satisfaction • Free up staff for more strategic work

FIGURE 2: DEFICIENCIES OF TYPICAL NETWORK AND SERVICE OPERATIONS AND PAYOFF FROM AUTOMATION
[SOURCE: ANALYSYS MASON, 2019]

¹ See <http://www.analysismason.com/Research/Content/Case-studies/equinix-cisco-nso-rma07/> for a case study

configuring infrastructure and provisioning services takes too long, is prone to errors and does not give enterprise customers enough control over the services they buy and how they buy them. As such the payoff CSPs should expect from their network automation journey in support of their digital transformation is the resolution of significant operations problems and challenges. The payoffs from automation and the deficiencies of current networks are specified in Figure 2 of the previous page.

CSPs that have commenced the automation journey get to enjoy more efficient operations and improved service agility as well as accelerate time to revenue for new services.²

2.2 Challenges of network automation

Embarking on a network/service operations journey is typically done by the CTO and CIO organisations working together as sponsors through an automation task force. This journey will likely be one of several other major transformation initiatives vying for upper management and board attention. The automation sponsors are confronted with an array of significant internal and external challenges:

- The sponsors need to clarify the automation plan (where will it start, and where/when will it end?) and justify the spending on tools, staff and organisational realignment (when/what will the return be?) to satisfy the CFO and corporate board.
- Planning, engineering and operations staff need to be reskilled or hired for YANG model creation and programming as well as to embrace new methodologies such as DevOps and CICD.
- The automation task force will need to create a huge number of standardised service definitions, based on data models, golden templates, YANG models and other tools across the organisation.
- All the interested parties in the CSP organisation beyond the sponsoring organisations must work together efficiently to reach common goals, often through prodding from upper management.
- The CSP must encourage incumbent and new vendors to work together to support and facilitate multi-vendor operations.
- The CSP must provide assurance to customers, for example by reassuring them that any automated service updates will not lead to downtime because a last working version can be restored almost immediately.

Collectively, these challenges pose roadblocks for CSPs to complete the network automation journey as quickly as they desire and prevent them from achieving the business benefits of digital transformation.

²See <http://www.analysismason.com/Research/Content/Case-studies/equinix-cisco-nso-rma07/> for a case study

3 Network automation is a stepwise journey

There is no one prescribed network automation journey; multiple paths are possible depending on a specific CSP's market situation and business strategy. One main path is to virtualise first, via network function virtualisation (NFV), in effect starting from infrastructure up to obtain a programmable network infrastructure. An orthogonal path is to automate first, through WAN SDN,³ in effect from software control down, to create a programmable, real-time multi-layer/multi-vendor management platform. A few courageous CSPs have pursued both paths simultaneously, which is a monumental undertaking. In this section, we will discuss the rationale behind each of the two major paths and present Analysys Mason's

automation vision that averts automation islands.

3.1 Network automation through NFV

Within the path of network automation through NFV, there are three approaches of ascending complexity and payoff, namely

- domain-specific use-case approach
- domain-specific orchestration approach
- end-to-end orchestration approach.

Figure 3 illustrates the differences between the three approaches.

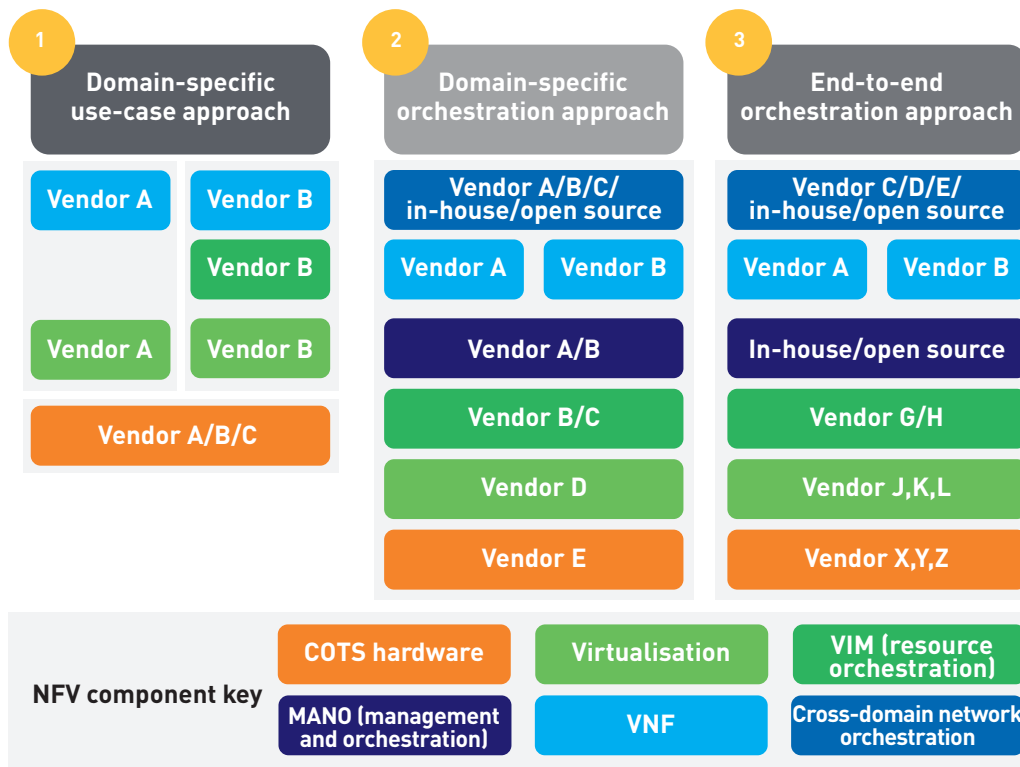


FIGURE 3: NFV APPROACHES TO ACHIEVE NETWORK AUTOMATION
[SOURCE: ANALYSYS MASON, 2019]

CSPs can start the journey by virtualising a single network function in a specific network domain.⁴ This is a very straightforward manoeuvre as it in effect creates a traditional network silo in a virtualised way using the existing management systems with little, if any, orchestration. Examples include isolated vIMS and vEPC deployments. The virtualised network function

(VNF) supplier is predominantly the party that approaches the CSP with a pre-integrated solution.

Alternatively, CSPs can implement *domain-specific orchestration*, where VNFs from different suppliers are deployed on the same platform in a given network domain. The level of automation is higher than in the

³ WAN SDN = Wide area network software-defined networking

⁴ A domain may be associated with a specific technology, such as mobile connectivity or business services, or it could be geographically determined.

first approach due to the use of a management and orchestration (MANO) stack and the operational automation in place support the onboarding and lifecycle management of individual VNFs.

The approach that promises the most payoff, in line with the original ETSI NFV goals,⁵ but is more sophisticated and therefore the hardest to accomplish, is *end-to-end orchestration*. Leading CSPs adopt this approach because they recognise the need for a digital network and operations platform that spans multiple network domains and brings together NFV and SDN. NFV components throughout the entire stack are interchangeable in this scenario.

3.2 Network automation through WAN SDN

Within the path of network automation through WAN SDN, the approaches are quite similar to those of NFV. Network automation approaches through WAN SDN also comprise a single domain, cross-domain and end-to-end approach. The main differentiator from the NFV path lies in its relative ease of deployment and time to market, because the initial WAN SDN deployment can be done through a software overlay atop existing WAN infrastructure. As such this path can

immediately deliver automated and cost-effective connectivity services to enterprise customers with significant reduction in manual errors.

In other words, network automation through NFV can be like knocking down a house and building a new (and one hopes better) house with new materials and tools on the same site, whereas network automation through WAN SDN is similar to adding a new electrical or heating system to the existing house.

Figure 4 illustrates the differences between the three approaches.

It should be noted that another key pillar of CSP's digital transformation is the automation of underlying customer- and ecosystem partner-related business processes. The ultimate objective is that customer/partner interfaces and the back-end systems, ranging from customer engagement to customer monetisation platforms and processes, are as digital as possible and underpinned by AI-driven automation. Most CSPs can only focus on one pillar of digital transformation at a time, depending on strategic priority and investment constraints.

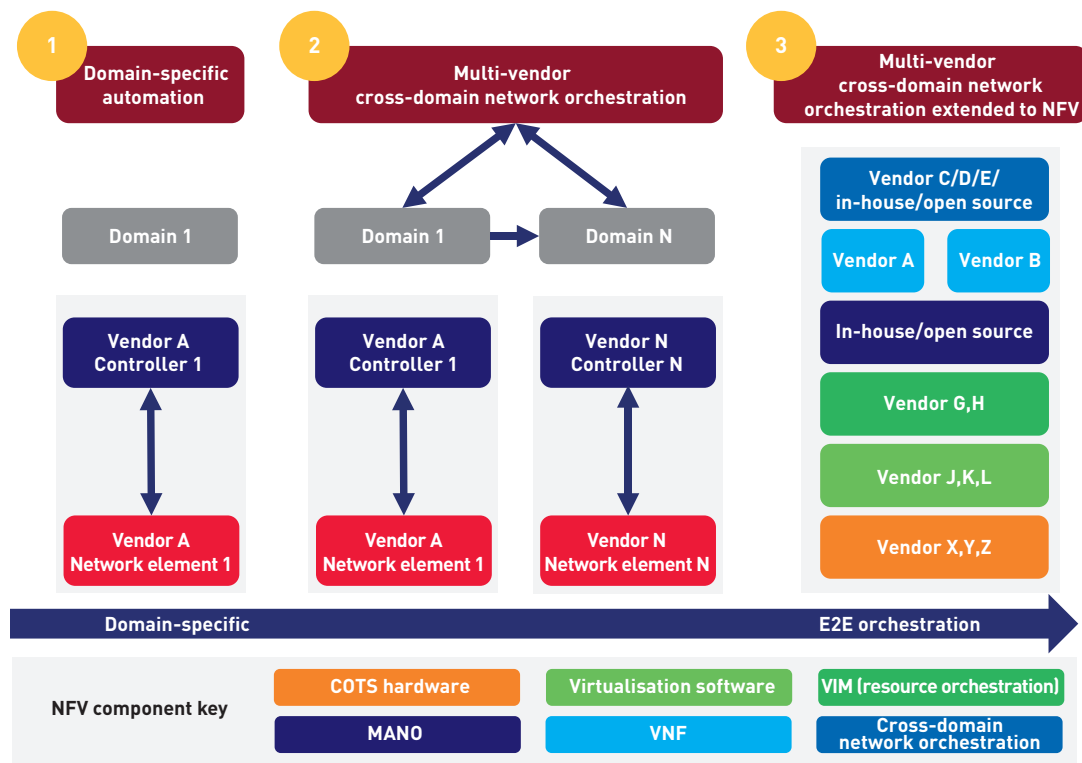


FIGURE 4: WAN SDN APPROACHES TO ACHIEVE NETWORK AUTOMATION

[SOURCE: ANALYSYS MASON, 2019]

⁵ See https://portal.etsi.org/NFV/NFV_White_Paper.pdf

3.3 Navigating network automation perils in a stepwise fashion

The other major challenge that can crop up as a CSP starts the automation journey is the propensity to create automation silos or islands. CSPs could deploy tools and technologies tactically to automate processes in certain operational scenarios, leading to disjointed and fragmented automation islands for specific domains.

In this scenario, while the isolated operations in a specific domain (business services or mobile connectivity, for example), or a specific task (IP traffic optimisation or trouble-shooting network faults) have been automated, the overall level of automation across the entire organisation would remain low, not yielding the automation bonus CSPs desire and brewing future interoperability and integration challenges.

In order to mitigate this risk, CSPs embarking on the network automation journey need to have in mind a series of steps to join up automation into a well thought-through overall vision.

CSPs, through divergent 'land and expand' approaches, can begin the network automation journey through orthogonal paths.

For instance, one CSP can start the journey by automating one enterprise WAN communications service end to end (E2E), improving automation and striving for autonomy *one service at a time*. It can then proceed, using the same tool set, to automate other services, from different service/operational domains E2E, followed by automating the operations of all the underlying WAN infrastructure, before adding VNFs to the WAN infrastructure (vCPE/SD-WAN) and ultimately joining up the WAN automation with the NFV virtualisation.

A Tier-1 CSP from Developed Asia-Pacific took up a divergent path: it has shifted all of its enterprise service provisioning to be model driven and is moving the practice to the broadband and core infrastructure domains, to enable service modelling across the whole organisation.

These divergent paths of stepwise journeys are illustrated in Figure 5.

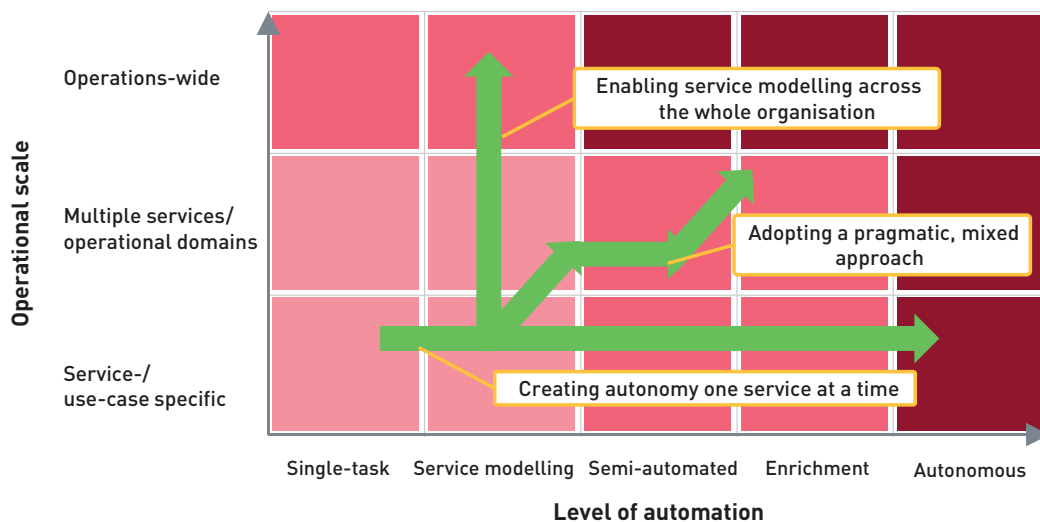


FIGURE 5: THE STEPS A CSP CAN TAKE IN ITS NETWORK AUTOMATION JOURNEY
[SOURCE: ANALYSYS MASON, 2019]

Most CSPs will need to take a pragmatic, mixed approach as they carefully think through their overarching automation vision, and how domain and task automation can be brought together to enable E2E services and lifecycle processes and avert the emergence of automation islands. Leading CSPs such as AT&T and Telefónica are forging ahead with new operational models and management/orchestration platforms to achieve their objective of E2E automation and simplification across multiple domains and services.

Analysys Mason refers to such an overall vision of the autonomous, 'self-driving' network as the digital network and operations platform (DNOP).⁶ The main elements of the DNOP are summarised in Figure 6.

The DNOP is a long-term vision that can be realised only when CSP networks become fully cloud native and

automated. The industry is still some years away from achieving this vision. However, we believe CSPs should adopt as many DNOP principles and capabilities as are feasible to support them as they start automating hybrid networks. For example, CSPs should ensure that their near-term approach discourages operational silos and is based on extensible tool(s) that can be evolved into a platform that sources best-of-breed multi-vendor and open-source components built in a cloud-native way (as microservices). The platform should expose these components through open interfaces (APIs) for reuse/composition purposes. It should support DevOps concepts to speed the creation, integration and management of components and services composed from them. It should provide policy-driven management and orchestration to enable the automation of platform processes.

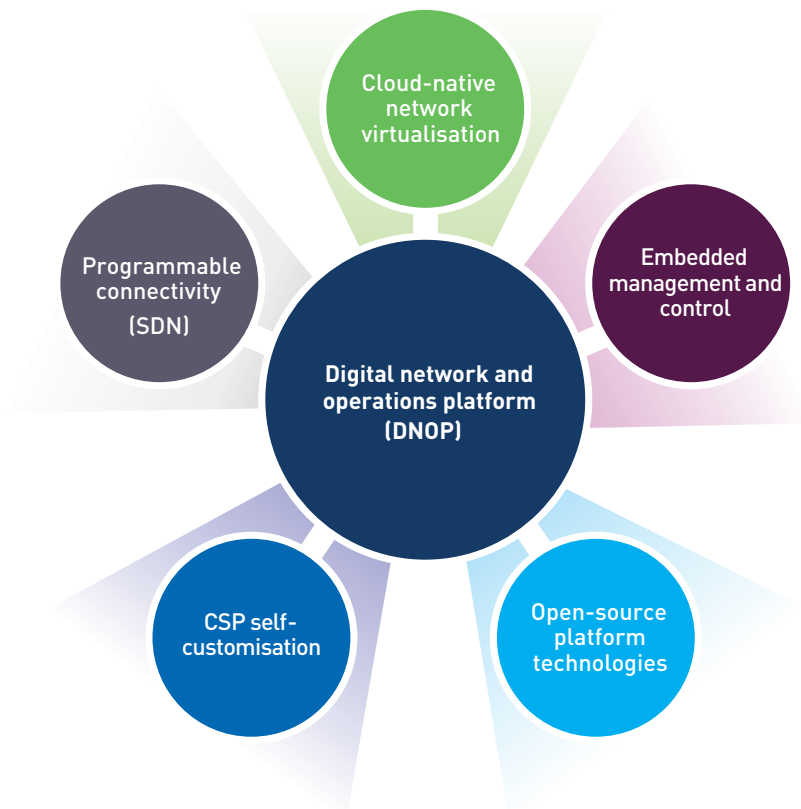


FIGURE 6: ANALYSYS MASON'S DNOP
[SOURCE: ANALYSYS MASON, 2019]

⁶ Figure 6 provides a simplified view of what Analysys Mason calls a 'digital network and operations platform'. For more information, see www.analysismason.com/defining-dnop-5g-rma16.

4 Benefits and best practice from CSPs on the network automation journey

As described in earlier sections of this white paper, network automation is a journey on a path strewn with rewards and perils. It is also a journey that is best undertaken in a stepwise fashion. We interviewed a number of CSPs from developed markets specifically for this study to build on the CSP interviews and research we carry out regularly. In this section, we discuss the CSPs' experience of the network automation journey thus far, focusing on the benefits of

network automation as reported by the CSPs and conclusions that can be drawn on best practice for network automation.

4.1 Benefits of network automation achieved to date

Figure 7 illustrates the benefits achieved to date reported by CSPs across four categories.

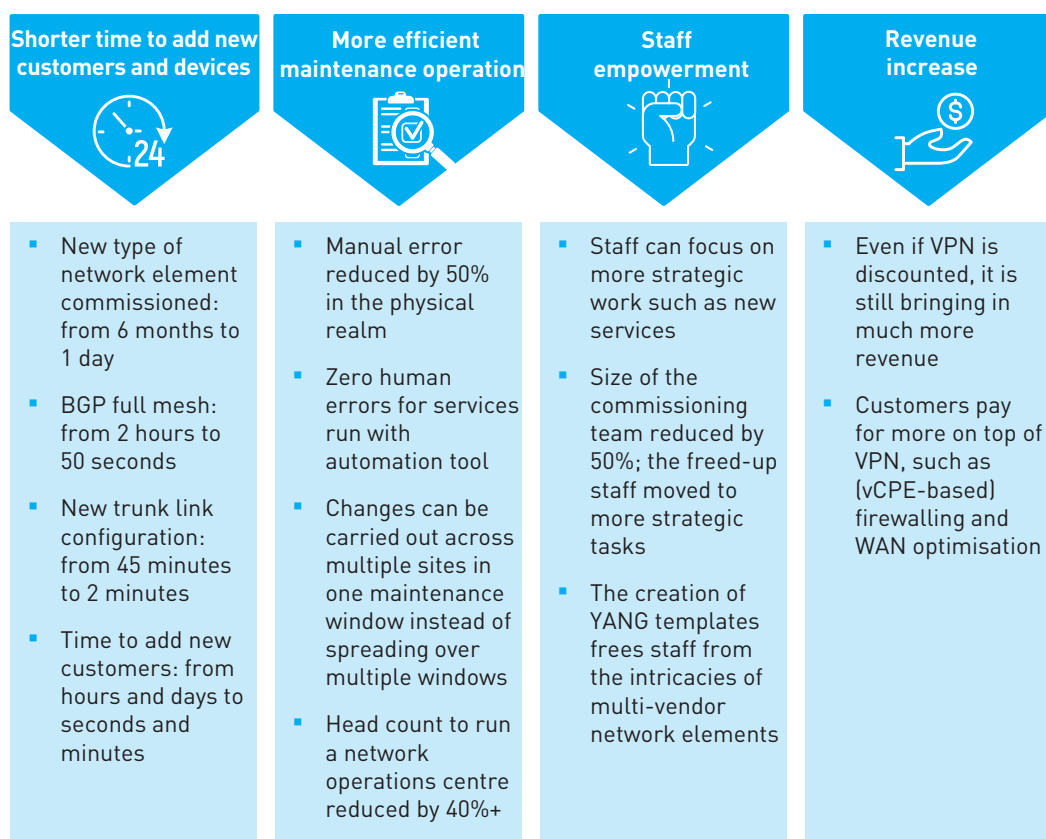


FIGURE 7: BENEFITS OF NETWORK AUTOMATION REPORTED

[SOURCE: ANALYSYS MASON, 2019]

The early cluster of benefits CSPs observed after embarking on the automation journey relate to the vastly improved operations that were once handled manually. The time needed to add new customers or network elements to the network shrinks significantly and manual errors become a thing of the past. One Tier-1 CSP from North America was particularly pleased because its enterprise customers are happy with the improved efficiency of rolling out changes across their sites as well as the roll-back features that ensure no service downtime.

In terms of empowering staff, the majority of CSPs we talked to are pleased with the time freed up from mundane tasks to focus on more strategic, revenue-generating activities. It appeared that headcount reduction is typically far from their minds.⁷

The CSPs we have spoken with for this and related research efforts tended to emphasise operations improvements rather than revenue uplift as the key goal and received benefit of network/service automation. They were able to draw a straight line between the improved operational efficiency and improvements in customer satisfaction.

“We weren’t trying to eliminate people. We were trying to improve service time to revenue, to enable services with a click of a button: that was goal # 1, 2, 3 and 4.”

Interconnection and data-centre operator based from North America

⁷ The outlier comes from one Tier-3 mobile-only CSP from the Middle East and Africa region, which was very pleased to cut down the headcount of its NOC by 40%.

4.2 Best practice for network automation

The best practice for network automation can be grouped into four categories, as illustrated in Figure 8.



FIGURE 8: STEP-BY-STEP BEST PRACTICE FOR NETWORK AUTOMATION [SOURCE: ANALYSYS MASON, 2019]

Solid upper management support

The CSP leadership team needs to provide a strong mandate and budget for the network automation task force to kick off the effort. This is because the network automation journey requires resources and priorities across many different teams to be aligned to meet specific goals. This alignment might involve a mindset shift, for example from paying external suppliers to carry out certain operations to investing in tools and training for the CSP's staff. It also extends to pushing the mantra of automation based on standardised service definitions, data models (such as YANG models), golden templates, use cases, supported software and hardware versions, among others. This needs to involve all the affected teams such as pre-sales, planning and architecture as well as the engineering and operations teams, because the automated service definition and design has to be precise and free of ambiguity so that when it is pushed downstream, the operations staff would not encounter any errors or confusion.

“We have received very strong support from the top because there is a lot of resistance for how things were done before. Without his support this simply cannot work.”

Tier-1 integrated CSP from Western Europe

Concrete starting point and clear end goal

The CSP needs to pick a solid starting point and clear goals that will give tangible benefits quickly, which reinforces the support from upper management.

“We targeted our WAN automation initially at commercial enterprise services, and specifically at physical element automation; these services have more complex needs than residential services do.”

Tier-1 fixed-only CSP from North America

The CSP also needs to be cognisant that it cannot pull off network automation in one go and should not try to do so. However, it should have a clear idea on where it is heading in this journey, such as DNOP, with clear steps to ultimately join up any separate automation efforts.

“Quite honestly, this is a lot of work with a steep learning curve. A big bang isn't the answer – it is a journey, started with viable business cases rather than building future infrastructure.”

Enterprise-focused CSP from Developed Asia-Pacific

“Our network core is pretty manual, while our enterprise services domain that sits on top of it is pretty automated. Automating end-to-end from our network core to the consumer home will take us about two years, and we've just started.”

Enterprise-focused CSP from Developed Asia-Pacific

Partner rather than supplier

The CSP needs to have technology vendors be partners. The CSP has to have control of the network automation journey and make sensible buy/build decisions at points along the way as it gains more expertise. The CSP needs to be ready to act as its own system integrator (SI) to get what it actually wants, but few CSPs will be in a position to truly do that. A vendor that offers a build-operate-transfer model could therefore be the best option for some CSPs. Most CSPs we talked to consider it imperative that they learn how to build capabilities in-house over time, ranging from developing their own customer portal and automating the order-to-cash process to developing their own YANG models at a minimum.

“With limited bandwidth and money, we need to own the kitchen instead of eating out the whole time.”

Tier-1 integrated CSP from Western Europe

Meanwhile, the CSP should not underestimate the challenges of getting vendors to work together in order to create E2E automation. For instance, if a network asset is YANG/NETCONF capable, the modelling effort can be significantly reduced as the automation tool automatically discovers the number of ports in a specific switch. This saves a huge amount of time when the network consists of thousands of network element flavours.

However, in multi-vendor situations some effort may be required to make two vendors' solutions 'play nice' together, and the CSP will need to set the expectation from the very beginning that its vendors co-operate. One of the CSPs we interviewed noted that it deployed a native YANG-capable automation tool and virtual network functions manager (VNFM) from different vendors. The automation tool vendor stepped up and carried out the bulk of the integration work by writing adapters and APIs so that the automation tool communicates with the other vendor's VNFM.

“It would have been easier to go with a monolithic solution (for NFVO and VNFM) rather than a best of breed solution with open interfaces, but then we would have had to compromise.”

“All our current RFX mandate network elements to be YANG/NETCONF capable.”

Tier-1 fixed-only CSP from North America

Interorganisational communications and goal alignment is crucial

The CSPs we have interviewed point to the huge benefit that simplified organisations can impart to the speed and smoothness of the automation journey. That does not mean that a huge organisational realignment and simplification process must precede the start of an automation journey. Any upper management empowerment or process improvements that break down organisational barriers, eliminate or improve inter-organisation handoffs, cultivate a culture of constant collaboration and innovation (such as embracing DevOps and CICD) will help speed automation. The creation of an inter-disciplinary team that supports formal and informal knowledge transfers can be particularly effective and can jumpstart the journey without massive organisational changes. The full benefit of automation, however, will accrue over time as automation scales operations-wide and organisations are simplified. One CSP observed, for example, that although the time to add new customers has been reduced to minutes once the order is received by the automated fulfilment processes, the rest of the business (such as customer contracts) had yet to catch up; the full E2E order-to-cash process could not improve further until the rest of the business does.

“At the beginning, it was tough because of all the hand-offs. Then we created the Chief Product Officer organisation that oversees both product management and SW/HW engineers.”

Interconnection and data-centre operator based from North America

5 Recommendations

CSPs should find comfort and confidence in the fact that network automation is not a 'big bang'

Modern approaches rely on open, multi-vendor and standards-based approaches to network automation, not 'big T' transformations based on expensive and intensive bespoke professional service extravaganzas. Beware vendors pitching big bangs; automation is a journey, and benefits can be obtained with the first step. WAN SDN-based approaches in particular should lead to tangible benefits from the initial step on the journey.

CSPs should select a partner or partners that can help smooth and speed the journey's start

The right vendor partner or partners can help CSPs get to the first stop on the road to automation by helping with existing system's integration, skill training and other critical elements of change. Open APIs and YANG-based modelling (preferably native YANG) are a must and can help CSPs yield the full spectrum of benefits from automation. In addition, open source automation software can be a boon to CSPs that want to take advantage of community expertise. However, CSPs should be clear that self-managed open source tools can come with a huge hidden cost, in the form of salary for a team of software developers and time to do the development. Therefore, it may be wise to look for a partner that can absorb those costs.

An ideal partner will structure the engagement to suit the CSP: from providing a productised solution that CSPs with the staff and the wherewithal can integrate and expand on their own on the one end of the spectrum, to full build-operate-transfer options on the other end of the spectrum.

CSPs should look for organisational realignment opportunities along the journey

At least some organisational realignment will likely be needed to smooth the journey to full autonomy and operations-wide scale. Respondents told us that organisational simplification can provide a huge benefit in terms of speeding the automation journey, but it need not be done before taking the first step. If it can be done at least in step with the automation journey, this will help assure that each subsequent step can be taken with more nimbleness and confidence.

6 Introduction to Cisco Network Services Orchestrator (NSO)

The research conducted by Analysys Mason captures two core beliefs that also shape the Cisco automation portfolio. First, a successful automation strategy is something that plays out over time. The most successful companies move forward incrementally but consistently. Automation is like compound interest: each successful project builds upon and amplifies the benefits of prior projects. Second, as Figure 5 aptly illustrates, there is no single 'right' path for automation – every CSP will have different goals, capabilities and priorities.

As an automation platform, Cisco Network Services Orchestrator (NSO) is designed with these insights in mind. It offers the scalability to be used for simple task automation, all the way to sophisticated cross-domain service orchestration on a global scale. Because every

CSP has its own unique journey, NSO is designed for maximum flexibility. It supports a rich and diverse set of 'northbound' APIs and software interfaces from programmatic or RPC-based protocols (such as NETCONF/RESTCONF) to language bindings such as Erlang, Java, Python and C. NSO also provides human-to-machine interfaces, such as a web UI and a set of CLIs. At the other end of the stack, NSO uses a hardware abstraction layer that can automate not only Cisco gear but also over 170 other non-Cisco devices. This power and flexibility are why NSO is in production at the ten largest service providers in the world and a growing number of large enterprises.

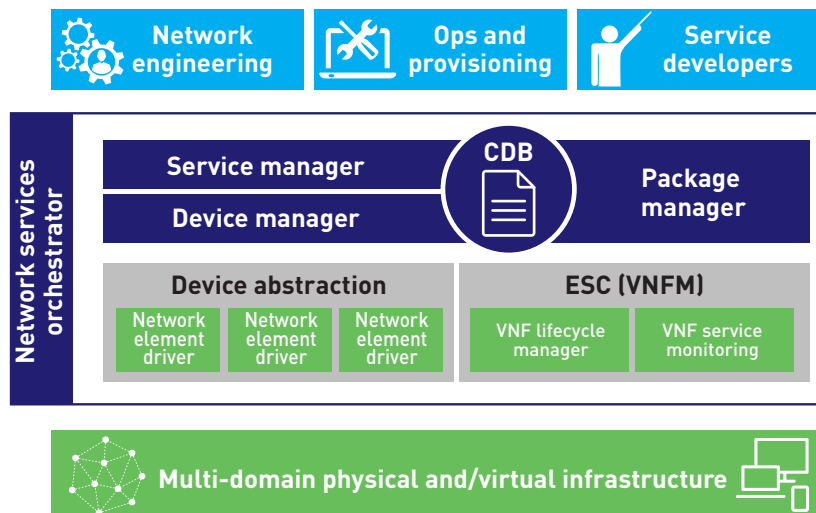


FIGURE 9: ARCHITECTURE DIAGRAM OF NSO
[SOURCE: CISCO, 2019]

About the authors



Dana Cooperson (Research Director) leads Analysys Mason's six software and networks technology research programmes. Her team's mission is to help customers to progress toward and benefit from a more automated, autonomous, cloudified future, rather than be threatened by this market shift. Her areas of expertise are intelligent fixed and mobile network infrastructure, automation and operations. Dana's research and consulting focuses on the communications software/network market and technology best practices required for digital business transformation and enabled by the integration of NFV, SDN and other IT technologies for virtualisation, cloudification and automation.



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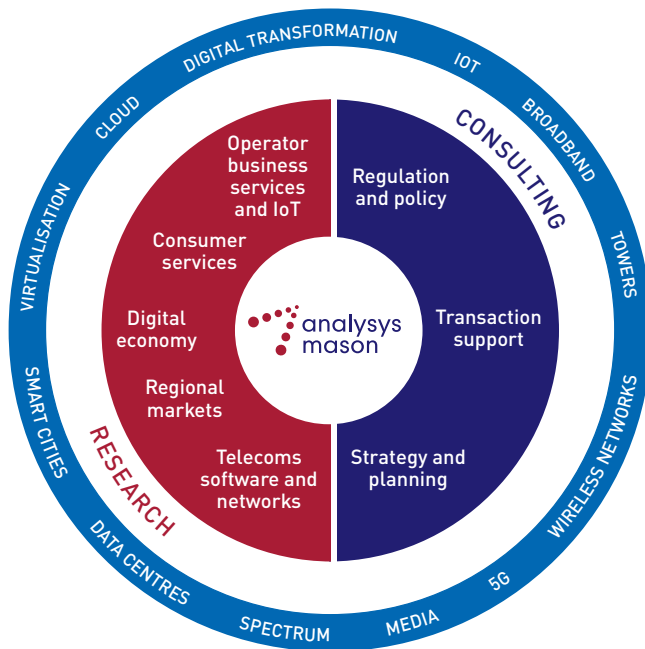
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- Clients benefit from regular and timely intelligence, and direct access to analysts.

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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 the following key areas.

Consumer services programmes

- Mobile Services
- Mobile Devices
- Fixed Broadband Services
- Convergence Strategies
- Video Strategies

Operator investment programmes

- Operator Investment Strategies
- Network Traffic
- Spectrum

Telecoms software and networks programmes

- Software Forecast and Strategy
- Telecoms Software Market Shares
- Network-focused**
- Next-Generation Wireless Networks
- Video and Identity Platforms
- Service Design and Orchestration
- Automated Assurance
- Network Automation and Orchestration
- Digital Infrastructure Strategies
- Customer-focused**
- Digital Experience
- Customer Engagement
- Monetisation Platforms
- AI and Analytics

Digital economy programmes

- Digital Economy Strategies
- Future Comms

Enterprise and IoT programmes

- Large Enterprise Voice and Data Connectivity
- Large Enterprise Emerging Service Opportunities
- SME Strategies
- IoT and M2M Services
- IoT Platforms and Technology

SMB ICT programmes

- Managed Service Provider Strategies

Regional markets programmes

- Global Telecoms Data
- Americas
- Asia-Pacific
- Middle East and Africa
- European Core Forecasts
- European Telecoms Market Matrix
- European Country Reports

DataHub

- ~2500 forecast and +250 historical metrics
- Regional results and worldwide totals
- Operator historical data



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's Custom Research team 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.analysismason.com/research.

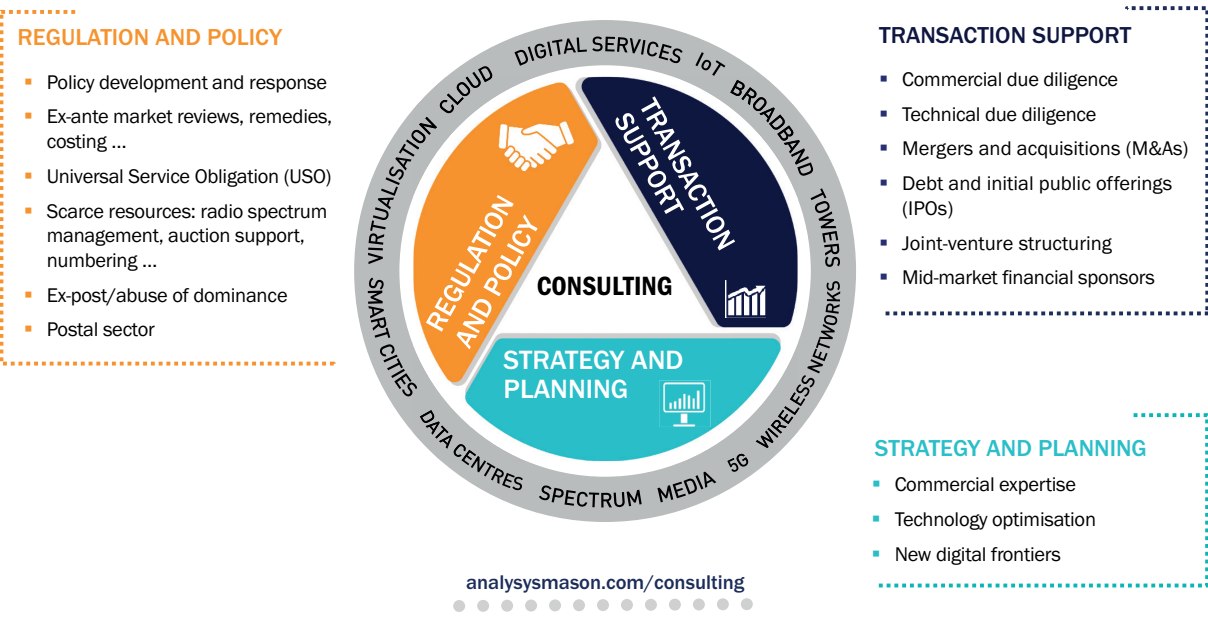
Consulting from Analysys Mason

For more than 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 telecoms, media and technology (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.








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.

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