analysys mason

White paper

Open, disaggregated networks will transform MNOs' 5G business cases

May 2020

Roberto Kompany and Caroline Gabriel

RESEARCH

Contents

1. Executive summary

Mobile ARPU has fallen significantly in the past 5 years in most regions around the world, but the mobile data traffic in many regions more than doubled each year between 2010 and 2015. Analysys Mason forecasts that it will continue to grow until 2024, at which point there will be five times as much data traffic as in 2018. Mobile network operators (MNOs) have embarked on their 5G journeys since late 2018 in the expectation that the new technology will bring additional network capacity to help them to meet demand and enable new consumer and enterprise services that will drive significant revenue growth.

MNOs recognise that very different network architecture will be required to deliver the ambitious targets that they have for 5G. Analysys Mason conducted a survey of 60 mobile operators (including Tier-1 and 2 MNOs and new entrants) and found that almost one third of MNOs are aiming to reduce the total cost of ownership (TCO) by 20% or more within just 3 years of deploying a new network. The ability to flexibly support a wide range of new services is even more important for smaller or new mobile network deployers because it enables them to differentiate themselves from their larger rivals.

It will be difficult for most MNOs to make the business case for 5G without these levels of cost reduction and service flexibility, and a radical new approach to network architecture is required to achieve them.

This new approach to mobile economics relies on deploying the network entirely in the cloud (to achieve the same economics as webscale companies) and on ensuring that these networks are based on open standards, which will support multi-vendor implementations along with an increase in competition and innovation. Two thirds of the MNOs in our survey considered these open platforms to be essential or important to their business strategies, and this figure rose to 92% among MNOs planning to implement a fully cloud-based network.

This paper outlines three ways in which operators and network equipment vendors must work together to achieve this open, multi-vendor, cloud-based network and details the related benefits (economies of scale, flexibility and cost-effectiveness). It outlines how the migration to new, open architecture will be accelerated if vendors embrace multi-vendor initiatives such as Telecom Infra Project and O-RAN Alliance, which will in turn increase the levels of operator confidence in deploying brand new cloud-based systems. It illustrates the importance of these alliances in facilitating co-operation between vendors and in developing operator requirements. Based on these operator requirements, open specifications can be aligned to business cases, thereby bringing the economic benefits of open platforms to the previously closed mobile network ecosystem. It also outlines the commercial impact for executive decision makers of cloud-based networks in which different elements can be deployed separately (where resources are required) and can be mixed and matched, Lego-style, to reflect the precise business model. It shows how operators and vendors can co-operate to move towards these cloud-based networks with return on investment (ROI) at each stage.

As well as enabling an unprecedented variety of services and user experiences, and dramatically lower TCO, these new architecture frameworks will lower the barriers to entry to the mobile network supply chain because of the lower hardware costs. The open interfaces between different units will also allow operators to build truly multi-vendor networks. This will open up the supply chain, thereby further improving MNOs' economics and their ability to access the latest innovations.

These changes set up a cycle of falling TCO, rapid network updates and agile introduction of new services, whose impact on the business case will snowball over the years. This will only be achieved by using a clear, step-by-step roadmap, which introduces open technologies and delivers strong ROI at every stage.

MNOs need to start planning their own roadmaps based on their own business priorities now. Their active participation in the open networks initiatives will accelerate progress for the whole industry and expand the ecosystem. This means that mature, deployable platforms will be available whenever an MNO wants to start reaping the benefits of lower-cost, higher service quality and greater profitability. This will make the end-to-end, cloud-native dream achievable, and will enable the realisation of the full commercial and socio-economic benefits of 5G.

2. New commercial imperatives are driving the development of new network architecture

- **MNOs have challenging commercial goals for their next-generation networks: lower TCO, higher revenue, greater service diversity and enhanced user experience.**

- **At least two thirds of MNOs believe that open, cloud-native architecture is essential to keep the business case afloat as data usage grows and ARPU growth falls.**

2.1 Introduction

MNOs' commercial requirements and imperatives have changed dramatically over the past few years and will change even more quickly in the 2020s. MNOs must therefore re-evaluate their mobile network architecture frameworks in order to remain competitive in the marketplace and deliver on these changes. Key elements of this transformation include:

- disaggregation, which involves breaking the network into pieces that can be mixed and matched according to the business case
- virtualisation, which replaces dedicated boxes with different network functions and runs these functions as software on standard servers.

The ultimate goal is an end-to-end cloud-native network designed from scratch to run on cloud infrastructure, thereby bringing MNOs the kind of economies of scale that webscale providers enjoy.

This paper will explore why achieving an end-to-end virtualised, cloud-native and disaggregated network is essential for MNOs and outlines how open platforms can transform the business case and mitigate the risks. It will pay special attention to the radio access network (RAN): the most expensive part of the network and, for most MNOs, the most challenging network domain to virtualise.

The conclusions will be based on analysis of the operator and vendor ecosystem, including a survey conducted by Analysys Mason. 60 Tier-1 and 2 mobile and converged operators, including established and new providers, were questioned as part of this survey in order to understand how their business goals would shape architectural choices for their end-to-end networks in the coming 5 years.

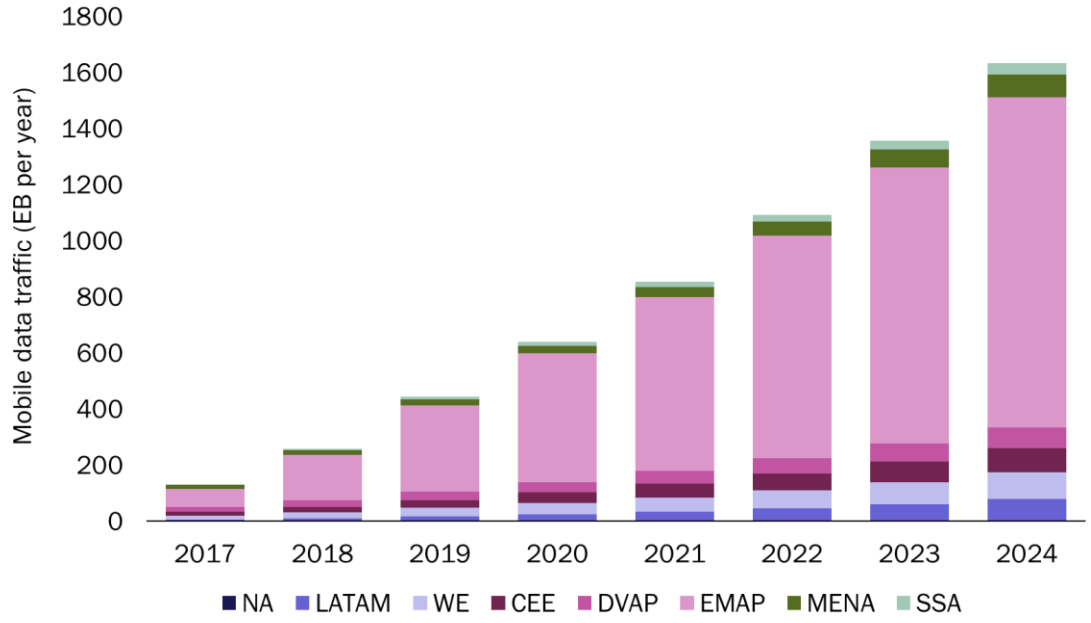
2.2 The changing mobile business landscape

The dawn of 4G mobile networks, together with the democratisation of large screen smartphones in the early 2010s, led to huge mobile data traffic growth in many regions. New use cases, such as music and video streaming, began to grow in popularity as the previous barriers to adoption (poor user experience due to a low network quality of service (QoS) and high cost because of MNOs' high per-megabyte data charges) started to be removed.

Mobile data traffic more than doubled each year between 2010 and 2015, particularly in North America (NA) and the Middle East and North Africa (MENA). Traffic also grew in other developed regions with an annual growth rate of over 60% until 2017, after which the rate of growth began to slow to over 30% yearly.

Analysys Mason forecasts that the launch of 5G mobile networks in late 2018 will result in the global mobile data traffic growing to almost 1800EB per year by 2024, a 5-fold increase compared to 2018 levels (Figure 2.1). Typical 5G devices are expected to consume three to four times more data than their 4G counterparts, and data traffic may increase by 100 times that for 4G devices in some areas of heavy usage, such as in dense urban areas.

Figure 2.1: Mobile data traffic, by region, 2017–2024



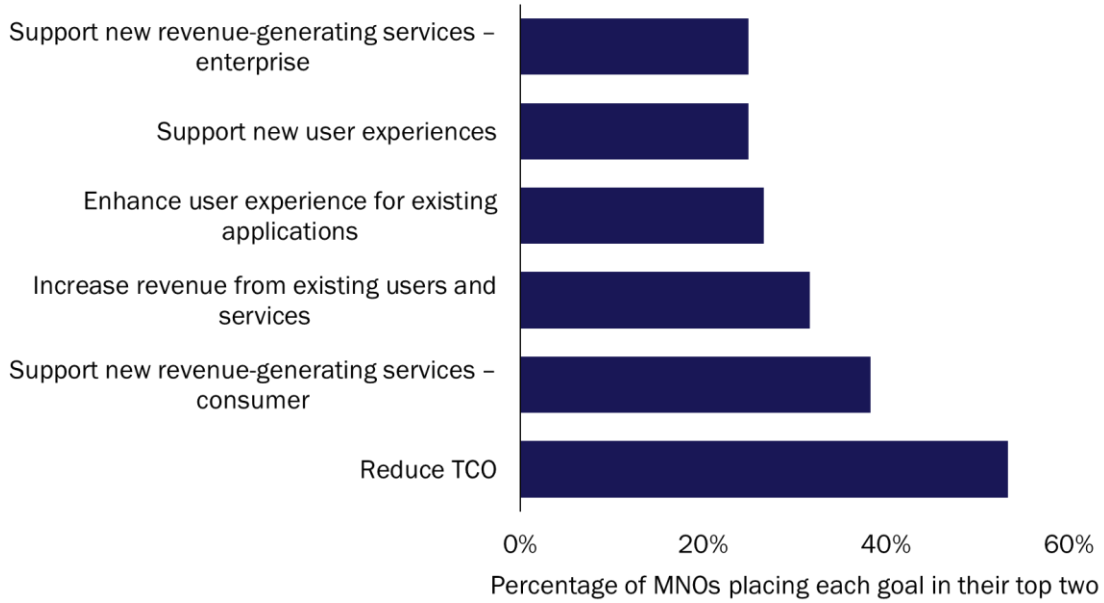
Source: Analysys Mason, 2020

2.3 Data traffic growth is changing MNOs' commercial priorities

This rapid growth in mobile data traffic and the migration to 5G has created new challenges for MNOs' business models. MNOs must invest to increase their network capacity, but the increased data demand has not translated into revenue growth. Indeed, mobile ARPU has fallen significantly in the last 5 years in most regions around the world. This is increasing the pressure on MNOs to diversify their revenue bases (for example, with new enterprise and industrial services) and to reduce the cost of delivering data.

Figure 2.2 shows the key top-level commercial objectives that will shape MNOs' decisions. Reducing the total cost of ownership (TC) is the most urgent objective for many MNOs; more than half of those in our survey said that this was one of their top-two objectives. Other important drivers are generating new revenue from new or existing user bases and improving the user experience across many applications.

Figure 2.2: MNOs' most important high-level commercial goals for next-generation network deployments, 2019[1]



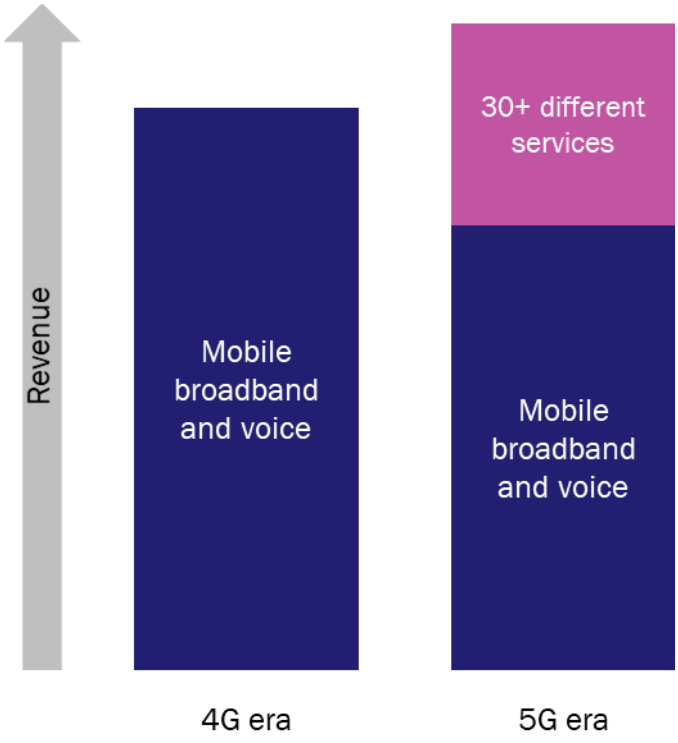
Source: Analysys Mason, 2020

The emphasis is on new revenue sources because of the limited revenue or margin growth that is available from established mobile broadband applications. The opportunities for traditional operators to increase their revenue and for alternative deployers to carve out a market rely on new use cases. These may be new user experiences for mobile broadband consumers (such as virtual reality gaming) or services targeted at the enterprise, industrial and IoT sectors to enable players in these sectors to support their own digital transformation programmes. In either case, the network will need to behave very differently for each new use case.

Embracing only one or two of these new opportunities will not compensate for the decline in mobile broadband and voice revenue growth in the 5G era. MNOs must be able to support a large number of services, each delivering incremental revenue, with a sufficiently low cost of delivery to ensure a healthy margin, even on niche use cases (Figure 2.3).

1 Respondents first provided a free-form list of goals. They were then asked to select the two most important goals from the six that were most commonly cited across the board.

Figure 2.3: MNOs' revenue mix in the 5G era compared to that in previous generations



Source: Analysys Mason, 2020

3. New architecture must support the new business priorities

- **Traditional inflexible networks will not support the diversity of mobile use cases that are required in the 5G era.**
- **Virtualised architecture can reduce costs and enable new revenue, if planned carefully.**
- **Some large MNOs are showing the way, but new platforms will enable new types of service provider to join the market.**

Of the objectives highlighted in Figure 2.2, those related to revenue and user experience can be supported to a significant extent by adopting more-flexible, virtualised architecture, which allows resources to be allocated and optimised for specific tasks and to be quickly reassigned as required to support new services or experiences.

3.1 New usage patterns are driving the market towards virtualisation

The market shift towards increased mobile data consumption and the rapidly growing number of connections (including those for IoT devices) has compelled players in the telecoms industry to review their network capacity and scalability strategies. The traditional model of using purpose-built network elements to meet the increasing demand for traffic will no longer be cost-efficient. MNOs have therefore turned to virtualisation for new solutions.

Virtualisation involves the migration from using a hardware model (using dedicated boxes for each element of the network) to using virtual network functions (VNFs) that run as software on standardised, common off-the-shelf (COTS) hardware. These VNFs will increasingly run on cloud infrastructure.

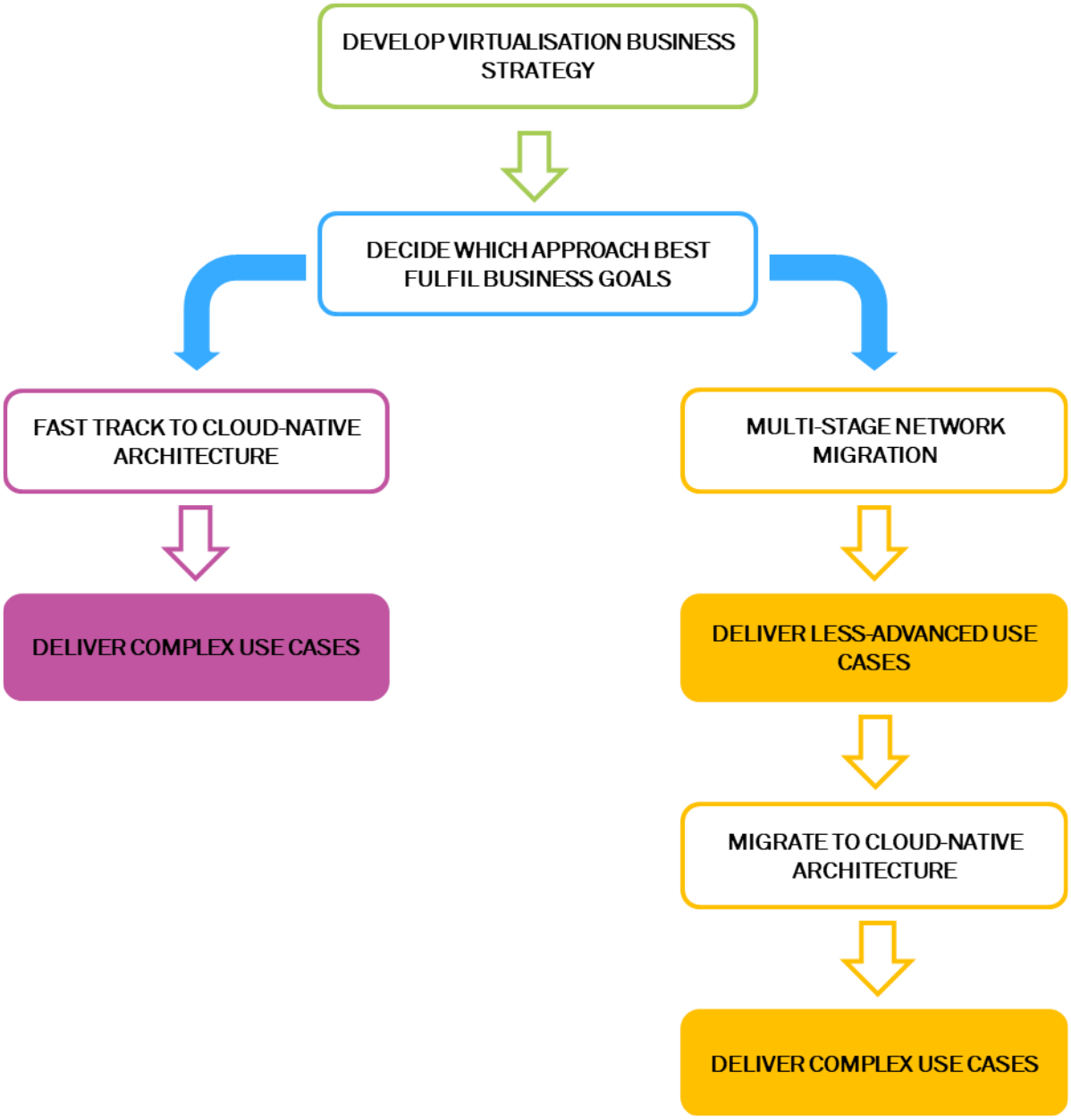
Virtualised networks reduce costs and time-to-market and increase the flexibility for new services. For instance, MNOs' staff can spend months setting up and configuring a new traditional hardware box in order to increase network capacity. This process can lengthen the time-to-market for new services, negatively affect customer satisfaction and increase churn. Instead, virtualisation will enable MNOs to more dynamically add new resources as required by rapidly deploying new virtual machines (VMs) that run on COTS architecture. This makes the network more-scalable (up and down), more-automated (essential for densification) and more-flexible to support a range of diverse use cases.

3.2 MNOs must plan their migration, which may involve multiple phases

The deployment choices and the timing of the migrations will shape both the services that an MNO can support and the costs of its next-generation network. Virtualisation will be a multi-stage process and it is important that MNOs see tangible benefits at each stage.

Some MNOs are already trialling or deploying virtualised, disaggregated networks, and the work of these MNOs (such as AT&T, China Mobile and Telefónica) will provide important lessons for wider roll-outs in the future. However, each MNO will define its own roadmap and pace of change to suit its business model. Figure 3.1 shows the two possible approaches that MNOs can take with their network migration strategies.

Figure 3.1: Two possible approaches to MNO network migration



Source: Analysys Mason, 2020

Many MNOs will start by simply running existing network functions as software on COTS hardware, as some have done with their 4G core networks. They will then move to cloud-native architecture, which is designed from scratch to make use of cloud infrastructure. This will break the functions into many small microservices that can be mixed and matched 'Lego-style' to best suit the application required. In parallel, the physical elements of the network can be separated from the software and placed in the most efficient locations to suit traffic patterns. For instance, the radio and antennas in the RAN will often be deployed remotely from the cloud server on which digital baseband functions are running.

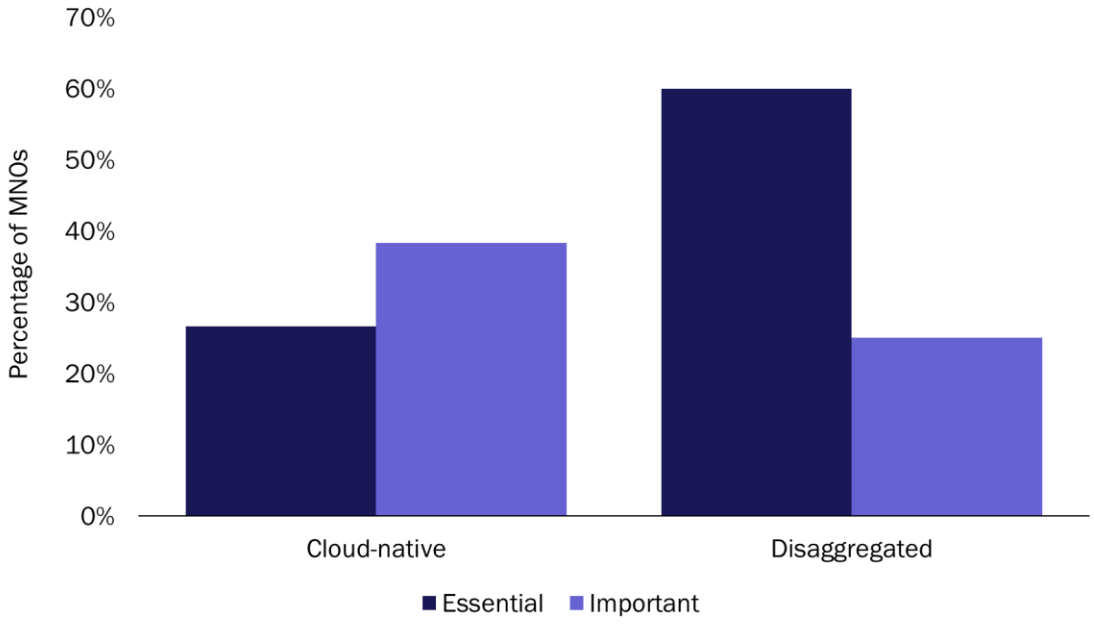
This is a disaggregated network: different hardware and software elements may come from different vendors, provided that the interfaces connecting them all together are open and standard. This is central to the work of open initiatives such as Telecom Infra Project (TIP). TIP is an alliance of operators, vendors and other stakeholders from across the telecoms ecosystem that aims to facilitate the development of open networks. It is

developing requirements based on MNOs' commercial needs, which will inform the new open specifications that will be defined by other groups such as the O-RAN Alliance, Open Networking Foundation (ONF) and GSMA.

The end goal for many will be a fully cloud-native, end-to-end platform, because that will support full-service flexibility. This, in turn, will enable the support of a far greater diversity of network behaviours and use cases, for instance by enabling fully dynamic end-to-end slicing (which allows virtual sections of the network to be repurposed on the fly to support the requirements of particular users or applications).

Figure 3.2 shows that 65% of respondents to our survey consider cloud-native architecture to be essential or important to making their next-generation end-to-end networks commercially and technically successful. The figure is even higher (85%) when it comes to disaggregation. (It is worth noting that these percentages are higher for end-to-end networks than for any single network domain, showing that the potential gains of new architecture are far greater if they are implemented end-to-end.)

Figure 3.2: Percentage of MNOs that consider cloud-native architecture and disaggregated architecture to be essential or important to their next-generation end-to-end network, 2019

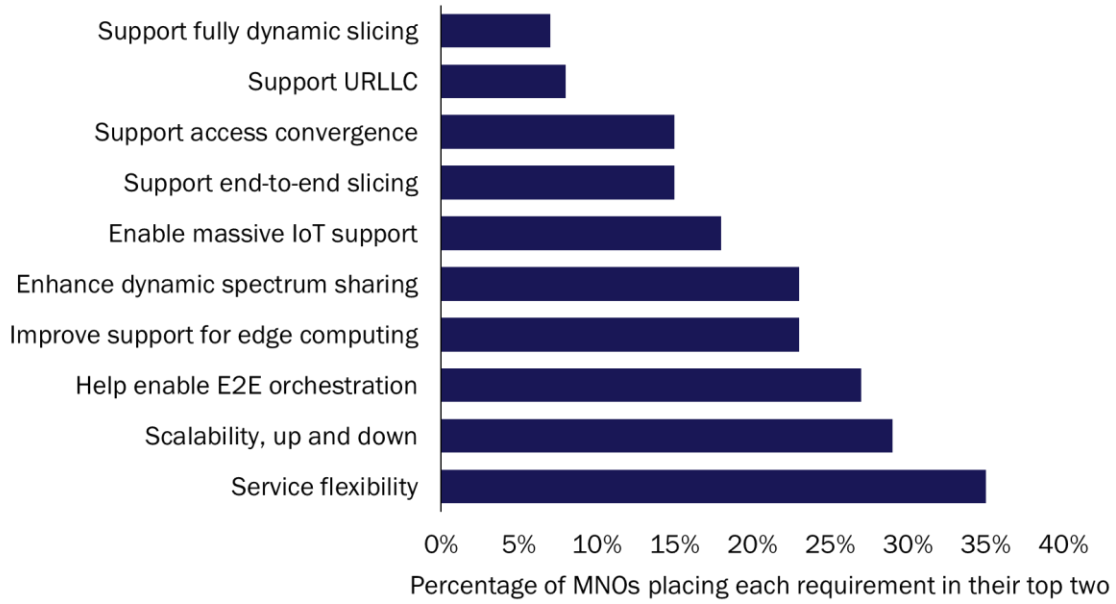


Source: Analysys Mason, 2020

In the past, a specific network would have been required to support the specialised requirements of, for instance, an ultra-low-latency transport signalling application or a virtual reality conferencing service. Only a very-high-value service could justify the cost of deploying and running these specific networks for the MNO and the customer. However, virtualised and disaggregated networks allow functionality to be distributed flexibly in slices as required by a particular use case.

In our survey, slicing was just one of the features of the ideal next-generation network that respondents considered to be important to supporting their commercial objectives. Figure 3.3 shows the 10 most important requirements that emerged.

Figure 3.3: *MNOs' 10 most important requirements of a next-generation network, in terms of the commercial model, 2019*[2]



Source: Analysys Mason, 2020

The flexibility to launch, change and remove services on-demand is a top-two priority for the new network for 35% of MNOs. Scalability and slicing help to enable this flexibility. Those targeting the Internet of Things (IoT) also need specialised network capabilities to support massive numbers of devices and ultra-reliable, low-latency communications (URLLC). The impact of this flexibility will only be fully felt if it is supported end-to-end (E2E), hence why 27% of MNOs consider E2E orchestration to be a top-two critical requirement.

It would be impossible for a traditional monolithic network to enable such a wide range of requirements simultaneously, and MNOs would be forced to make difficult priority choices when configuring their platforms. That is no longer acceptable in the 5G era; commercial success relies on being able to support a wide diversity of users, markets and applications, some of them as-yet unforeseen, without constantly reconfiguring the physical network.

3.3 New architecture supports operator diversity and greater customer choice

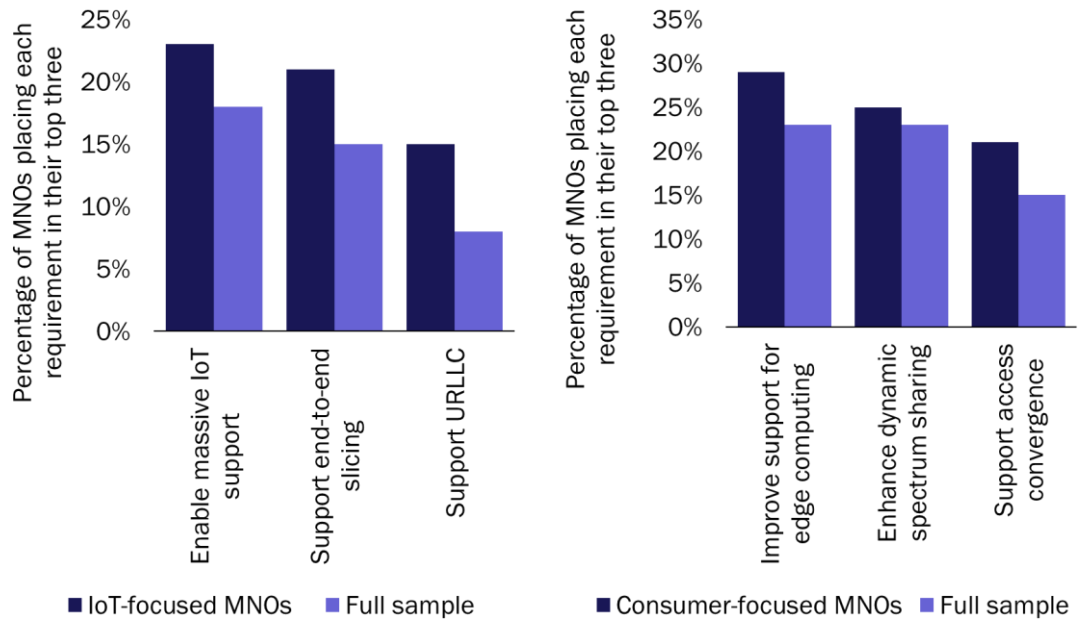
The commercial objectives that MNOs have for their next-generation networks are not uniform. Smaller and newer MNOs often have a more urgent need to be agile because they will frequently target quite specific industries or applications, but need to be able to change their focus as markets shift. A more-affordable and flexible network will enable a new breed of MNOs that can make a strong business case to concentrate on one type of service or user group alone. This is a contrast to the conventional MNO model, which relies on generic services for whole populations. The two will complement one another and provide better choices for users with specific requirements, such as very-high-quality AR/VR experiences or industrial-class IoT connectivity.

[2] Respondents first provided a free-form list of features. They were then asked to select the two most important from the 10 that were most commonly cited across the board.

Industry co-operation to create open, affordable networks will therefore be critical in enabling different types of MNOs to be competitive, whatever their business model.

Figure 3.4 illustrates the contrast in priorities between MNOs whose primary commercial drivers are IoT-related and those that expect that the majority of revenue growth will come from consumer applications such as VR gaming.

Figure 3.4: Top-three network requirements for respondents with a primary focus on IoT (left); top-three network requirements for respondents with a primary focus on new consumer use cases (right), 2019



Source: Analysys Mason, 2020

Reduced TCO and end-to-end orchestration are important for all, but other priorities vary significantly depending on the MNO's focus. For example, it is far more important that the network is optimised for massive IoT support, end-to-end slicing and ultra-reliable, low-latency communications for IoT-focused MNOs than for the average respondent to our survey. The top-three requirements for consumer-focused MNOs are edge computing, dynamic spectrum usage and access convergence, which relate to improved user experience and greater resource efficiency.

There would be a significant negative impact on economies of scale and the ecosystem of equipment, applications and devices if each MNO were to build an entirely different network to support their varying priorities. The importance of a cloud-native and fully open architecture is that a single platform can be adopted by any MNO and can be configured, in software and using skills and tools that are common across the industry, for particular business cases. It can also be adapted as those cases change.

There is also the important option to distribute the cloud-based network wherever resources are needed. Localised implementations of the virtualised core and RAN controller can be combined with small cell antennas and edge compute nodes, for instance, to form highly localised or specialised 'sub-networks' to serve specific purposes. These local networks will be important proving grounds for new architecture and open interfaces in the early stages because they present no risk to the main network, but the real economic advantage will come when all the networks are based on the same platform and microservices architecture to avoid fragmentation and encourage scale.

Figure 3.5 shows the percentage of respondents that expect to deploy a distributed technology to support a specific area of new revenue in the 5G era. The most common use cases for these discrete networks (or, in future, slices) are edge computing, IoT, end-to-end solutions (such as enterprise private or industrial networks), indoor and outdoor connectivity for rural inclusion and urban densification, smart cities and URLLC services.

Figure 3.5: Percentage of respondents that will deploy various types of distributed technology for five selected use cases

Use cases	Distributed core	Local RAN	Slices
Edge computing	17%	20%	17%
IoT	13%	13%	20%
Private networks	8%	12%	8%
City networks	33%	23%	7%
URLLC	3%	3%	15%

Source: Analysys Mason, 2020

4. Networks must be open as well as virtualised for maximum impact

- **Virtualisation only delivers part of the benefit that is possible with new architecture.**
- **Open, multi-vendor systems based on common interfaces will enable a broad ecosystem with high levels of competition and innovation.**
- **These open specifications will enable new network economics that will make MNOs' business cases more robust in the 5G era.**

A virtualised, cloud-based network is not, on its own, the solution to all of the challenges that 5G brings. It will not, per se, deliver reduced TCO, and it will not necessarily guarantee the best possible quality of experience, nor the maximum diversity of revenue streams.

4.1 Open systems introduce competition and innovation

The essentials of any business model (that is, reduced cost, improved quality and increased addressable revenue) are only optimally supported by a network that is cloud-based, open and multi-vendor. Open interfaces introduce competition into the supply chain, thereby driving down costs and improving MNOs' ROI. The respondents that said that reduced TCO was one of their top-two commercial goals for their next-generation network were almost twice as likely to say that they would adopt an open, multi-vendor strategy. In terms of quality and service flexibility, an open platform allows MNOs to select the best components for their particular services and customers and to change them in the future if those needs alter because of a change in business model.

MNOs will only be able to build a next-generation platform affordably by using fully open specifications, with the confidence that the platform can be constantly adapted to new application priorities without having to be physically reconfigured each time.

Open platforms have proved elusive in the past because key interfaces between different elements of the network have been implemented in proprietary ways by each vendor. However, with mobile economics becoming very challenging, the need for open, competitive ecosystems is becoming urgent, and the industry is increasingly getting behind fully open specifications (devised by groups such as the O-RAN Alliance) that are aligned to MNOs' commercial requirements, as distilled by the work of TIP.

MNOs are already issuing major requests for proposals (RFPs) based on the TIP requirements and on specifications from O-RAN and other groups such as Open Networking Foundation (ONF). For example, Vodafone has pledged to apply the open RAN approach to its entire European footprint over the coming years, while Rakuten Mobile in Japan has switched on the world's first end-to-end cloud-native network, with O-RAN interfaces between elements. Deutsche Telekom, Etisalat, Telefónica, Telstra and Turkcell are just a few of the other operators that are trialling or deploying open, virtualised networks.

Open platforms are also essential to accelerate the pace of cloud-native architecture development in every part of the network. To date, progress has been very different in different network domains, making the end-to-end vision impossible. In particular, there are many challenges associated with disaggregating the RAN. This paper

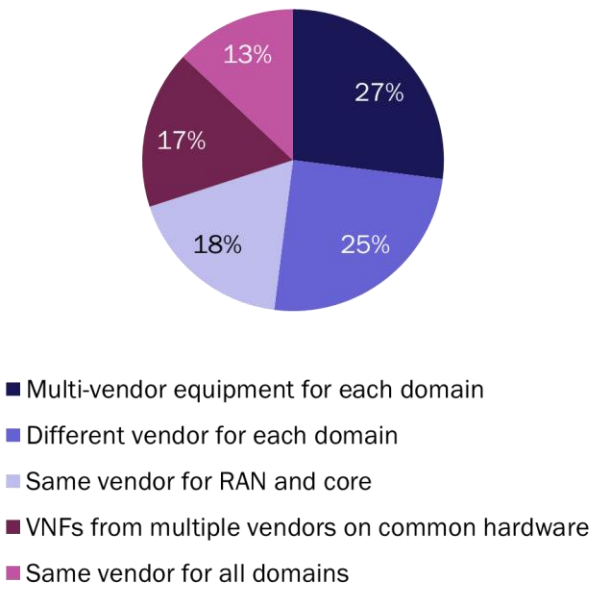
will argue that an open platform is the missing link that will make the virtualised RAN practical and economic, and will lay the critical foundation for the ultimate goal: an end-to-end cloud-native network.

4.2 New platforms will break open the network supply chain

Open platforms do not only enable a diversity of services for MNOs. They also allow equipment and software vendors of all sizes to address a market with critical scale, and attract the makers of application- or industry-specific devices and applications that can design products to open, uniform specifications rather than having to adopt rarefied technologies and skills.

All this will diversify the supply chain at every level from chips to RAN and core networks to applications and devices. This will provide new opportunities for a broad ecosystem of suppliers, open up new choices for MNOs and increase vendor competition. Figure 4.1 shows the importance to MNOs of having the freedom to pursue a multi-vendor strategy (in the cases where this makes best commercial sense). Only 13% expect to use a single vendor across all network domains for their next-generation network, while 27% aim to have solutions from multiple vendors in every domain.

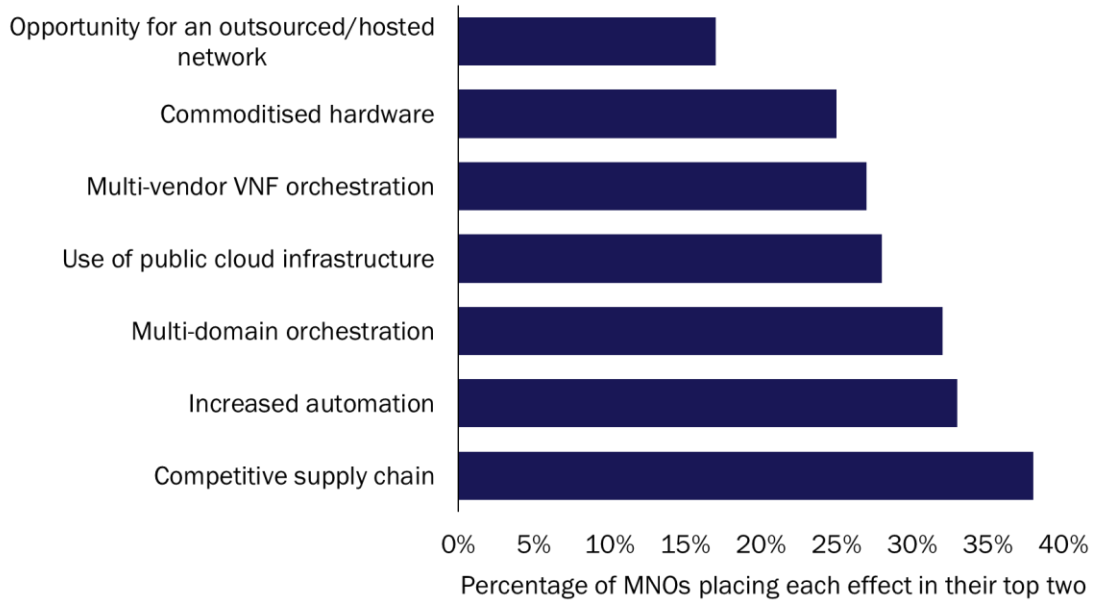
Figure 4.1: Percentage of MNOs that expect to use a multi-vendor strategy in their next-generation networks, 2019



Source: Analysys Mason, 2020

The opening up of the supply chain goes beyond just providing a wider choice of equipment vendor. It affects choices that an MNO can make throughout the end-to-end network. MNOs believe that the most important effect of end-to-end, open, disaggregated networks on their business cases will be via the introduction of a competitive supply chain (Figure 4.2). Other supplier choices are enabled by the new architecture too. 28% of MNOs say that the option to use public cloud infrastructure to host virtualised network functions is a top-two commercial benefit, while 17% are interested in outsourcing their network entirely under a cloud-based managed services deal.

Figure 4.2: Top seven ways in which an end-to-end open platform will affect the ability of MNOs to meet their business targets, 2019



Source: Analysys Mason, 2020

Figure 4.2 shows the main commercial effects that MNOs expect to see once they move to an open end-to-end implementation. The cost savings from using commoditised hardware and public cloud infrastructure are maximised when they are applied to all domains, as are the benefits of multi-vendor orchestration and automation. The adoption of cloud-native and end-to-end networks will greatly increase the levels of automation and multi-vendor, multi-domain orchestration, thereby further magnifying the efficiencies of the network and the ability to swap vendors and functions in and out as required.

5. Open platforms will help MNOs to address the most challenging domain, the vRAN

- **The RAN is the most critical domain for MNOs' 5G business models, but is the most challenging to virtualise. Two thirds of MNOs expect a TCO reduction of at least 10% within 3 years if they achieve this virtualisation.**

- **Open platforms, such as those being developed by TIP and O-RAN Alliance, will lower the barriers to virtualising the RAN and accelerate progress.**

- **The benefits of open platforms are the most dramatic in the vRAN, and this is the missing link that must be made to achieve an open end-to-end network.**

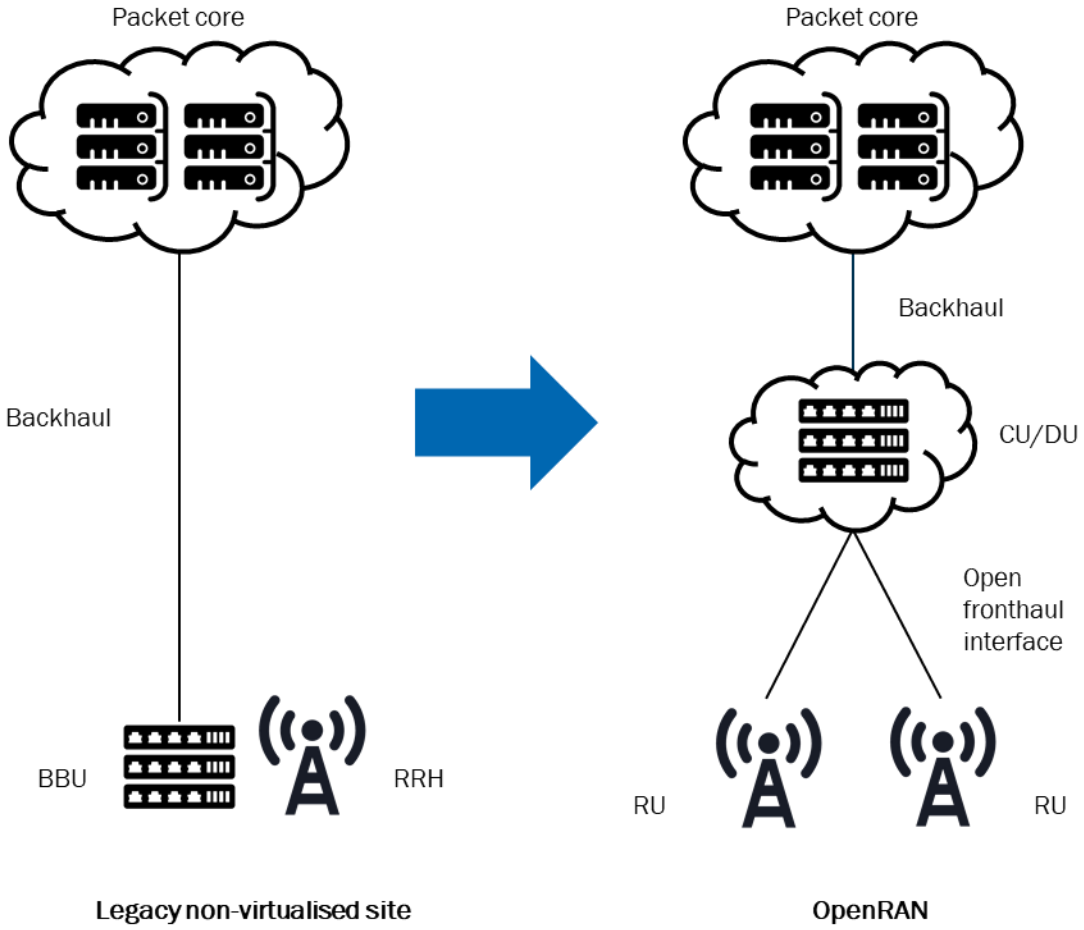
5.1 The vRAN is the last mile of network virtualisation

The telecoms industry has been working on virtualisation for several years, but not all network domains have been virtualised at the same rate. For example, the virtualisation of the 4G evolved packet core (EPC) has progressed further than that of the RAN.

However, it is critical for the RAN to be virtualised, disaggregated and opened up if MNOs are to achieve the new economics that they require for a successful business case. The RAN accounts for more than two thirds of mobile network TCO and the way it is planned and optimised has the most direct impact on user experience. However, it is the most challenging network domain to virtualise (particularly using x86-only environments), and the one where most MNOs still see significant risk.

These challenges explain why much of the early virtualisation work has happened in other domains. In our survey, 78% of MNOs said that they plan to deploy a virtualised core before the end of 2022, and of those, 60% aim to have begun a cloud-native core implementation. The timescales are typically longer in the RAN: only 3% of MNOs said that they plan to have a fully cloud-native RAN by the end of 2022 (Figure 5.1).

Figure 5.1: Evolution of the RAN and core architecture from monolithic to cloud-native



Source: Analysys Mason, 2020

Even MNOs with very advanced virtualisation programmes will typically leave the RAN until last. We believe that open architecture will help to mitigate the perceived risk and disruption, and will lower the barriers to virtualising the RAN. In turn, it will have a significant commercial impact on the mobile industry in the coming 5 years.

One of the key drivers for virtualising the RAN is the move to 5G; 30% of MNOs do not plan to virtualise a 4G macro RAN, but only 7% say the same about 5G. This is partly because the commercial drivers for undergoing a highly disruptive architecture shift have only become imperative with the introduction of 5G platforms (which are broader than just 5G radio), which can enable new business models for both new and traditional MNOs.

These commercial drivers are becoming increasingly urgent and the existing vRAN timelines are too long to enable many MNOs to take early advantage of new 5G opportunities. The advent of open architecture is the lifeline that many need to address the risks of vRAN migration and adopt a more-ambitious roadmap.

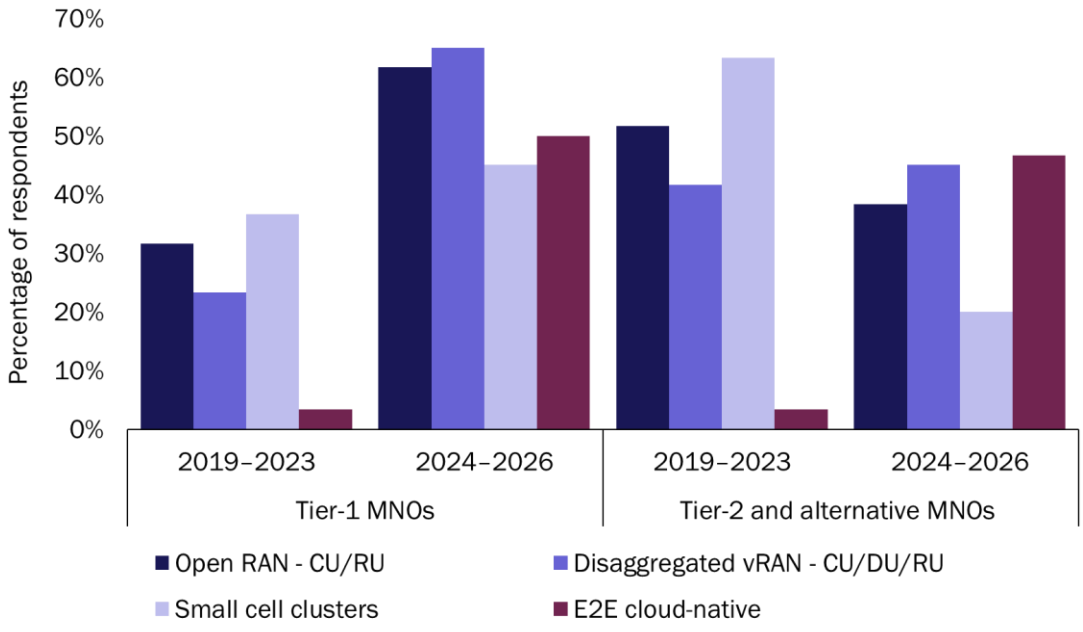
This is seen clearly in the results of our survey. MNOs' RAN virtualisation plans vary considerably in terms of which migration path they will adopt and the timing of each stage, but they are more ambitious than in a similar study 2 years ago (before open RAN options were commercialised).

Some of the variations are regional. The adoption of advanced architecture, particularly that that is end-to-end and cloud-native, has been particularly strong in China, Japan and South Korea, though much of the early work has been proprietary. Most of the near-term interest in open RAN architecture has been focused on two scenarios: rural and suburban expansion in emerging markets, and densification in Europe.

However, the variations between different types of operator are far more significant. There was a fairly even split between Tier-1 MNOs and Tier-2 MNOs or alternative operators (the latter being new entrants or non-traditional deployers of cellular networks, such as neutral hosts) in our survey. The results clearly show that open RAN platforms could provide alternative operators with a means to gain an advantage over larger players by using a more-flexible approach. If they succeed, the market would become more-diverse, with dramatic consequences in terms of the choices available to consumers and enterprises.

Our survey shows that smaller and alternative operators will generally move more quickly to deploy new architecture than their older, more-traditional counterparts (Figure 5.2). Over half expect to have started to roll out open RANs commercially by the end of 2023, compared to just a third of Tier-1 MNOs. This reflects the need for smaller and new operators to move quickly in order to make the most of the cost-effectiveness of the new platforms and to build networks that can support services and user experiences that are clearly differentiated from those of the established leaders. Of course, they have fewer challenges in terms of migrating complex legacy networks, which will be a factor slowing down the Tier-1 players. However, the deployment of open RANs by large MNOs will gather pace from 2023, as these players address the complex challenges of migrating their significant conventional deployments. The percentage of large players with open and disaggregated RANs will be even higher than that of their smaller competitors by the end of 2026.

Figure 5.2: Expected deployment of the four phases of open RANs, by operator type, 2019–2026



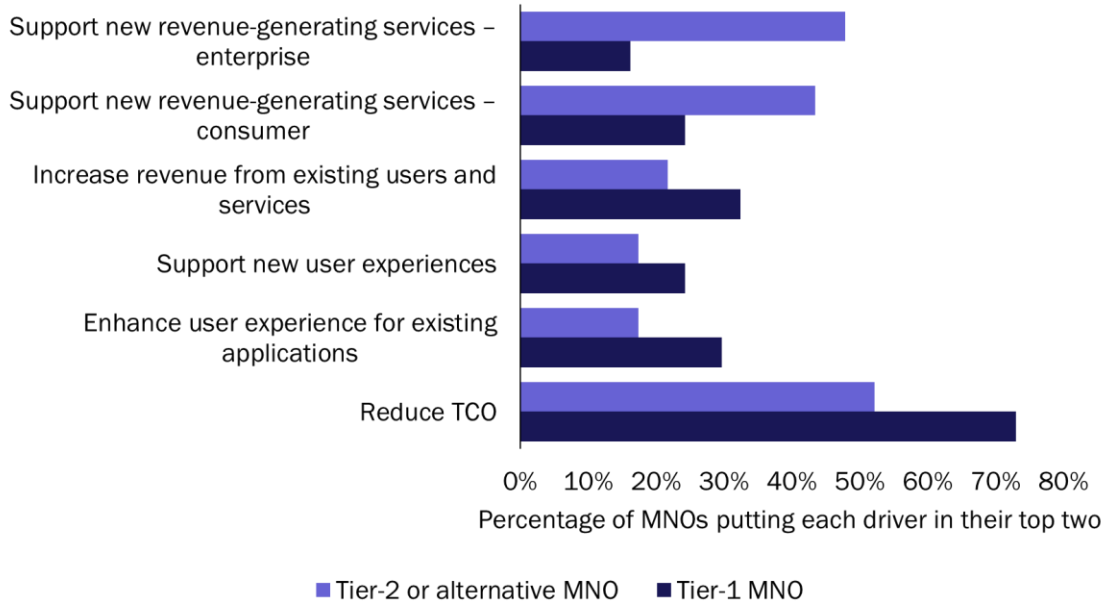
Source: Analysys Mason, 2020

The business drivers for virtualising the RAN differ by operator type too. Smaller and new MNOs have a clear requirement to be agile and to pre-empt existing MNOs in offering new services, or to address gaps in the market where large providers may find it hard to make a strong business case, such as rural connectivity or

industrial campus environments. This means that the commercial drivers behind their network choices are driven by a combination of service flexibility and cost-effectiveness.

By contrast, large MNOs are initially driven primarily by the need to reduce the total cost of ownership of their new networks (Figure 5.3), and this dominates their network decisions in the first 2–3 years of network roll-out. However, many are planning ahead for an extreme level of service agility. This will only be achieved by implementing fully disaggregated, cloud-native architecture which is not fully commercially tested yet.

Figure 5.3: Primary business drivers for deploying open RAN, by operator type, 2019



Source: Analysys Mason, 2020

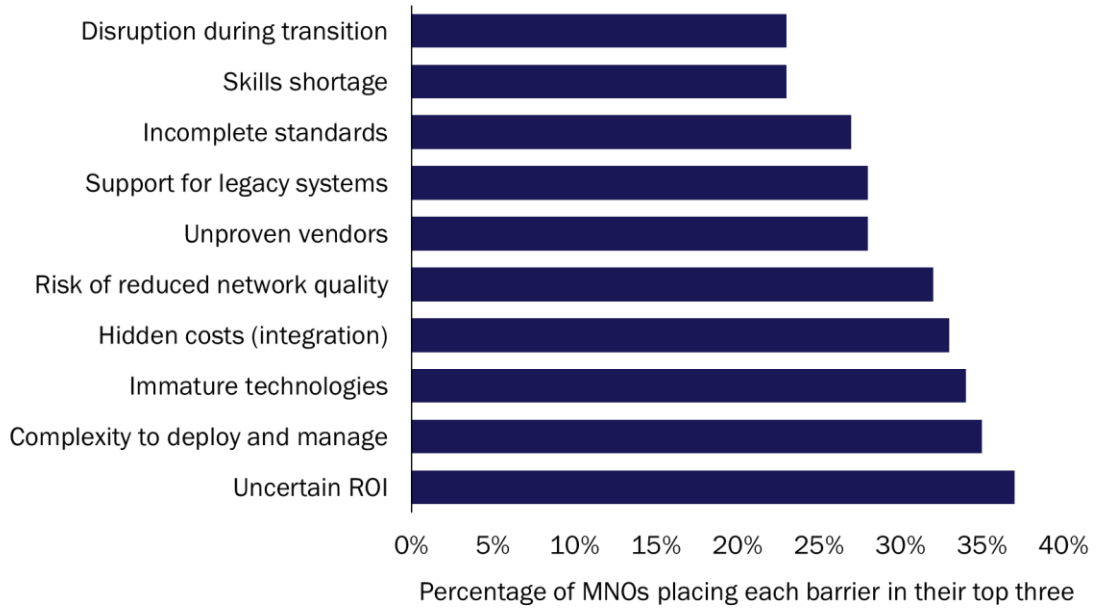
5.2 Open platforms are key to accelerating the vRAN journey

Our survey results show that there is still considerable uncertainty about new RAN architecture, and even more about end-to-end network migration. Almost half of MNOs remain unsure about when, and even whether, they would deploy an end-to-end cloud-native network.

There are complex architectural choices to make, and the risks when migrating the RAN are the highest because the RAN forms the largest part of an MNO's network spending (around two thirds of the total). An end-to-end network strategy is clearly impossible unless the perceived risks are addressed in phase 1, thereby limiting the benefits of virtualisation.

Our survey identified specific issues that could delay the adoption of the vRAN (Figure 5.4). Most of these related to uncertainty about ROI, the technologies and the supply chain, as well as the cost and complexity of migration. These barriers could lead to a situation where MNOs are always waiting another year for a stable, trusted solution, and in so doing, are repeatedly deferring the benefits of an end-to-end cloud-native network. The key factor that can improve MNOs' certainty and confidence to deploy is a fully open, multi-vendor ecosystem.

Figure 5.4: MNOs' primary barriers to adopting a vRAN, 2019



Source: Analysys Mason, 2020

The history of technology shows us that the best way to mitigate the risk associated with an individual choice is to make it simple to migrate to another, and that the best way to build trust, confidence and a base of real-world evidence is for everyone to innovate on common platforms, which in turn drives a broad base of solutions, vendors, skills and price points. This accelerates the process of achieving hardened, robust solutions and completing the testing and integration that will make them deployable. This, in turn, will result in a proven base of vendors, as well as system integrators. The latter will play a very important role in early open multi-vendor deployments; they will ensure that solutions from multiple suppliers will work seamlessly and will reduce the time and cost for MNOs to activate a working, open network.

In other words, the industry needs a new set of open standards in order to achieve the fully disaggregated, cloud-native, end-to-end network with confidence and affordability.

The success of the cellular network has been built on standards (mainly from 3GPP), but these are not enough on their own to enable cloud-native networks. Emerging platforms need to take account of cloud technologies in a unified way, and they need completely open interfaces to ensure that the different elements of a disaggregated network can be mixed and matched according to requirements. New standards must look further too and allow for multi-vendor interoperability, not just between physical network elements, but between virtual network functions within a single core or RAN.

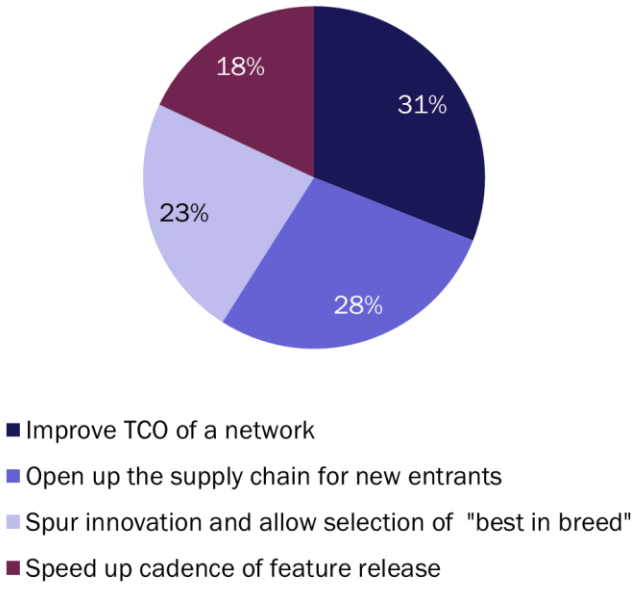
Initiatives such as TIP, the ONF and the O-RAN Alliance are all working on open standards, both to improve on existing specifications and to introduce new, cloud-native concepts into mobile network standards. The importance of openness is clear to MNOs. At least two thirds of the respondents to our survey considered open platforms to be essential or important to their network strategies, and that figure rose to 92% for MNOs that plan to deploy an end-to-end, cloud-native network before 2024. 63% are actively evaluating open platforms for end-to-end 5G; the most popular options being TIP and O-RAN (often together).

MNOs will start to see returns as soon as the RAN is addressed. This is essential if the barriers to progressing to future phases of open networks are to be lowered because MNOs must have the confidence to move ahead.

The benefits that are the most measurable in the short term relate to costs and the practicalities of procuring, deploying and upgrading networks. Revenue benefits, driven by more-flexible architecture, typically take longer to become tangible, though they are essential to the business case (especially for smaller and new MNOs).

The most important near-term benefits are highlighted in Figure 5.5. This shows that improved TCO is the most commonly cited direct commercial consequence of open disaggregated platforms, followed by the related issue of a more-open supply chain.

Figure 5.5: Most significant commercial impacts of adopting an open RAN platform (as cited by MNOs that are considering such platforms to be essential, important or somewhat important to their business cases), 2019



Source: Analysys Mason, 2020

MNOs' expectations of the benefits of the vRAN are ambitious. Two thirds of respondents expect that their network TCO will have fallen by 10% or more compared to their current network in the first 3 years of deployment. 28% are targeting reductions of 20% or more. We believe that these targets will be impossible to achieve if current platforms and the associated economics persist.

Open platforms allow MNOs to choose the best of breed solution for any given function, and to change that in the future as new choices emerge. They also allow MNOs to enhance their networks and services on a rapid (eventually continuous) basis rather than having to wait for a major upgrade every few years.

6. Conclusion: emerging open networks will enable all stakeholders to benefit from 5G

Not all of the virtualised, open networks that are deployed will enable 5G from day one. 4G is often the starting point (for example, in Rakuten's deployment in Japan and in initiatives to bring connectivity to rural communities), and will remain part of the network for many years to come. However, 5G will often be the catalyst to migrate to a new architecture.

5G represents a large opportunity for MNOs to capture new service revenue from consumers and enterprise customers because of its ability to support new experiences including ultra-realistic virtual reality or critical communications. Such services can help to transform the traditional mobile broadband model, which is under significant pressure in terms of profitability and growth.

The wide variety of use cases and traffic patterns that a successful 5G model will enable will mean that MNOs will need very flexible networks that can deliver functionality where it is required, as well as far larger numbers of cell sites. All of this will require the network to be very flexible and highly automated to keep costs low and quality of service high.

As this paper has illustrated, open, cloud-based networks with equipment and software from multiple vendors are critical to making this flexibility and cost-efficiency achievable in the near term. MNOs and vendors can work together, facilitated by open alliances such as TIP, to develop requirements documents as the basis for open specifications. Early trials and deployments of platforms from organisations such as the O-RAN Alliance and ONF are showing the industry what can be done, and are building confidence. Examples of operators that have run trials and deployed open platforms include Vodafone, Telefónica and Deutsche Telekom in Europe, NTT DOCOMO and Rakuten Mobile in Japan and Etisalat in the UAE.

The next stage will be to build on these early specifications and tests to create a fully open platform that lowers the barriers to entry for many vendors, and which is easily deployable by MNOs of all sizes and business models. This, in turn, will provide the foundations for further future migration to fully cloud-native, end-to-end networks that can support further enhancements such as network slicing. All of these changes will enable the next-generation mobile network to provide growth for the whole ecosystem: MNOs, vendors, enterprises and consumers.

7. Recommendations

- **Vendors must develop truly open and multi-vendor platform strategies to relieve MNOs' fears about deploying best of breed virtualised networks to meet their business goals.** 53% of the MNOs surveyed consider TCO reduction to be one of their top-two commercial goals for their next-generation networks, and these players were almost twice as likely to say that they would adopt an open multi-vendor strategy in their next-generation network than those that did not consider TCO reduction to be important. However, MNOs believe that it will still take a number of years before a fully end-to-end open and competitive multi-vendor supply chain becomes available.

- **Vendors that have not yet joined initiatives such as TIP or ORAN Alliance should do so in order to develop open architecture and remain relevant in the 5G era.** MNOs believe that openness will deliver positive benefits to their business models, compared to conventional architecture, and will demand it from their vendor partners. At least two thirds of the respondents to our survey considered open platforms to be essential or important to their network strategies, and that figure rose to 92% for operators that plan to deploy an end-to-end, cloud-native network before 2024.

- **Vendors and MNOs should work together to ensure that they plan end-to-end open networks.** The benefits of open, cloud-native technologies are greatly amplified when they are deployed in all network domains in a harmonised way. End-to-end orchestration is a top-two critical requirement for 5G for 27% of MNOs, and 85% of those believe that disaggregation is essential or important to achieve it. Vendors can provide enabling products and services to help MNOs to develop a clear roadmap towards full end-to-end disaggregation, even where they have already virtualised individual domains.

8. About the authors

Roberto Kompany (Senior Analyst) is a member of Analysys Mason's Telecoms Software and Networks research team and is the lead analyst for the *Next-Generation Wireless Networks* research programme focusing on strategy and market research. He is also a Cambridge Wireless Special Interest Group (SIG) mobile broadband (MBB) champion and a regular speaker at industry events. Prior to joining Analysys Mason, Roberto worked for Dixons Carphone, where he analysed the effect on the business of shifts in the telecoms market – for example, in terms of mergers, operator KPIs and technology – in Europe and the UK. Previous positions included consultancy, where he helped a variety of clients worldwide with mobile-related projects, such as a capex reduction and developing a 5-year strategy for an incumbent's wireless infrastructure.

Caroline Gabriel (Principal Analyst) leads Analysys Mason's wireless research. She contributes to our *Next-Generation Wireless Networks*, *Operator Investment Strategies* and *Spectrum* research programmes and works directly with our research clients to advise them on wireless network trends and market developments. She has been engaged in technology analysis, research and consulting for 30 years, and has focused entirely on mobile and wireless since 2002.

This whitepaper was commissioned by Telecom Infra Project.

Published by Analysys Mason Limited • Bush House • North West Wing • Aldwych • London • WC2B 4PJ • UK
Tel: +44 (0)20 7395 9000 • Email: research@analysysmason.com • www.analysysmason.com/research

Registered in England and Wales No. 5177472