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Perspective

Open Network Index: evaluating operators' progress and attitudes to 'openness' across core, RAN and edge

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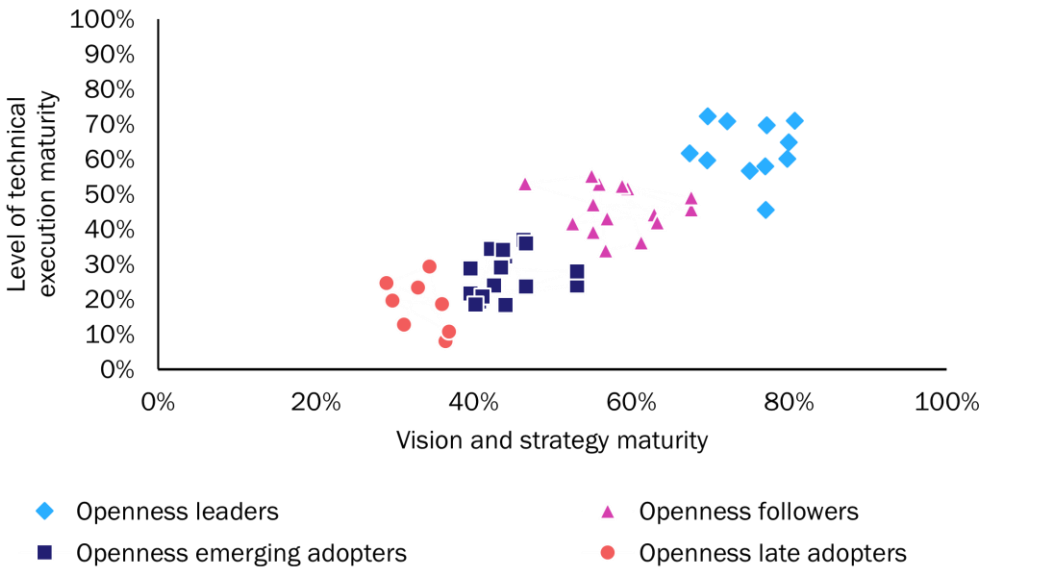
1. Executive summary

Open networks apply proven cloud concepts to the networking domain while enabling components to be sourced from a broad ecosystem of vendors. Open networks boast high levels of automation and programmability and are built around the concept of utilising a common, horizontal cloud platform that supports cloud-native network functions from multiple vendors and from multiple network domains. Operators can enhance the flexibility, agility, composability, innovation and operational efficiency of their networks by implementing open architectures and open operating models.

To understand operator progress towards open networks, Analysys Mason surveyed 50 leading Tier-1 operators worldwide between December 2023 and January 2024. We then benchmarked operator progress from a vision/strategy perspective and a technical perspective to form the first iteration of Analysys Mason's Open Network Index (ONI) (see Figure 1.1).

Figure 1.1: Open Network Index: open network progress of 50 Tier-1 operators, categorised by vision/strategy and technical execution maturity, worldwide, December 2023–January 2024



Source: Analysys Mason

Operators are embracing open networking principles but continue to struggle with implementation

Our survey respondents displayed a strong willingness to align themselves with open networking principles, and many have already established open networking transformation strategies and business cases for this purpose. However, the technical implementation of open network architectures and (especially) open operating models remains challenging for operators. Overcoming these hurdles will require operators to build skills internally and to partner more closely with network-function-neutral vendors such as IT vendors, systems integrators (SIs) and public cloud providers (PCPs).

Horizontal network cloud architectures are the gold standard for operators but adoption remains slow for all network domains

The concept of an open cloud is central to the vision of open networks. Open clouds enable operators to run all network functions on a common, disaggregated cloud platform using commercial off-the-shelf (COTS) hardware. A common platform will help operators to eliminate network silos, which simplifies their operations and will result in cost-saving synergies (such as the reuse of operational and automation tooling).

Our research revealed that there was considerable variance in respondents' adoption of horizontal cloud platforms. The respondents that were most aligned to openness aim to adopt such a platform, but many had yet to implement this vision because it requires significant effort to do so. Furthermore, some of the respondents with the lowest levels of technical execution maturity reported that they will continue to use networks based around domain-specific operational silos.

The adoption of open networks is highest in the mobile core domain but operators are also extending their transformation efforts to the RAN and network edge

The adoption of open networking in the mobile core is driven by the growing use of disaggregated network clouds to support operators as they move from network equipment providers' (NEPs') vertically integrated mobile core network clouds to 'do-it-yourself' (DIY) or PCP-led cloud stacks. For the RAN domain, those respondents with the highest degree of technical execution maturity have already adopted closed vRAN, but operators are showing much more interest in the future adoption of Open RAN, which Analysys Mason defines as a subset of vRAN. Most operators that we surveyed want to deploy multi-vendor Open RAN but mainstream deployment appears to be 2 to 3 years away due to the complexity of such networks and maturity issues with the technology. In the shorter term, operators are considering single-vendor Open RAN. In addition, operators are gradually building out their network edge using open architectures to support new revenue-generating services such as enhanced mobile broadband (eMBB), ultra-reliable and low-latency communications (URLLC), massive machine type communications (mMTC) and fixed-wireless access (FWA). However, this build-out of edge infrastructure and the adoption of edge use cases remains nascent.

Operators need to develop an openness strategy and approach its implementation in the right way

Based on this study, Analysys Mason has identified several actions that operators should take to accelerate their transformation to open networks (see section 5).

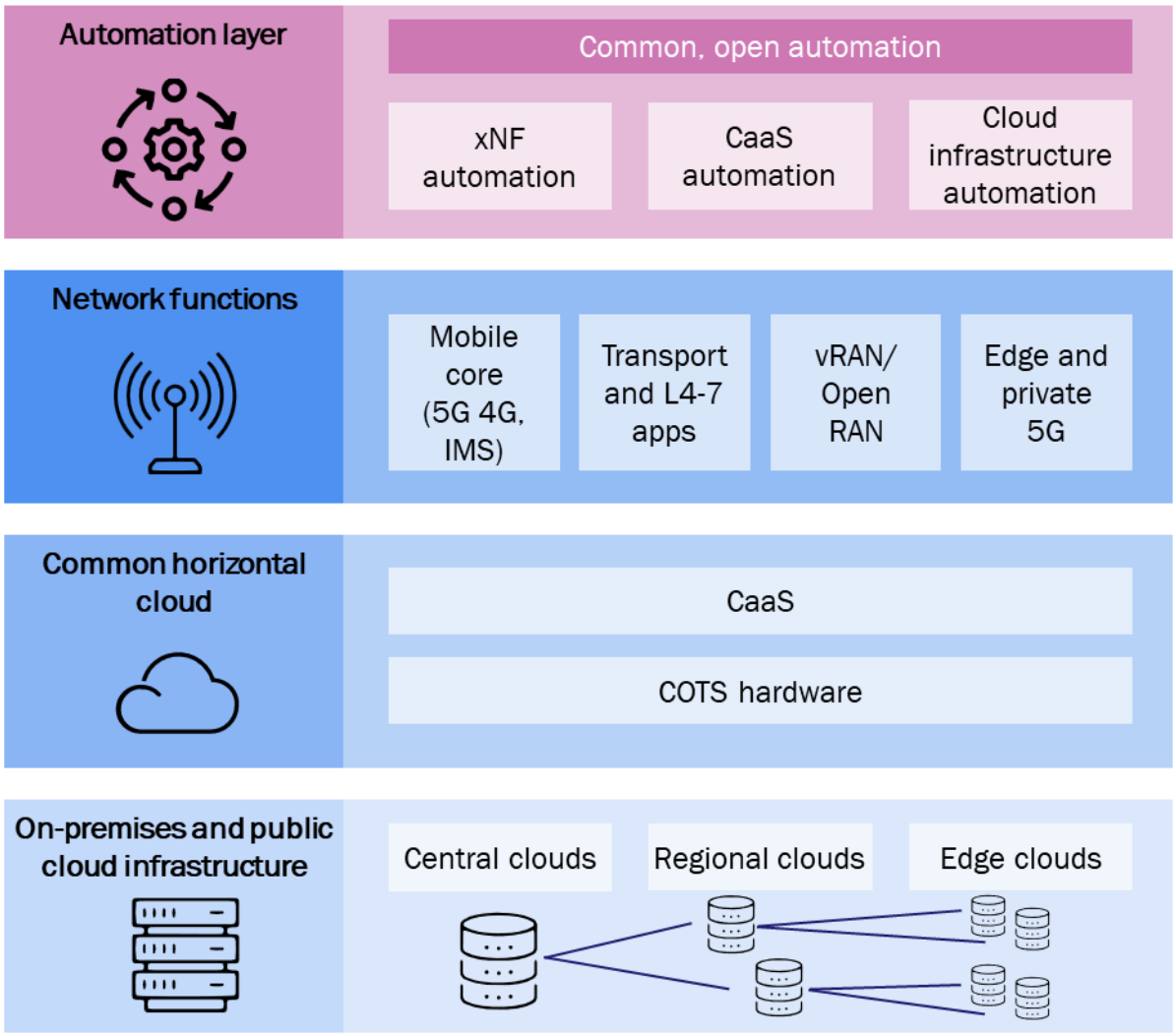
Operators should create cross-domain teams for openness, incrementally adopt a horizontal cloud platform approach starting from the most mature domains and engage with new partners that can help resolve the complexity of open networks. It is also important to for operators to monetise their open networks by taking advantage of the flexible, componentised and modular nature of open, disaggregated network architectures. Finally, operators should increase their involvement with industry bodies that focus on the development of open cloud principles.

2. Industry progress towards the deployment of open networks

2.1 What is an open network?

Open networks are based on non-proprietary technologies and standards, including open hardware and software developed by open communities, as well as software technologies that individual vendors are exposing, typically through open application programming interfaces (APIs), to anyone who wants to use them. Open networks draw on the work of multiple standards organisations, both telecoms industry-specific and, increasingly, from the general IT world. Open networks are software-driven, running on de facto standard cloud technologies on top of COTS hardware, with horizontally layered architectures that reduce dependencies on proprietary vendors across layers. In an open network, network functions of multiple types from multiple vendors can run on open, horizontal cloud software and hardware platforms.

Figure 2.1: Open network architectural components



Source: Analysys Mason

The benefits of open networks are well-known. Networks based on open technologies encourage faster and higher levels of innovation than can be achieved by a single vendor focused on proprietary, multi-layer development. Openness also lowers barriers to market entry, which in turn creates more vendor choice and deployment flexibility at each level of the open network architecture. Open networks can be managed and automated using widely available, non-proprietary tooling, which reduces operational costs.

The 5G network has been designed – and can be implemented – as an open network that will run on a horizontal cloud platform that is distributed across central and regional data centres and in far edge locations in the network. The way that operators are implementing (or intend to implement) their 5G networks and edge nodes is therefore an excellent indication of their commitment to open networks.

2.2 Introducing the Open Network Index (ONI)

Analysys Mason's Open Network Index (ONI) sets out to test operator strategies for adopting open networks and assess the technical progress that operators are making towards deploying them. Our ONI uses six key indicators[1] to evaluate where operators are in their journeys towards open networks.

Three indicators measure operators' **vision and strategy** for open networks and therefore their position on the x-axis of the ONI matrix (see Figure 2.3). Analysys Mason's research into network virtualisation and cloudification over the past 10 years has shown that a strong vision for network transformation, articulated and led by senior executives, is the single most-powerful indicator of operator success.

1. **Openness vision.** This indicator evaluates the importance that operators place on key aspects of open networks, as well as the commercial benefits and objectives that they aim to achieve by committing to an open network approach.
2. **Open architecture and operational strategy.** This indicator assesses the extent to which operators are implementing – or have plans to implement – both an open networks **architecture** strategy based on an open, horizontal cloud platform and an open networks **operations** strategy based on open, cloud-native automation and tooling.
3. **Open partnerships and industry cooperation.** This indicator evaluates the openness of operators to partnerships with new vendors, as well as their level of industry co-operation and depth of support for industry alliances and standards bodies.

Three further indicators measure how mature operators are in terms of their **technical execution** of open networks and therefore their position on the y-axis of the ONI matrix (see Figure 2.3).

4. **Open vendor approach.** This indicator assesses operators' plans and implementation progress towards including multiple vendors in their 5G and edge deployments. Willingness to 'plug and play' different vendors at different points in the network architecture is a key measure of an operator's commitment to open networks.
5. **Adoption of open cloud.** This indicator tracks operator implementations of a horizontal cloud platform as the foundation technology for their open networks. The indicator measures deviation from the optimum solution: a container-based, horizontal cloud that is disaggregated from network functions so that it can support any function from any vendor across network domains.

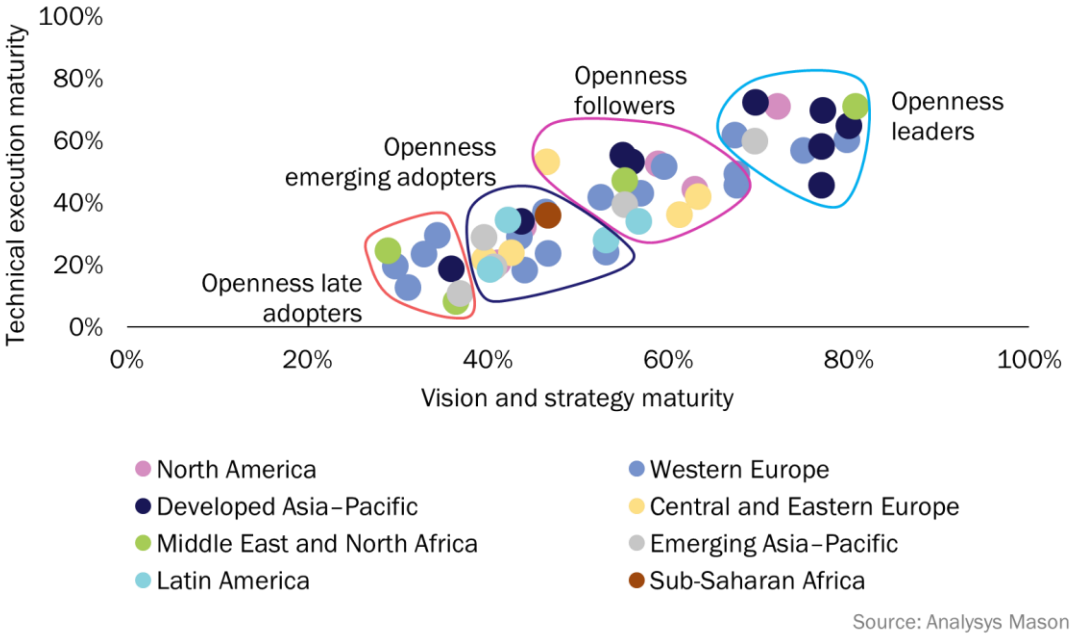
[1] A more-detailed definition of the six indicators that drive ONI can be found in the Appendix.

6. **Open network domain execution**. This indicator interrogates the deployment maturity in each of the open domains that ONI covers: mobile core, RANs and edge. It measures operators' timelines for adopting open networks, the scale of their open network deployments and the maturity of their commercial models.

2.3 Four categories of operator emerged from our open network benchmarking exercise

In late 2023/early 2024, 50 Tier-1 mobile operators worldwide responded to Analysys Mason's ONI questionnaire. Their responses were fed into a model developed by Analysys Mason and scores were grouped according to the three vision/strategy indicators and the three technical execution maturity indicators to determine each operator's position in the ONI matrix (see Figure 2.3).

Figure 2.3: Open Network Index: 50 Tier-1 operators categorised by vision and strategy and by technical execution maturity, December 2023–January 2024



Source: Analysys Mason

It is striking that the 50 operators mapped to the matrix fall into four distinct categories,[2] which we characterise as follows.

- **Openness leaders.** These operators have a deep commitment to open networks as evidenced by their advanced vision for openness, supported at the highest levels of the organisation; the strategic nature of the business drivers that are guiding them towards open networks (such as a focus on innovation) and their roadmaps for – and progress towards – multi-vendor, 'plug and play' network implementations at scale, based on advanced cloud architectures. This category includes a higher proportion of operators from developed Asia–Pacific (APAC) than in any of the following categories, which supports other Analysys Mason research that shows that operators in APAC are investing in open network transformation and innovation ahead of their more-cautious counterparts in other regions.

- **Openness followers.** Operators in this category are implementing aspects of open networks but they are more tactical in their approach than those in the *Openness leaders* category. These operators have a more-limited vision and strategy than the leaders, driven by pragmatic, rather than strategic, business concerns. A

[2] See the appendix for more detail on how operators were categorised.

number of *Openness followers* are at a similar stage and scale of network deployment to the *Openness leaders* but with a weaker commitment to an advanced horizontal cloud platform. Furthermore, *Openness followers* are likely to make slower progress towards the implementation of truly open, multi-vendor and standards-based networks than *Openness leaders* because they lack the strong level of senior executive support that the *Openness leaders* enjoy.

- **Openness emerging adopters.** This category of operators, which includes operators that are just starting their journey towards open networks, is interesting because of its diversity. The category includes operators from developing markets that have emerging strategies that are strikingly aligned with those of the *Openness leaders*. Although they have not yet started to deploy the architectures that they are defining, their vision indicates that such operators may well overtake many of the *Openness followers* within the next 3 years if they execute their strategies successfully. However, this category also includes cautious adopters with more-pragmatic strategies and lower ambitions for open networks that are likely to join the *Openness followers* category as their network deployments mature.

- **Openness late adopters.** These operators do not have a clear concept of what an open network is, and they have not yet started to formulate a strategy for achieving openness or to win senior executive support for investment in the organisational, cultural and technical change needed to support open networks. They have a low appetite for risk and perceive significant risks associated with moving away from incumbent vendors and embracing a more multi-vendor, open ecosystem centred on a disaggregated, horizontal cloud platform. These operators are highly cost-conscious and tactical in their approach to 5G network deployment.

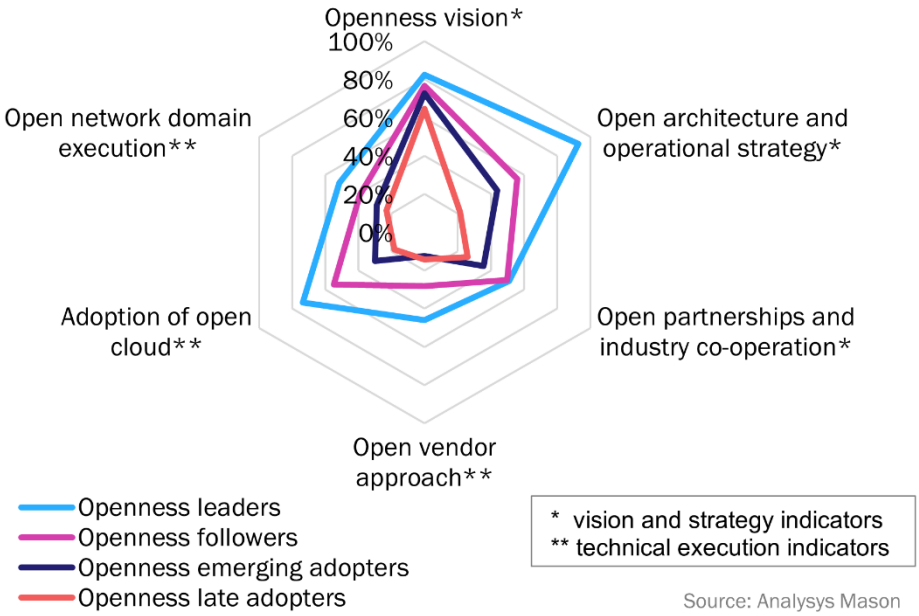
3. Evaluating the performance of the four operator categories against the six key ONI indicators

3.1 Mapping operator categories to the ONI indicators

Figure 3.1 shows the average index performance of the four operator categories across the six open network indicators: three vision/strategy indicators and three technical execution maturity indicators. This mapping highlights the different open network maturity profiles of the four operator categories at a fine-grained, indicator level.

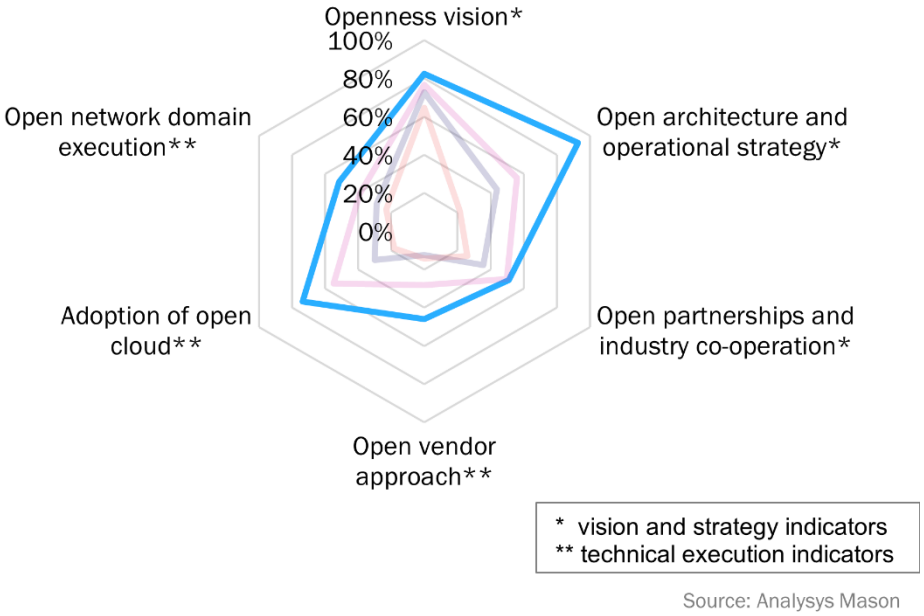
This section will analyse the profiles of each operator category to tease out where there is greatest variation between categories. It is noteworthy that there is least distance between operator categories when it comes to their support for an open networks vision, as demonstrated by the mapping of the categories to the strategy indicator ‘Openness vision’. In the *Openness late adopters* category, operators are just beginning to think about open networks, but they expect very similar business outcomes to those in the *Openness leaders* category, for example. This suggests that open network messaging is resonating with operators at all levels of technical execution maturity.

Figure 3.1: Mapping of four operator categories to Analysys Mason's six ONI indicators, worldwide, December 2023–January 2024



3.2 Openness leaders have strong intentions towards open networks but have yet to put these fully into practice

Figure 3.2: Mapping of the 'Openness leader' operator category to Analysys Mason's six ONI indicators, worldwide, December 2023–January 2024



Openness leaders have clear views on what they want to achieve from open networks and understand the importance of the key organisational and technical components that will help them to achieve their goals. *Openness leaders* are more likely than operators in any of the other categories to be governed by strategic business drivers in their adoption of open networks, for example, by revenue generation opportunities and the exposure of open, cloud-based networks to third parties for innovation and monetisation.

Openness leaders have focused on their open network architecture strategies, with 91% having already implemented such a strategy. Executing on an open architecture strategy means embracing a horizontal cloud platform: *Openness leaders* are more advanced than operators in other categories here, with 78% having a strategy for a horizontal cloud platform that can support multiple network function vendors and 55% of the sample having implemented such a cloud.

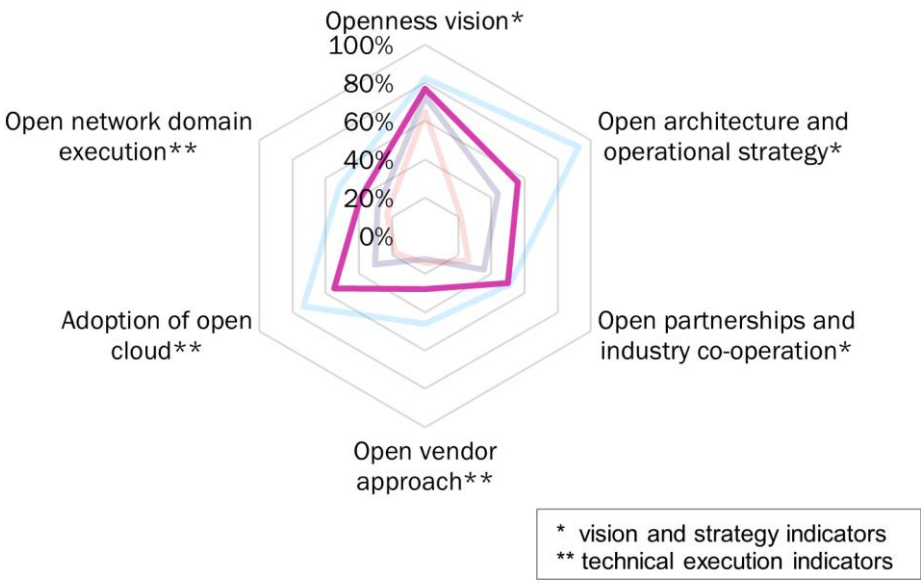
Despite being ahead in architecture strategy, however, *Openness leaders* sometimes lag behind operators in other categories in terms of the development of a strategy for open network operations. This reflects the struggle that many operators are experiencing in transitioning their traditional network operations to cloud-native operations. *Openness leaders* expect IT vendors to be their strategic partners in developing an open operating model. They view IT vendors as more neutral and open than NEPs and able to provide a key benefit of an open, cloud-based network: reduced operational costs through the ability to use commodity IT tooling in support of cloud-native automation.

Until *Openness leaders* have executed on their architecture strategy to deploy a cloud platform and then put in place the required operational automation for the full architectural stack (cloud infrastructure and cloud-native network functions as illustrated in Figure 2.1), they will be hampered in their ability to scale highly distributed open network deployments such as for Open RAN and the network edge. Although 62% of *Openness leaders* are commercially deploying 5G cores (well ahead of the other categories), only 16% are deploying Open RAN at any scale today and their edge deployments are similarly limited. More detail of operator performance in each domain can be found in section 4 below.

Openness leaders are not significantly ahead of operators in other categories (particularly *Openness followers*) in their alignment with the vision/strategy indicator ‘Open partnerships and industry co-operation’. This relative lack of involvement in industry alliances, standards bodies and open-source projects that promote open networks informs the corresponding technical execution maturity indicator ‘Open vendor approach’. Similar to other operator categories, Openness leaders are showing a lack of interest in including multiple vendors in their 5G core and RAN deployments. This may be because vendor options for Open RAN, for example, are limited and/or because operators have concerns about the costs associated with systems integration and maintenance, as well as the effort involved in a multi-vendor network. However, unless *Openness leaders* participate more fully in industry efforts to drive open networks forward, such costs and efforts will remain at their current levels. *Openness leaders* can advance their maturity by improving their industry collaboration and commitment to deploying multi-vendor networks.

3.3 Openness followers need a bolder strategy for horizontal, cloud-based, open network architectures and operations

Figure 3.3: Mapping of the 'Openness follower' operator category to Analysys Mason's six ONI indicators, worldwide, December 2023–January 2024



Source: Analysys Mason

Although close to *Openness leaders* in their vision for open networks, *Openness followers* are more likely to be driven to adopt open networks by tactical drivers such as capex and opex reduction. They are significantly behind *openness leaders* in the development of an open architecture strategy and similarly to *Openness leaders*, their open architecture strategies lag behind their strategies for operating such an architecture in production.

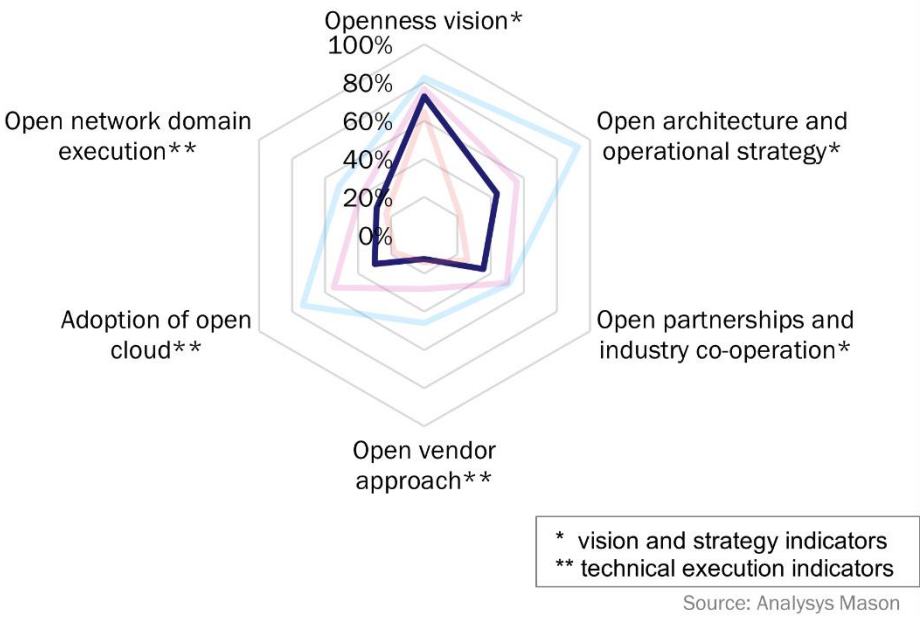
Less than half (44%) of *Openness followers* have a horizontal cloud platform strategy and their implementation record in the network domains that are the focus of this study is correspondingly weaker. *Openness followers* need to strengthen their strategic approach to open networks, and particularly the disaggregation of a horizontal cloud platform from network functions, in order to close the gap with *Openness leaders* and ensure that they can reap the benefits of openness as their network deployments scale.

Openness followers are demonstrating higher levels of participation in relevant industry open standards bodies and initiatives than *Openness leaders* but their commitment to multi-vendor, open networks is currently weaker. *Openness followers* may hope that their presence in open network consortia will influence incumbent vendors to support open network interfaces and approaches so that they can later open up their networks to multiple vendors. However, their strategies and messaging do not yet reflect this. This will make vendors less inclined to provide open network support.

Our survey responses suggest that operators in this category will narrow the gap with *Openness leaders* in the next 3 years.

3.4 Openness emerging adopters must mature on all fronts in order to drive execution

Figure 3.4: Mapping of the 'Openness emerging adopter' operator category to Analysys Mason's six ONI indicators, worldwide, December 2023–January 2024



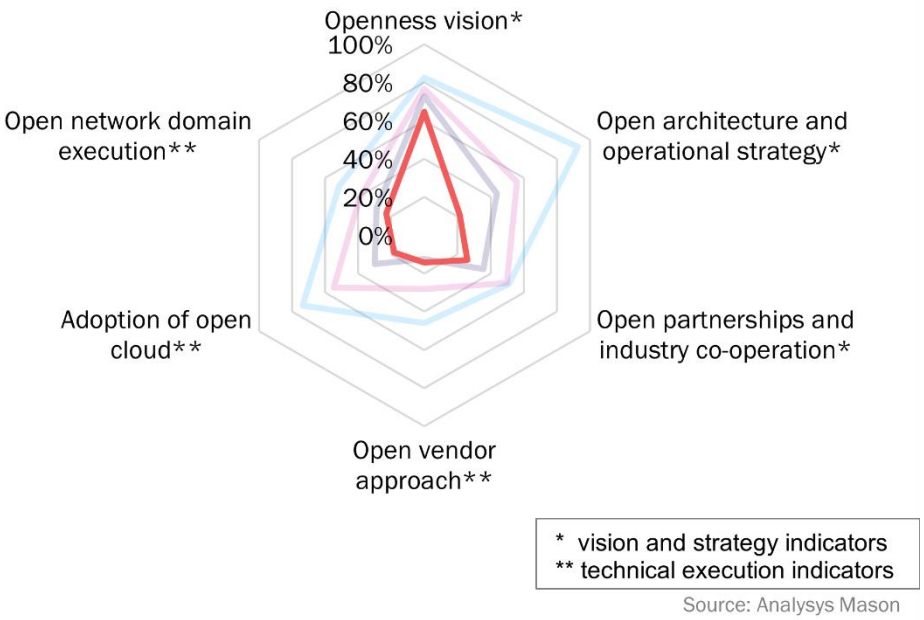
Source: Analysys Mason

Despite having a strong understanding of what an open network could look like and the business benefits that it would confer, less than half the operators in the emerging adopter category have started to develop a strategy for an open network architecture and only a quarter are working on a strategy for open network operations. A mere 9% of operators in this category have plans to adopt an open, horizontal cloud to support network functions from multiple vendors. Most operators in this category are still planning to deploy function vendor-specific vertical stacks, although the more technically advanced operators expect such stacks to be based on open cloud technologies. Overall, however, operators in this category demonstrate a low appetite for moving to multi-vendor networks or participating in the industry initiatives that are fostering open network developments.

Openness early adopters are at an early stage of technical execution: if they wish to fulfil their vision and deploy open networks in the future, they need to adopt a holistic approach to determining how they improve their performance across all the other indicators.

3.5 Openness late adopters need to evolve their vision for open networks by developing a cloud-based architecture and operations strategy

Figure 3.5: Mapping of the 'Openness late adopter' operator category to Analysys Mason's six ONI indicators, worldwide, December 2023–January 2024



At present, operators in the *Openness late adopter* category show a reasonable level of awareness and vision for open networks, but they are heading towards network deployments without an open strategy. It remains to be seen whether operators in this category have the appetite for investment in the organisational and cultural changes needed to support open networks, since their performance against the other vision and strategy indicators is particularly weak (see Figure 3.5).

Nevertheless, as *Openness late adopters* are at the very beginning of an open network journey, they have an opportunity to put the right approach in place from the start, developing open network architecture and operational strategies simultaneously, and prioritising the specification of an open cloud platform (whether they procure this through a function vendor or as a disaggregated horizontal cloud able to support network functions from multiple vendors).

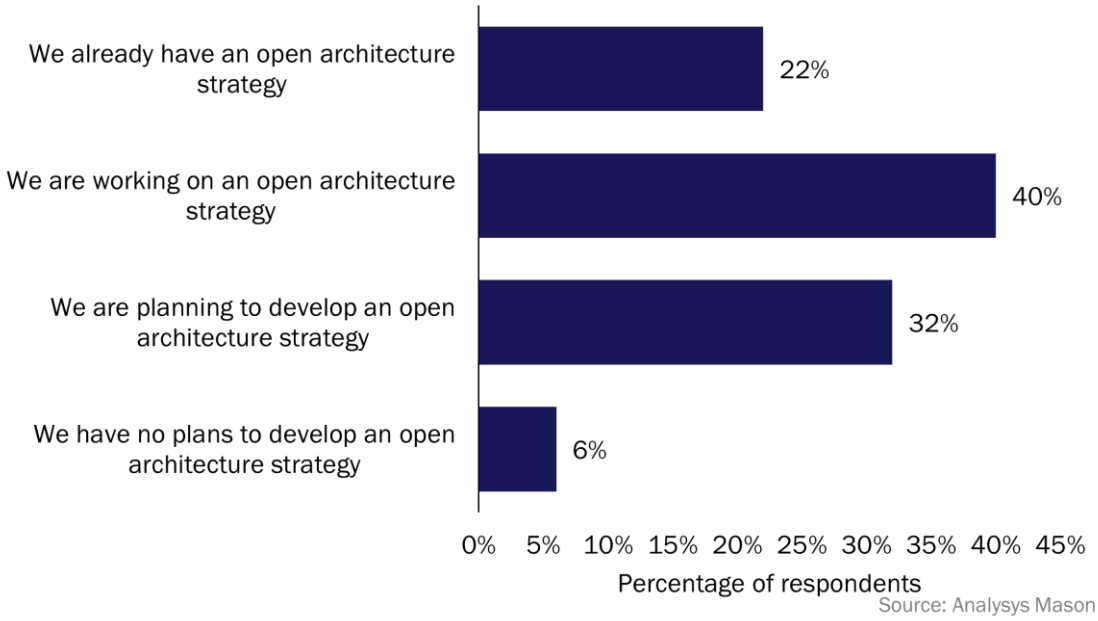
4. Operator approaches to openness in the core, RAN and network edge domains

4.1 Overall operator progress towards open networks

Participants in this study widely recognised the importance of transitioning to open networks. The most frequently cited benefits were the efficiencies associated with adopting horizontal cloud platforms (62% of respondents)[3], being able to streamline operations (52%), enabling interactions with new vendors and partners (44%) and encouraging a culture of innovation (44%). Respondents were generally well-aligned with an open network vision, with 94% of respondents planning to adopt open network architectures. Operators are lagging slightly behind in the adoption of open operating models, but still 88% of respondents reported that they plan to adopt open operating models.

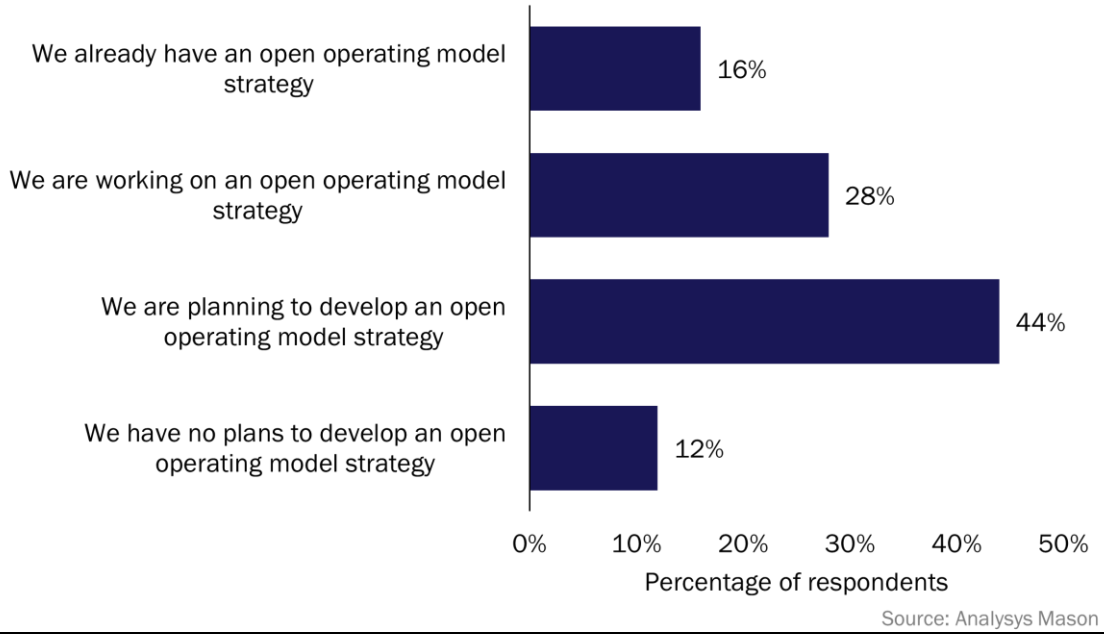
To quickly unlock the benefits of open networks, operators will need to accelerate investment in developing joined-up open operating models that can streamline operations across multiple network domains. Operators can potentially begin by adopting open operating model practices for the more-mature mobile core domain and then apply learnings and successful practices to other domains.

Figure 4.1: Do you already have a strategy for adopting an open architecture?; n = 50, worldwide, December 2023–January 2024



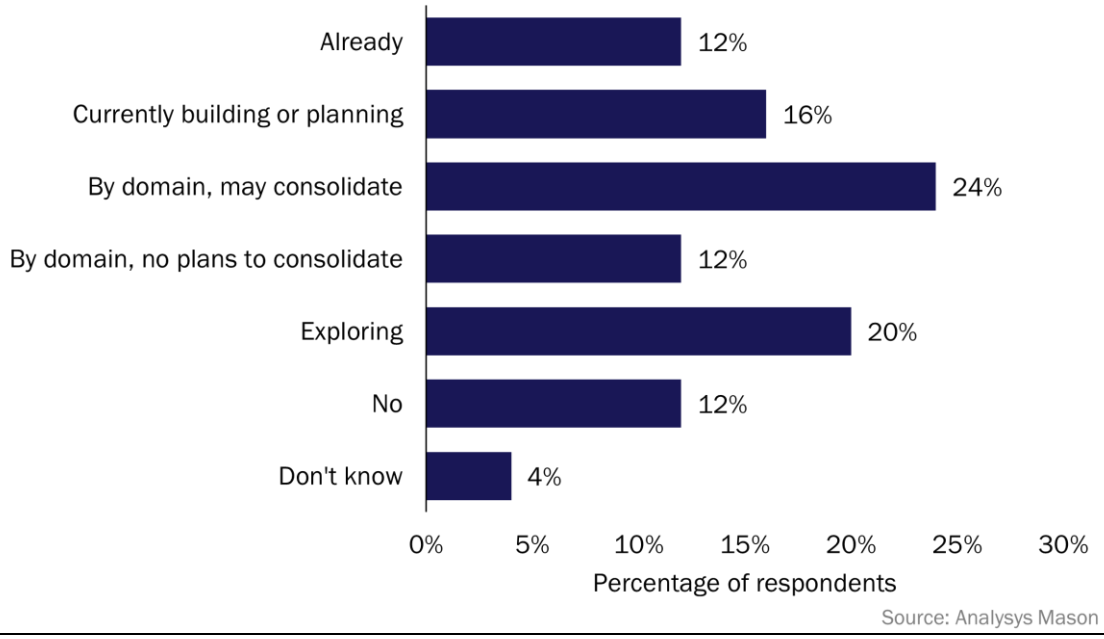
[3] What operational and organisation benefits are you hoping to achieve by transitioning to open networks?; *n* = 50.

Figure 4.2: Do you already have a strategy for adopting an open operating model?; n = 50, worldwide, December 2023–January 2024



Our research also indicates that a growing number of operators support the vision of adopting a horizontal cloud architecture for network functions. This is because operators that cling to vendor- and function-specific network cloud silos will find it more difficult to achieve the opex benefits associated with virtualised and cloud-native network functions as they struggle to overcome challenges with integration, deployment and automation. As Figure 4.3 indicates, most operators have not yet implemented a consolidated horizontal platform that acts across domains. However, it notable that many operators are exploring the possibility of implementing a horizontal cloud platform or plan to consolidate their existing domain-specific cloud platforms.

Figure 4.3: Do you have a horizontal, multi-vendor cloud platform strategy for your networks?; n = 50, worldwide, December 2023–January 2024



To more deeply understand operator progress towards open networks, Analysys Mason analysed operator maturity on a per-domain basis.[4] The execution of open networks in the mobile core network domain is further ahead than for the RAN and edge domains, with respondents in this study scoring on average of 46% for 'technical execution maturity' in the mobile core domain versus 32% and 34% in the RAN and edge domains respectively. However, there was generally a strong correlation between the maturity of operators across domains. For example, the most mature operators had already implemented a horizontal, multi-vendor cloud platform in each of the core, RAN and edge domains.

4.2 Operator progress towards openness in the mobile core domain

The transformation of the mobile core domain is a key near-term priority for many operators

The cloud-based transformation of operators' mobile core networks (that is, the use of virtualised network functions (VNFs) and/or cloud-network functions (CNFs) in the mobile core) has been ongoing for several years, with around two-thirds of operators deploying a cloud-based legacy mobile core and a similar proportion deploying a cloud-based non-standalone (NSA) core. While operators have mainly adopted VNFs for these domains, the 5G standalone (SA) core domain is cloud-native by design; its deployment therefore poses additional complexities for operators. Around one-third of respondents have already commercially deployed 5G SA core networks, with the rest of respondents distributed across the various stages in the planning/production lifecycle.

Figure 4.4: At what stage of the planning/production lifecycle are you in for your cloud-based mobile core?; n = 50, worldwide, December 2023–January 2024

	Design and planning	Trial and PoC	Supplied readiness	Procurement	Onboarding	Partial xNF	Full xNF	SI	Production	Don't know/no plans
Legacy	0%	0%	0%	0%	0%	0%	0%	2%	66%	34%
NSA	0%	4%	0%	2%	0%	0%	2%	0%	64%	30%
SA	8%	8%	10%	6%	4%	20%	10%	4%	32%	0%
IMS[5]	4%	8%	4%	8%	6%	8%	8%	2%	32%	20%

Source: Analysys Mason

Just 5 of the 50 respondents in this study have completely migrated their 5G core networks to 5G SA. Only 11 respondents have 5G SA networks but many in this small group have only deployed these networks at relatively small scales (for less than 20% of their 5G traffic). Therefore, while less-advanced operators expect to begin their 5G SA deployments in the next few years, more-advanced operators will be occupied with scaling their 5G SA networks in that timeframe. On average, survey respondents forecasted that 5G SA will be available to 53% of their subscribers within 3 years, up from just 14% today.

Operators are adopting new network cloud models based on disaggregated network functions that run on a common, horizontal cloud platform

For the first generation of LTE/4G networks, operators predominately relied on single-vendor network clouds, consisting of vertically integrated network functions and cloud platforms from a NEP. This approach limited the

[4] See the appendix for spider charts that show how each category of operator performed against the relevant ONI indicators for each domain.

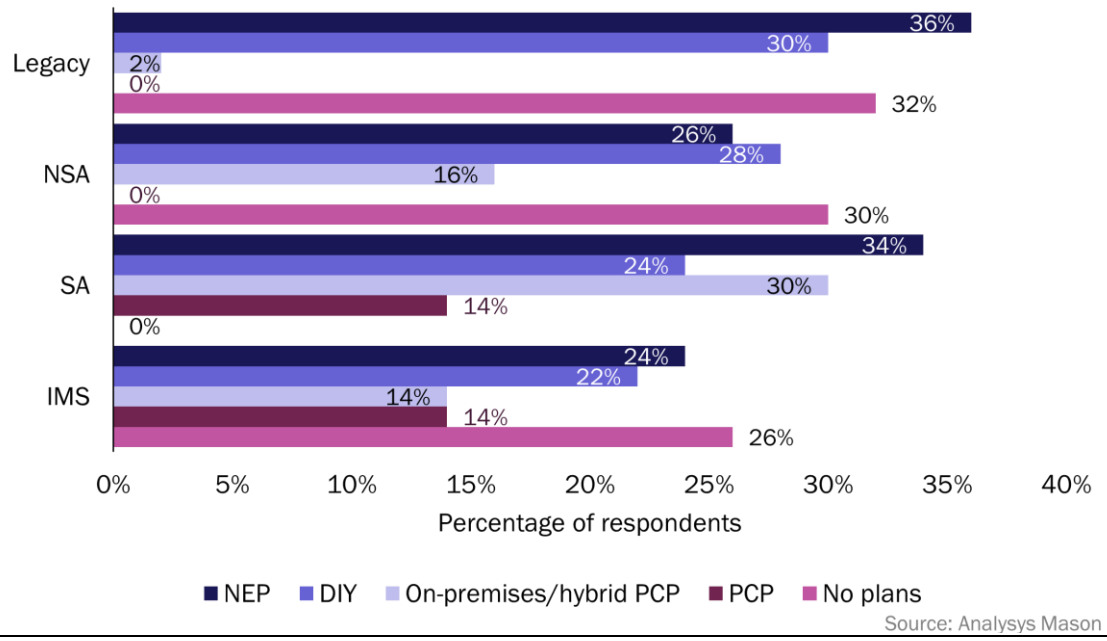
[5] IMS = IP Multimedia Subsystem

ability of operators to build networks that use best-of-breed components from multiple vendors and also resulted in highly siloed and fragmented networks. Operators have subsequently pushed vendors to release disaggregated network functions that can be deployed on any cloud platform.

Operators are aiming to build/procure horizontal cloud platforms on which they can deploy all of their network functions. For the mobile core domain, 16% of respondents already have a horizontal cloud platform for network functions, with a further 26% currently building or having concrete plans to build such a platform. Adopting this approach will enable operators to eliminate network silos, allowing for more unified and programmable network operations. Horizontal platforms also offer additional operational efficiency benefits, enabling operators to reuse processes, pipelines, tools and automation capabilities for multiple network functions. Furthermore, these cloud platforms will support the deployment of network functions from multiple vendors; 74% of respondents plan to use network functions from at least two vendors in their 5G SA cores within 3 years.

Operators that leverage horizontal cloud platforms can either use DIY private clouds or adopt a PCP-led cloud stack. A DIY cloud approach means that operators use a cloud platform from a software-only cloud platform provider or build a cloud platform in-house, potentially using open-source components, and run this platform on COTS hardware. Operators that use PCP-led stacks deploy their network functions on PCP cloud platforms either in the public cloud or on-premises, with operators often opting for a hybrid cloud model. These alternatives to vertically integrated mobile core network stacks are gaining traction among operators, with PCP-led network cloud stacks gaining momentum for the first time for 5G SA core.

Figure 4.5: Which of the following deployment models is being used for each mobile core?; n = 50, worldwide, December 2023–January 2024



Deploying and operating disaggregated networks requires operators to rethink their partnerships for open architecture and open operating models

A key reason why around one-third of operators are still using vertically integrated network clouds from NEPs for their 5G SA cores is the simplicity of working with tightly implemented systems with end-to-end support. Deploying and operating disaggregated mobile core networks can incur significant costs and introduce complexity for operators. To resolve this complexity, the most technically mature operators in this study are

working with a diverse range of function vendor-neutral partners such as SIs, PCPs and other IT vendors to support their cloud-based core deployments. Our survey revealed that NEPs are operators' preferred partner for addressing open network architecture challenges: 74% of respondents preferred to partner with NEPs for their 5G NSA cores but just 40% of respondents said the same for their 5G SA cores. Developing effective relationships with partners will be key for operators that want to scale their 5G SA core deployments. Furthermore, these partners can help operators to simplify their legacy networks, helping to prevent network complexity from spiralling upwards as new technologies are introduced.

Figure 4.6: Which of the following options is/will be best-suited to support your internal teams in addressing the most-pressing challenges with your open network architecture for the mobile core domain?; n = 50, worldwide, December 2023–January 2024

	SI	NEP	PCP	Other IT	Outsourced
Legacy	13%	79%	0%	3%	5%
NSA	10%	74%	0%	13%	3%
SA	22%	40%	16%	16%	6%
IMS	12%	59%	10%	10%	10%

Source: Analysys Mason

4.3 Operator progress towards openness in the RAN

Operators are showing interest in Open RAN but adoption progress remains slow

Of the respondents in this study, roughly 25% have already commercially deployed cloud-based RAN. Most of these respondents have done so in the form of closed vRAN (that is, single-vendor, cloud-based RAN stacks that lack open internal interfaces). However, only an additional 10% of the 50 respondents have further plans to deploy closed vRAN (on top of the 20% that have already deployed closed vRAN). Open RAN solutions, compatible with specifications from organisations such as the O-RAN Alliance, feature much more heavily in operators' future plans. While only 6% of respondents have currently deployed Open RAN, a further 88% have plans to deploy Open RAN in the future.

Figure 4.7: At what stage of the planning/production lifecycle are you in for your cloud-based RAN?; n = 50, worldwide, December 2023–January 2024

	Design and planning	Trial and PoC	Supplied readiness	Procurement	Onboarding	Partial xNF	Full xNF	SI	Production	Don't know/no plans
Closed vRAN	2%	0%	6%	0%	0%	2%	0%	0%	20%	70%
Single vendor Open RAN NEP	10%	10%	10%	0%	2%	4%	4%	2%	2%	54%
Single vendor Open RAN challenger	4%	2%	2%	4%	0%	4%	4%	8%	4%	64%
Multi-vendor Open RAN	18%	30%	10%	4%	0%	4%	2%	4%	0%	26%

Source: Analysys Mason

A key driver behind the development of Open RAN standards is to make it relatively straightforward for operators to select and integrate software components from multiple vendors. 74% of operators plan to adopt

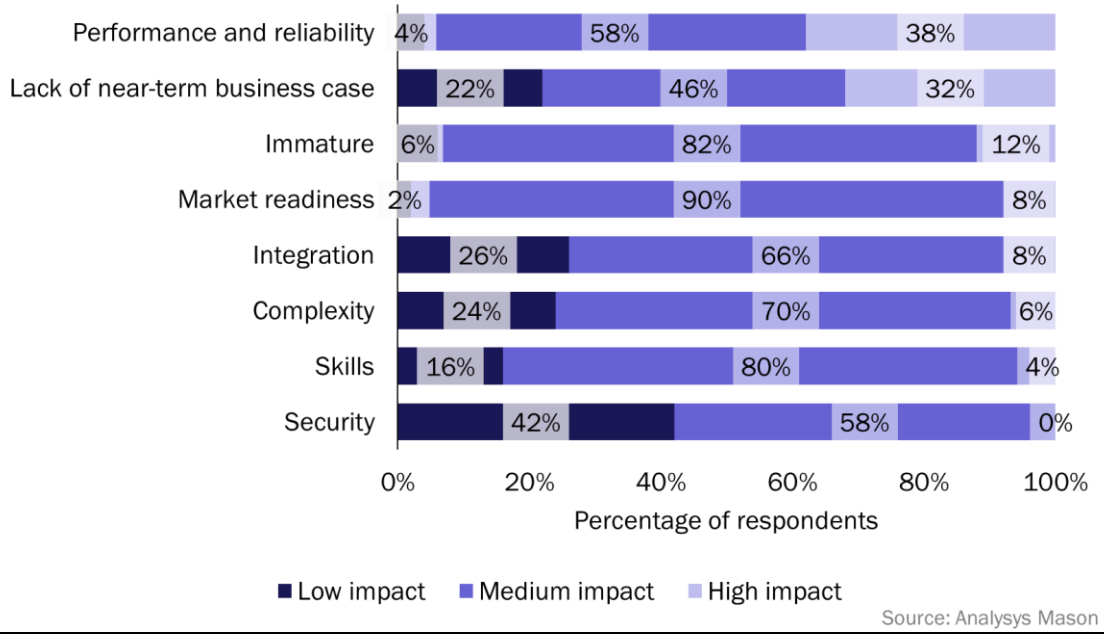
multi-vendor Open RAN but mainstream deployments remain 2 to 3 years away. However, to avoid some of the complexities associated with integrating different RAN software components, many operators are planning to deploy Open RAN-compliant software but with all components sourced from a single vendor. This option remains less popular than multi-vendor Open RAN because it limits operators' ability to select best-of-breed components. However, this approach has enabled operators to accelerate Open RAN deployment timelines.

Operators that deploy single vendor Open RAN solutions can either source software from incumbent NEPs or challenger vendors. A slightly higher proportion of respondents have plans to deploy single vendor Open RAN from NEPs (46%) than solutions from challenger vendors (36%), likely due to the simplicity of being able to work with familiar vendors and the greater maturity of NEPs' solution. However, deployment timelines are accelerated for challenger vendors' single vendor Open RAN solutions, with 82% of survey respondents reporting that they will deploy challengers' vendor-based Open RAN expecting to do so within 2 years. In contrast, only 48% of the respondents that said they would deploy NEP-based Open RAN will do so within 2 years. This suggests that adopters of challengers' vendor-based Open RAN are generally more committed to open networking principles and therefore see the deployment of Open RAN as more of an immediate priority.

The increasing maturity of the Open RAN ecosystem will lead to a tipping point in adoption levels in the next 2 to 3 years

Operators being slower to cloudify their RANs than their mobile core networks due to the difficulties of meeting RAN performance requirements and the complexities of managing highly distributed RAN infrastructure. Respondents in this study indicated that the performance and reliability of Open RAN was the main reason for slowing down adoption. However, as the Open RAN ecosystem continues to evolve, the performance gap between vRAN/Open RAN and appliance-based RAN is gradually closing, which will make cloud-based RAN solutions a more-viable alternative in the coming years.

Figure 4.8: Score each of the following challenges on the impact they have on your progress towards adoption of Open RAN; n = 50, worldwide, December 2023–January 2024



Many operators also believe that there is not yet a compelling business case for investing in Open RAN. Open RAN promises to deliver capex savings by giving operators access to a broader vendor ecosystem. It also promises opex savings by enabling more automated and intelligent networks. However, these savings must be

weighed against the greater complexity of integrating components from multiple vendors. The argument that Open RAN will deliver total cost of ownership (TCO) benefits is expected to become more compelling as these solutions scale and mature, and as ecosystem players improve their capabilities to support operators' Open RAN deployments.

4.4 Operator progress towards openness in the network edge

Operators are still in the early stages of implementing open network edge environments

Operators have been deploying vRAN/Open RAN nodes closer to the network edge to better meet RAN latency requirements. Operators can leverage these edge nodes and other nodes deployed both in the network/public edge and customer/private edge to support application workloads and edge services that require low-latency connectivity. Respondents reported that the primary driver behind developing an open network edge strategy was to support enterprise/B2B services such as URLLC and mMTC for industry verticals including manufacturing, transport, public safety, utilities and healthcare. However, operators are also aiming to support consumer services, such as eMBB and FWA, as well as internal AI/analytics workloads that need to run close to the edge.

While most operators have ambitious plans for network edge use cases, Figure 4.9 illustrates that respondents are still predominately in the early stages of the planning/deployment lifecycle. This is consistent with our finding that operators are taking a more-tentative approach to openness in the network edge compared to their core networks.

Figure 4.9: At what stage of the planning/deployment lifecycle are you in for the following network edge use cases?; n = 50, worldwide, December 2023–January 2024

	Design and planning	Trial and PoC	Supplied readiness	Procurement	Onboarding	Partial xNF	Full xNF	SI	Production	Don't know/no plans
eMBB	19%	19%	6%	10%	0%	4%	2%	2%	21%	13%
URLLC	19%	35%	6%	2%	6%	4%	0%	2%	6%	17%
mMTC	19%	15%	4%	2%	2%	4%	0%	2%	10%	40%
FWA	0%	4%	21%	8%	2%	0%	0%	4%	15%	44%

Source: Analysys Mason

Operators' public edge deployments can be grouped into interconnect, metro and industrial edges.[6] Interconnect edges are edge compute locations that support aggregation and peering points. Metro edges are on-net extensions of centralised clouds and data centres that better fit geographical computing demands. Industrial edges support applications that can run autonomously from centralised clouds; they can be deployed in the public edge when deployed at an operator's network edge (for example, at radio sites or aggregation points) or in the private edge when deployed on a customer's premises.

To date, operators have shown little interest in interconnect edges due to their limited historical success in providing content delivery networks (CDNs). In contrast, several operators have invested in providing metro, public industrial and private industrial edge capabilities. However, operators are competing against edge data

[6] For more information on the public edge, see Analysys Mason's *The edge: what it is and what it means*.

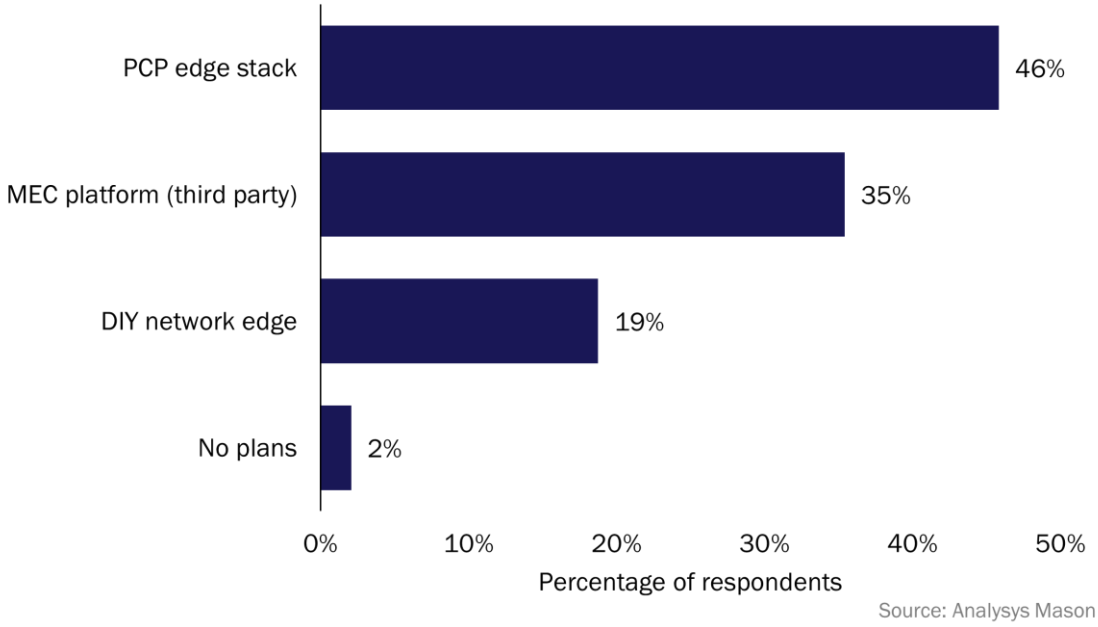
centre providers, CDN/edge compute platform providers and PCPs, which means that they will have to move quickly to capture a share of the metro edge and the more-rapidly growing industrial edge opportunity.

Operators' edge cloud platforms will need to support a broad range of edge use cases to maximise operators' revenue opportunity

Edge clouds are naturally horizontal, open platforms that are disaggregated from network functions and other applications that run on these clouds. Subsequently, these platforms will be able to support multiple edge use cases, including multiple network functions and enterprise use cases. 8% of respondents in this study already have a horizontal cloud platform for the network edge, with a further 10% currently building a horizontal edge cloud platform and 34% considering the feasibility of such a platform.

Most commonly, operators are building their edge cloud platforms using PCPs' edge stacks. This model is especially dominant in North America and Europe. However, operators using these stacks risk disintermediating themselves from parts of the edge value chain and just becoming network and co-location providers. To avoid disintermediation and to provide a more-differentiated offering, other operators are using third-party, multi-access edge compute (MEC) platforms or are building in-house network edge platforms.

Figure 4.10: Which of the following models are you adopting for your network edge strategy?; n = 50, worldwide, December 2023–January 2024[7]



[7] The values in this chart do not sum to 100% because one respondent adopted both a third-party MEC platform and a PCP edge stack.

5. Open networks: calls to action for operators

Based on our research, Analysys Mason has identified five calls to action for operators. Our respondents generally had a strong vision for open networks, so these recommendations focus on how operators can accelerate their implementation of open networks and maximise the value that is derived from openness.

Operators should create cross-domain, open-first task forces that enable operators to move towards a North Star goal of an open network

Openness in the network needs to be approached holistically, as an organisation-wide initiative, rather than efforts being constrained to individual domains. To achieve this, operators should set up a task force that defines an overarching architecture and cloud operating model for open networks and which guides decision-making processes and ensures open network properties, enablers and outcomes are implemented in a consistent way across all network domains. For example, such a task force would help an operator to identify synergies and share learnings between domains and specify common principles, standards and components that support the adoption of open networks.

Operators should incrementally adopt a horizontal cloud platform approach that incorporates both infrastructure and operations

Operators should ensure that their horizontal cloud platform approach incorporates both an infrastructure strategy and a model for operating the network with a high level of automation. The operating model for the horizontal cloud platform should be network-function-domain-neutral and it should improve operational efficiency by enabling multiple network functions and applications to be managed in a unified, automated manner. Although operators should define a target open architecture and open operating model that will eventually apply to all network domains, they can implement openness incrementally. Operators should start by implementing open networks in a more-mature and less-complex domain, for example, the mobile core, before expanding their approach to other domains, such as the RAN. This will enable them to refine their learnings, build up expertise and define best practices before moving onto more-challenging network environments. Similarly, operators can target the simplest use cases that will quickly deliver high value when adopting an open operating model. For example, operators may choose to begin by adopting Kubernetes-based automation and/or GitOps-based approaches for the least-disruptive use cases such as for experimental networks and/or for staging environments.

Operators should engage with neutral partners that can help them to tame the complexity of open networks

Without the support of appropriate partners, it will be challenging for operators to implement open network architectures and open operating models due to the complexity associated with moving away from vertically integrated systems with end-to-end support models. Operators need to pick neutral partners that can support their transformation to open networks and make open networking components more consumable. These partners will need to understand disaggregated networking models, have strong systems integration capabilities and be used to working with an open mindset.

Operators should follow a product-driven approach when implementing and deploying open networks and seek to improve network monetisation through their transformation efforts

Embracing open networks should be linked to the realisation of business value. Line-of-business (LoB) organisations need to understand the value proposition for open networks and be actively involved in shaping

implementation strategies. This will enable product-led implementation of open networks whereby implementation is shaped by market opportunities and customer requirements and demands. Operators adopting a product-led approach can take advantage of the flexible, componentised and modular nature of open, disaggregated network architectures. These architectures enable product management functions to specify and easily add new network capabilities or functions, or to recompose existing network elements into new services through capabilities such as network slicing, to meet evolving consumer and business customer requirements. This is more challenging to do with traditional, vertically integrated, monolithic network architectures compared to cloud-native network architectures. Furthermore, a product-centric strategy that engages LoB organisations will help to improve organisational buy-in for open networks.

Operators should join – and become actively involved in – industry initiatives and standards bodies that contribute to the development of open cloud principles

Many operators have strong engagements with well-established telecoms industry bodies such as the GSMA and the TM Forum. These bodies have traditionally aimed to improve standardisation and foster multi-vendor interoperability, but their activities in the areas of open cloud platforms and open operating models have been somewhat peripheral. Operators should deepen their involvement with initiatives such as the Cloud Native Computing Foundation (CNCF), Nephio and Sylva, which champion open infrastructure and open operations, and support the fundamentals of horizontal cloud platforms. In addition, operators should engage with the O-RAN Alliance, which is leading multi-vendor Open RAN interface and interoperability standards, with these standards leveraging distributed, cloud-native-based architectures. Participation in these initiatives facilitates knowledge sharing, enables operators to shape future standardisation efforts and empowers operators to exert greater influence over their vendors.

6. Appendix

6.1 Six ONI indicators: detailed definitions

Three indicators of vision and strategy maturity

1. **Openness vision.** This multi-faceted indicator evaluates how far operators are buying into the vision and messaging around open networks. It covers operator attitudes to disaggregated multi-vendor networks and how they expect to achieve such networks, for example, through the adoption of open APIs, industry specifications, open-source tools and new business models. It includes an operator's organisational and cultural readiness for open networks, such as appetite for risk, approach to innovation and acquisition of appropriate skillsets. In addition, this indicator factors in the degree to which an operator's business drivers for open networks are strategic and the degree to which its network transformation aspirations are visionary.

2. **Open architecture and operational strategy**. This indicator assesses the maturity of operators' plans to adopt an open network architecture strategy that leverages a horizontal, multi-vendor cloud platform and operators' plans to adopt an open networking operating model that leverages open, cloud-native automation and tooling.

3. **Open partnerships and industry co-operation**. This indicator assesses operators' reliance on different types of vendors to support internal teams to do network integration and deployment, including NEPs, PCPs, software-only cloud providers, SIs, IT vendors, independent software vendors and IT consulting

companies. It also assesses the extent of operators' involvement with industry bodies, standardisation efforts and open-source initiatives relating to open networking.

Three indicators of technical execution maturity

1. **Open vendor approach.** This indicator accesses the extent to which operators have already deployed networks which use multiple vendors within the 5G core and vRAN/Open RAN domains. It also factors into account operators' plans to deploy multi-vendor core networks and RANs within the next three years.

2. **Adoption of open cloud**. This indicator evaluates operators' plans to adopt a common horizontal network cloud platform for network functions in each of the 5G core, RAN and network edge domains. The gold standard is for operators to adopt a container-based, disaggregated horizontal network cloud platform that supports network functions from any vendor for any of these domains. This indicator also considers operators' current deployment models for network functions, as well as their plans to change these deployment models in the next 3 years. By deployment models, we mean whether operators use a NEP's cloud stack, have built their own cloud stack using a DIY approach or use a PCP's cloud stack, deployed in the public cloud and/or on-premises. In addition, we evaluate the extent to which operators use virtual machines and containers to run network functions.

3. **Open network domain execution**. This indicator evaluates operators' deployment timelines for adopting cloud-based network functions, which includes both virtualised and cloud-native network functions. It assesses adoption timelines for different mobile core domains (legacy, NSA, SA and IMS) as well as the RAN domain, for which we evaluate the use of closed vRAN, single-vendor Open RAN (from incumbent NEPs and challenger vendors) and multi-vendor OpenRAN. For the network edge domain, this indicator assesses adoption timelines for different edge use cases (for example, eMBB, URLLC and mMTC), as well as the sectors that operators plan to or currently target with these use cases.

6.2 Benchmark scores that determine Analysys Mason's four operator categories

Figure 6.1 shows the range in scores that each of the four categories of operators achieved when benchmarked against the indicators for vision/strategy and technical execution maturity. For each operator maturity category, a lower limit and an upper limit for each indicator group has been given. The 'Average' column shows the lowest possible average score for the combined indicator groups for each operator category.

Figure 6.1: Highest and lowest scores achieved for vision and strategy and technical execution maturity indicators by four operator groups

CSP openness category	Openness vision and strategy		Openness technical execution		Average
	Lower limit	Higher limit	Lower limit	Higher limit	Lower limit
Openness leaders	65%	N/A	46%	N/A	60%
Openness followers	47%	64%	34%	45%	45%
Openness emerging adopters	40%	46%	18%	33%	29%
Openness late adopters	N/A	39%	N/A	17%	N/A

Source: Analysys Mason

6.3 Analysis of operators' progress towards openness in the core, RAN and edge domains

Please note, we did not have any questions relating to the 'Open architecture and operational' strategy and 'Openness vision' indicators that asked about specific domains. Therefore, both of these indicators are excluded from the figures below. In addition, please note that the vision and strategy indicator 'Open partnerships and industry co-operation' has been restricted in the case of domain-specific analysis to the benchmarking of operator attitudes to open partnerships only.

Figure 6.2: Key network core openness indicator segments by operator grouping, worldwide, December 2023–January 2024

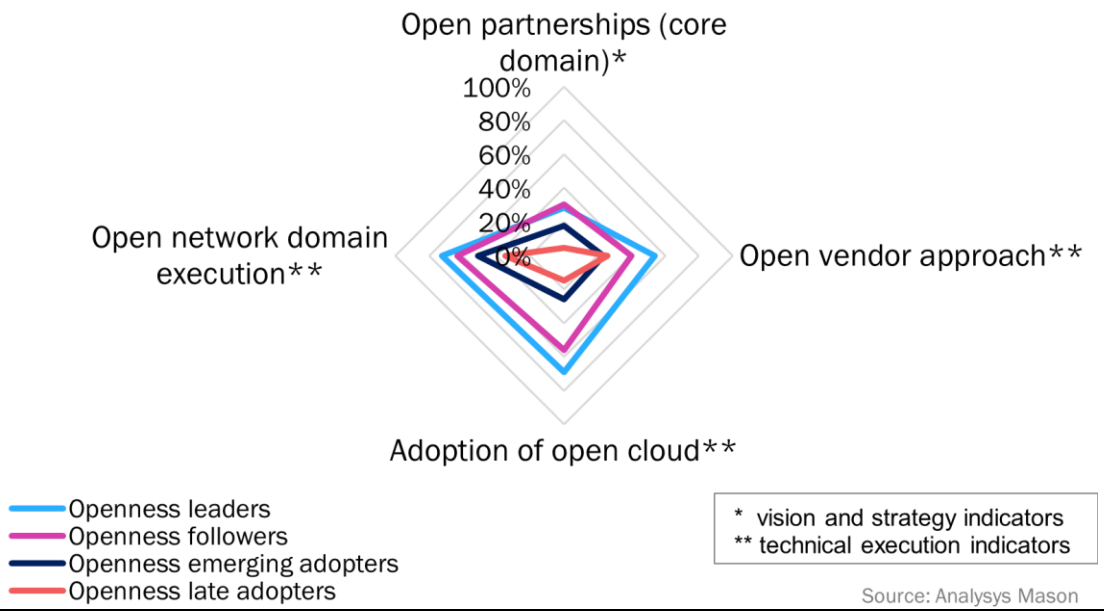
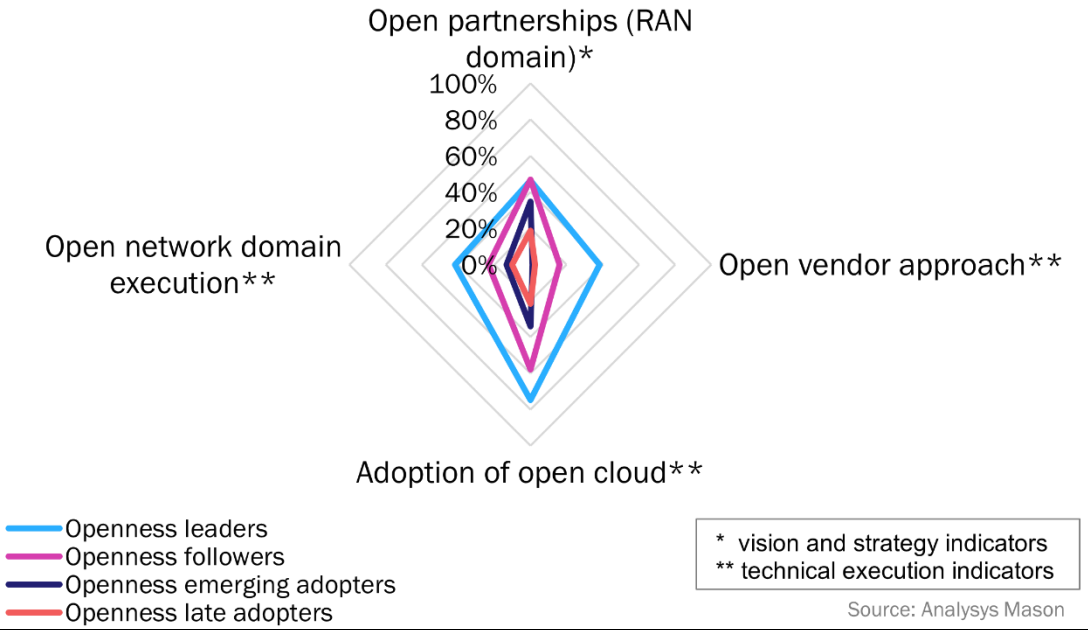
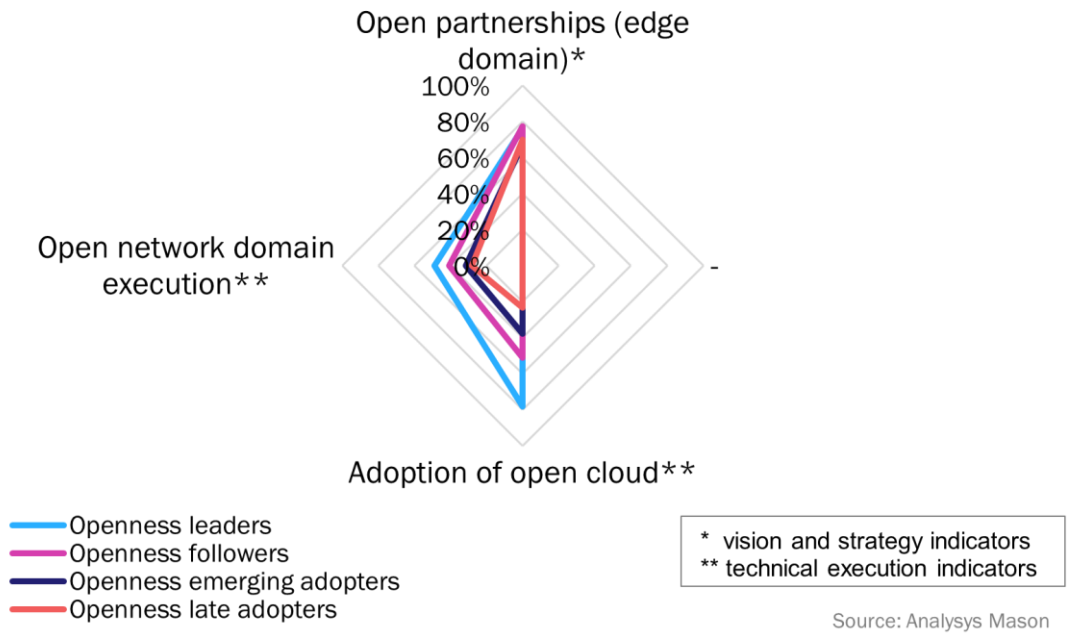


Figure 6.3: Key RAN openness indicator segments by operator grouping, worldwide, December 2023–January 2024



We did not ask questions relating to the indicator 'Open vendor approach' for the edge domain, so responses in this domain are not benchmarked against this index in the chart below.

Figure 6.4: Key edge openness indicator segments by operator grouping, worldwide, December 2023–January 2024



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