Perfect RAN or perfect edge: the Open RAN dilemma facing operators

Caroline Chappell and Caroline Gabriel

About this report

This report examines the architectural choices that operators need to assess now if they are to deploy vRAN or Open RAN in the next 1–6 years. As operators' ambitions to expand their 5G revenue streams grow, so will the need for the hyper-distributed edge. However, this shift comes with trade-offs for the RAN. This report analyses the factors that will help operators to decide how to balance the ideal edge infrastructure against the best radio network. We align this with individual commercial models of different types of operators. We also offer recommendations to operators about their options and assess how they can future-proof their networks. We also explain how vendors can smooth the path and accelerate the market. The report is based on case studies and a survey of 75 operators, conducted in June 2022.[1]

GEOGRAPHICAL COVERAGE

- Worldwide

CASE STUDIES

- BT models
- DISH Network (DISH)
- Rakuten
- Vodafone-Telenor

KEY QUESTIONS ANSWERED IN THIS REPORT

- What is the best balance between hyper-distributed edge cloud and high-performance radio for different 5G business models?
- What are the advantages of the very edge-centric architecture and what do early case studies teach us?
- What are the trade-offs that may have to be made in the RAN and how can they be mitigated?
- What technical and deployment advances are required to improve the balance for future deployments?

WHO SHOULD READ THIS REPORT

- Operators' technical strategists, architecture teams and CTOs
- Strategy and operator support functions within RAN vendors, cloud providers and systems integrators
- Policy makers that are considering Open RAN policy

[1] Analysys Mason's survey of 75 mobile and converged operators worldwide (including Tier 1 and 2 and challenger operators) that are considering or planning vRAN or Open RAN, conducted in 2Q 2022.

Executive summary

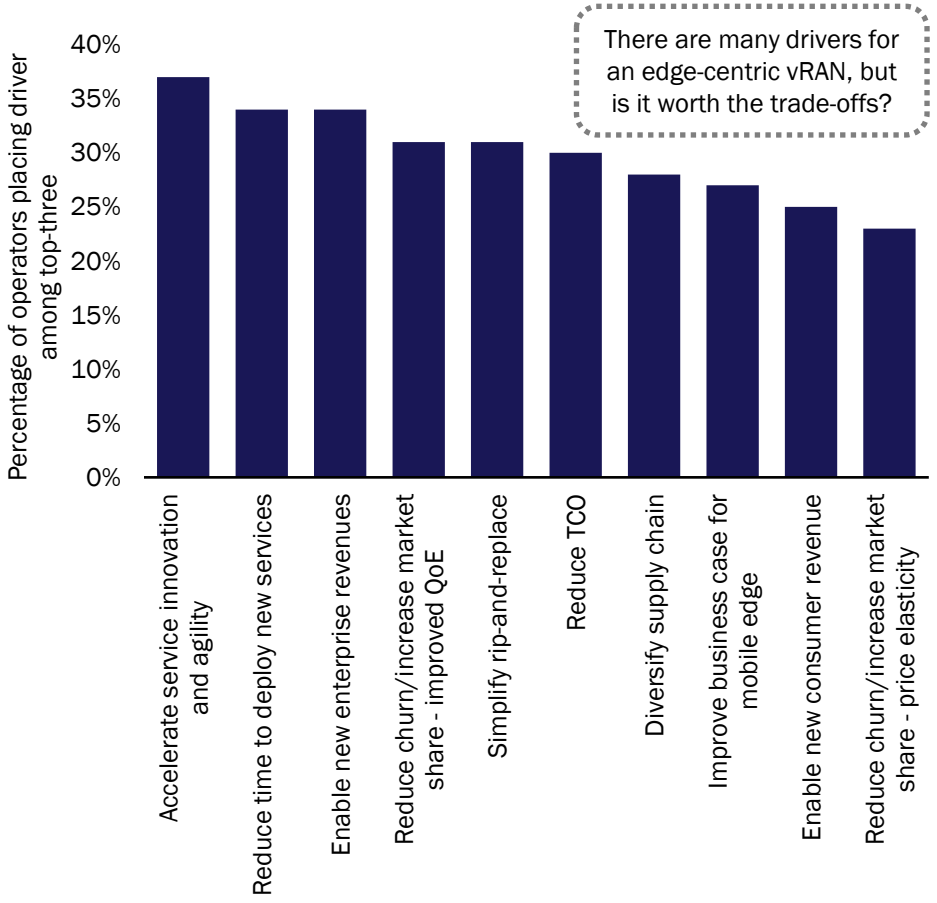
Operators are starting to assess their options for migrating to vRAN or Open RAN architectures. The 'perfect' edge cloud architecture for Open RAN and next-generation industrial applications is experimental and compromises radio performance. Operators must strike a balance between having an ideal edge infrastructure and having the best radio network, while keeping commercial priorities and enterprise customers in mind.

DISH Network (DISH) is perhaps the most fully-fledged case study to date of an Open RAN that has been designed with future-looking 5G enterprise use cases in mind, based on a hyper-distributed edge cloud. Other operators are interested in the new services and use cases such as slicing enabled by a very distributed edge cloud, but the current state of vRAN technology means that trade-offs between the design of the edge cloud and the design of the RAN are needed.

KEY RECOMMENDATIONS

- Operators and vendors that want to build a perfect hyper-distributed mobile edge cloud for enterprise use cases should help with industrial use cases that will justify edge investment.
- Vendors should help operators to model in detail the impact of different functional splits to help operators separate the hype from reality and to understand the trade-offs.
- Operators must decide which trade-offs are acceptable for their specific business model and commercial objectives if they plan to deploy vRAN in the next 3 years.

Figure 1: Top-three drivers for operator adoption of an edge-centric vRAN or Open RAN, worldwide, 2Q 2022[1]



Source: Analysys Mason

[1] Analysys Mason's survey of 75 mobile and converged operators worldwide that are considering or planning vRAN or Open RAN, conducted in 2Q 2022. Respondents were first asked to provide a list of all their drivers to deploy edge-centric vRAN. They were then asked to select the three most-important to their business model, from a list of the ten most-cited.

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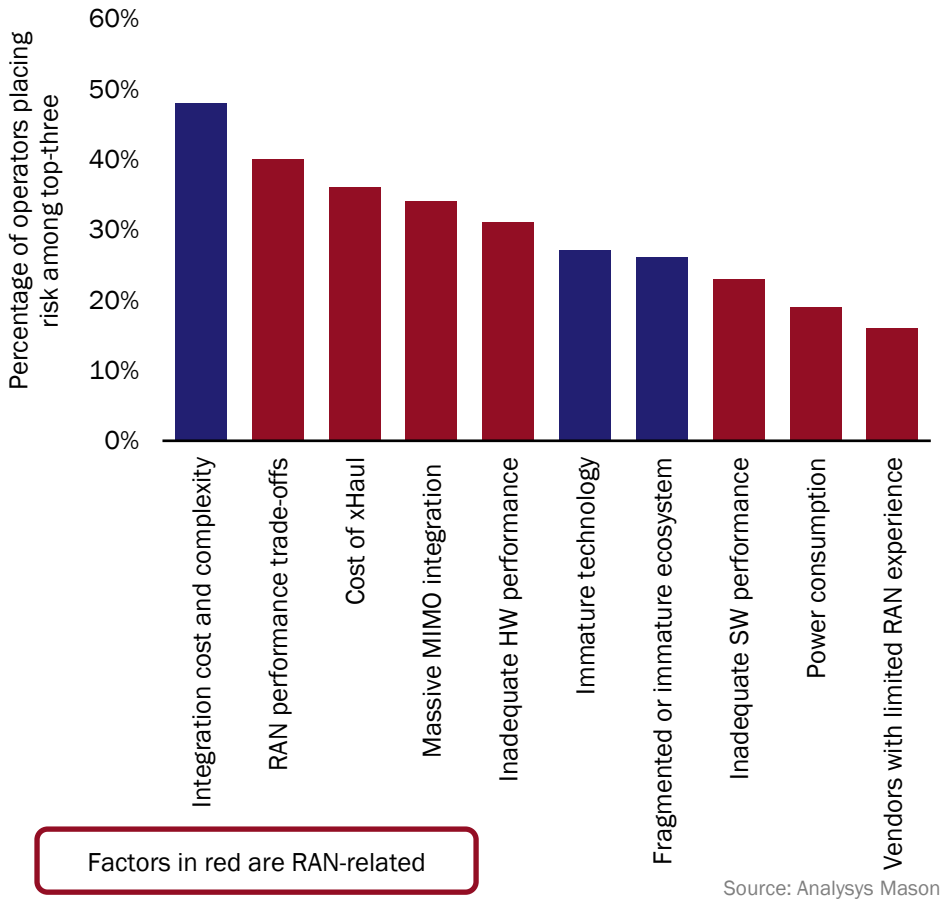
Challenge: the 'perfect' edge cloud architecture to run Open RAN and next-generation industrial applications is experimental and compromises radio performance

Hyper-distributed clouds in 'far edge' locations close to cell towers are, potentially, optimally located to support both Open RAN functions and emerging edge-native Industry 4.0 and metaverse applications. However, operators face difficult investment decisions when building out edge infrastructure because such use cases are unproven and radical edge cloud architectures currently compromise RAN performance.

Hyper-distributed cloud that spans thousands of locations (many of which may be resource-constrained and vulnerable) is a new phenomenon that requires technology choices that are different than those for centralised cloud, and also requires a new mode of application development. Edge cloud technologies are still maturing and edge use cases are in their infancy. Edge cloud developers face difficult decisions: conventional cloud stacks may not adequately support the scale, ease of management and real-time performance needed for edge clouds delivery, while innovative technologies are risky, disruptive and may not provide the right level of support.

Conversely, many operators and network function vendors have a centralised cloud mindset in relation to re-engineering and deploying virtualised RAN functions. The mapping of such functions to hyper-distributed cloud architectures is a work in progress that many radio engineers are unconvinced will succeed. The mismatch between what edge clouds can deliver and what virtualised RAN functions need is challenging for stakeholders that want to drive an Open RAN and MEC message to the market.

Figure 2: Top-three most-significant risks for operators worldwide deploying vRAN or Open RAN during 2022–2028[1]



Source: Analysys Mason

[1] Analysys Mason's survey of 75 mobile and converged operators worldwide that are considering or planning vRAN or Open RAN, conducted in 2Q 2022. Respondents were first asked to provide a list of all the risks that they associate with vRAN and Open RAN. They were then asked to select the three most-important to their business model, from a list of the ten most-cited.

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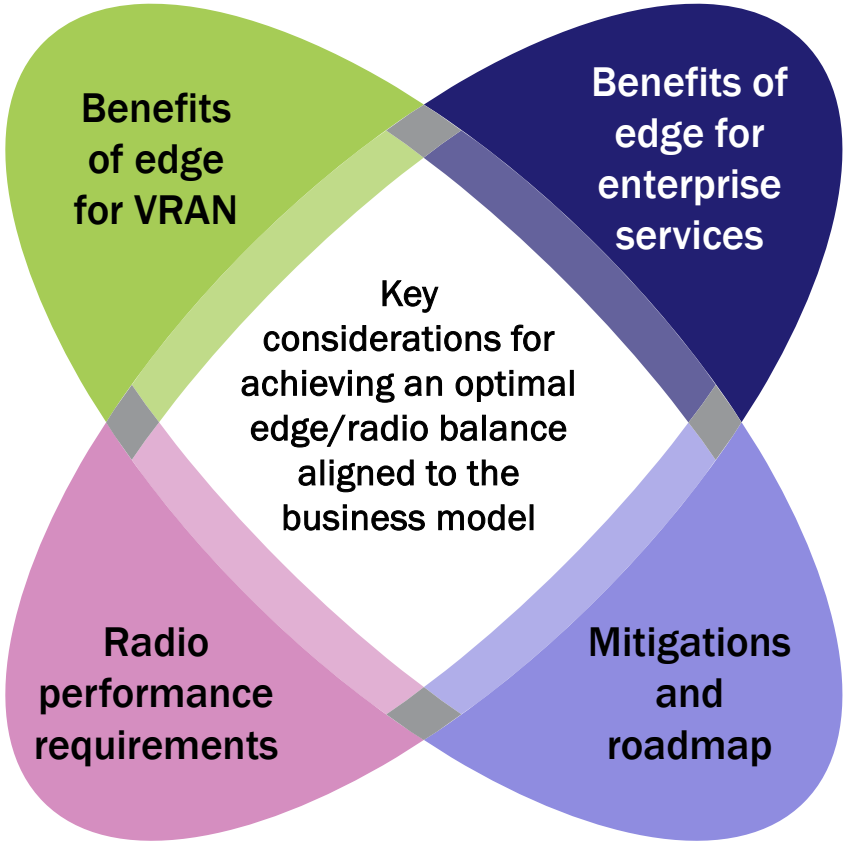
Solution: operators must strike a balance between having an ideal edge infrastructure and having the best radio network, while keeping enterprise customers in mind

A highly distributed edge cloud can map well to the topology of a 5G RAN and, if deployed by the operator itself, it can be monetised in various ways including enterprise services and wholesaling. However, operators that want to gain first-mover advantage must recognise that current edge technologies incur trade-offs in RAN performance, and they must ensure that these compromises do not undermine their business plans.

Operators increasingly recognise that the virtualised RAN, at least in its first iteration, will not match the integrated RAN in every aspect of cost/performance. This does not need to be a deterrent to embarking on vRAN deployment, as long as the risks are well-understood and mitigated, and the platform is future-proofed so that improvements can be accommodated easily.

Operators must clearly identify the most-important services and customers for their growth plan, and understand the specific RAN and edge performance and capabilities that these will require. In the first instance, operators can focus investment on the infrastructure that matters most. For instance, an operator whose business plan is driven by advanced video-centric smart city applications will be heavily reliant on massive MIMO, which is inadequately supported by current vRAN technologies, and the operator may need to adopt an interim solution such as E5. However, an operator that is focused on localised enterprise services such as smart factories will have a lower 5G traffic load, or can offload traffic to small cells, which are easier to virtualise than macrocells. Meanwhile, the edge cloud can be monetised with value-added services for the enterprise.

Figure 3. The four foundational considerations for operators deciding on an edge-centric vRAN approach



Source: Analysys Mason

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Recommendations

1

Operators and vendors that want to build a perfect hyper-distributed mobile edge cloud for enterprise use cases will need to help seed the market with industrial applications that will justify their edge investment.

Operators and vendors advocating investment in a hyper-distributed edge cloud recognise that the industrial use cases that demand such infrastructure are in their infancy. This makes the business case difficult in the current market. Both parties should encourage developers to create new applications for the hyper-disributed edge. Using the RAN as a proving ground should yield valuable lessons they can take to a broader set of enterprise customers.

2

Vendors should help operators to model in detail the impact of different functional splits to help operators separate the hype from reality and to understand the trade-offs.

In this early stage of the evolution of the vRAN, there are few commonly applicable architectures. Key choices such as the location of the edge-based distributed unit (DU) or the functional split between the radio unit and DU entail different compromises. It is essential for vendors to share their knowledge and support complex modelling and testing processes to help operators achieve the optimal balance for their network strategy.

3

Operators must decide which trade-offs are acceptable for their specific business model and commercial objectives if they plan to deploy vRAN in the next 3 years.

Operators must accept that current vRAN platforms force them to make trade-offs between deploying an industrial-grade hyper-distributed edge, and supporting the most-advanced capabilities of the 5G radio. Some may choose to delay deployment of urban vRANs until platforms are more mature (around 2025–2026), but those that want to move more quickly must decide which trade-offs will cause the least damage to their commercial models.

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About the authors

Caroline Chappell (Research Director) heads Analysys Mason's *Cloud* research practice. Her research focuses on service provider adoption of cloud to deliver business services, support digital transformation and re-architect fixed and mobile networks for the 5G era. She is a leading exponent of the edge computing market and its impact on service provider network deployments and new revenue opportunities. She monitors public cloud provider strategies for the telecoms industry and investigates how key cloud platform services can enhance service provider value. Caroline is a leading authority on the application of cloud-native technologies to the network and helps telecoms customers to devise strategies that exploit the powerful capabilities of cloud while mitigating its disruptive effects.

Caroline Gabriel (Research Director) leads Analysys Mason's *Networks* research practice, as well as leading many 5G-related research activities across multiple programmes including *Next-Generation Wireless Networks* and *Transport Network Strategies*. She is responsible for building and running Analysys Mason's unique research base of mobile and converged operators worldwide. She works directly with Analysys Mason's research clients to advise them on wireless network trends and market developments. Caroline co-founded Rethink Technology Research in 2002. Prior to that, she held various executive positions at VNU Business Publishing (then Europe's largest producer of technology-related B2B reports and publications). She holds an MA from the University of Oxford.

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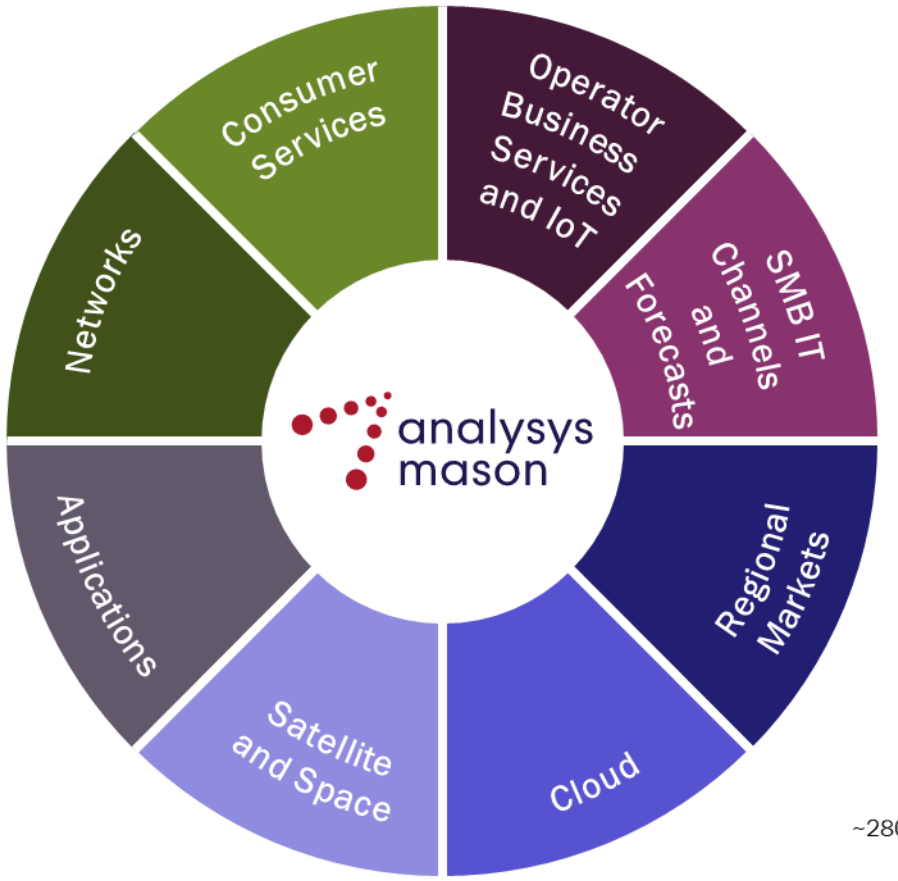

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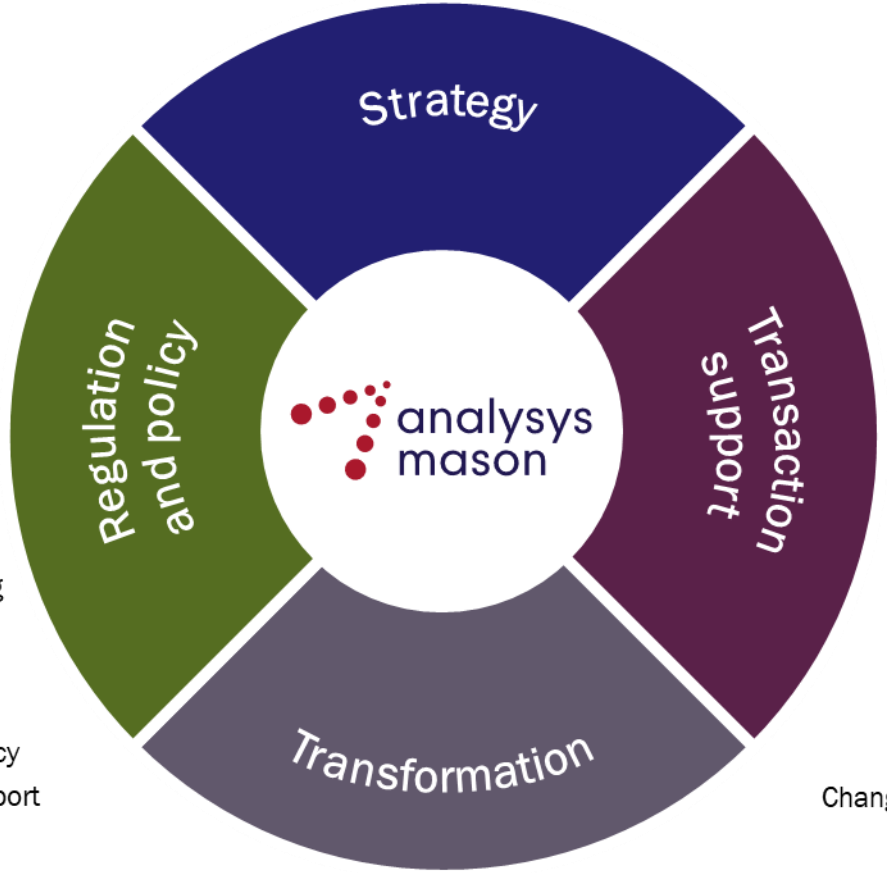

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