



xHaul challenges must be addressed before the vRAN can be commercially viable



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About this report

This report describes the way in which an open and capable xHaul (namely fronthaul and midhaul) architecture could unlock almost USD100 billion in operator spending on vRAN, and outlines the strategies that vendors must adopt to realise this.

This report defines the xHaul requirements in various deployment scenarios and assesses the ability of current solutions to address them.

It provides recommendations for a phased introduction of vRAN or Open RAN, and looks ahead to the critical innovations that are needed from the transport networks sector to make it possible to support xHaul cost-effectively in a 5G urban macro network with massive MIMO. Only with vRAN architecture that can fully support high-end radio platforms will the full value of the vRAN market be unlocked, thereby delivering the flexibility of the cloud alongside the performance of technologies such as massive MIMO.

The report is based on several sources:

- a survey of 76 mobile and converged operators that are assessing, trialling or deploying vRAN or Open RAN (conducted in July 2022), plus in-depth interviews
- interviews with vendors and open initiatives/testbeds
- spending forecasts for vRAN, Open RAN and xHaul.



KEY QUESTIONS ANSWERED IN THIS REPORT

- What are the key xHaul requirements to achieve maximum performance in a disaggregated 5G macro RAN?
- How far does current technology and architecture meet these requirements? What is the impact of the edge topology?
- What does the ecosystem need to develop in order to achieve a mature solution that provides operators with confidence to deploy?
- What is at stake if operators do not feel confident to deploy at scale?
- Which element will contribute the most to achieving the goals: physical connectivity, vRAN architecture choice or platform flexibility?



WHO SHOULD READ THIS REPORT

- Strategy, product management and product development executives within transport vendors, RAN vendors and xHaul specialists.
- Strategy and transport networks executives within operators with an interest in deploying disaggregated RAN within the next 5 years.
- Investors in Open RAN start-ups and projects.

Executive summary

Addressing xHaul (especially fronthaul) requirements is the biggest challenge to a viable deployment of a cloud-based RAN. Vendors must enable a flexible, step-by-step approach to vRAN architecture design to unlock revenue now, while setting out a roadmap to support 5G massive MIMO in the future.

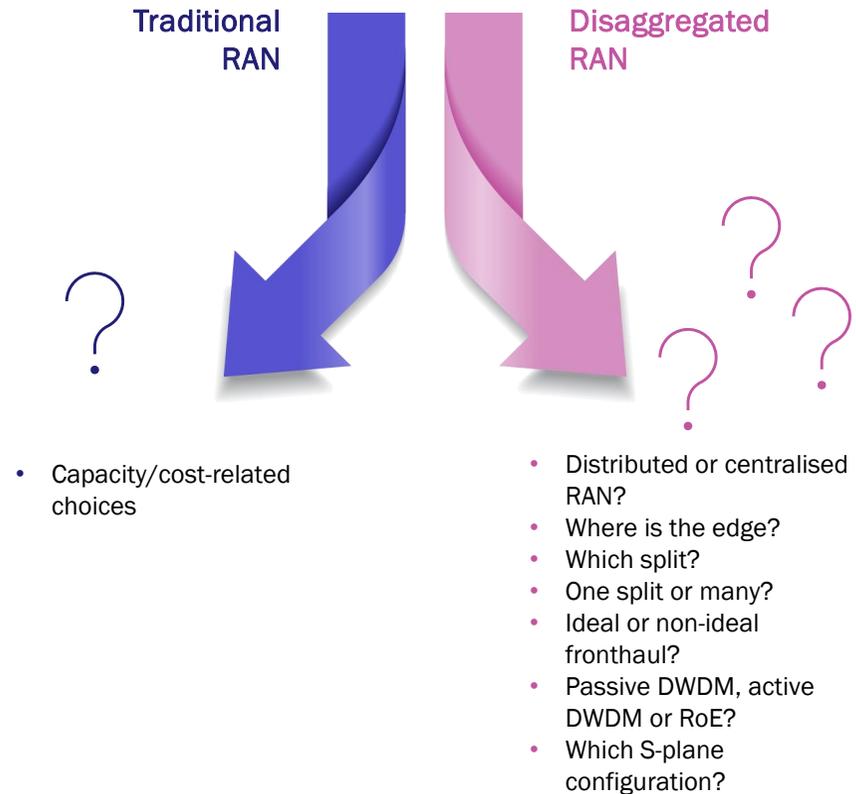
Analysys Mason’s operator research indicates that the interest in virtualised Open RAN is high, but that the adoption of such architecture in the macro network will be challenging and could result in USD98 billion of investment potential failing to be realised if not addressed rapidly. A key issue is finding the xHaul strategy that can deliver the right performance/cost ratio. Vendors must enable flexibility to avoid vRAN lock-in and should support a step-by-step approach to vRAN migration and xHaul deployment that is aligned with real use cases.



KEY RECOMMENDATIONS

- Operators must identify the vRAN architecture that suits their use case and understand the xHaul cost implications to assess viability.
- Operators should identify an initial vRAN use case with a clear ROI and establish a roadmap towards future, more-ambitious architecture, particularly 5G massive MIMO.
- Vendors must make that future attainable by developing flexible, open platforms that will reduce risk and broaden the innovation base, thereby encouraging near-term adoption.

Figure 1: Comparison of the decisions required to implement the traditional RAN and the disaggregated RAN



USD98 billion is at risk if the questions related to the disaggregated RAN cannot be resolved

Source: Analysys Mason

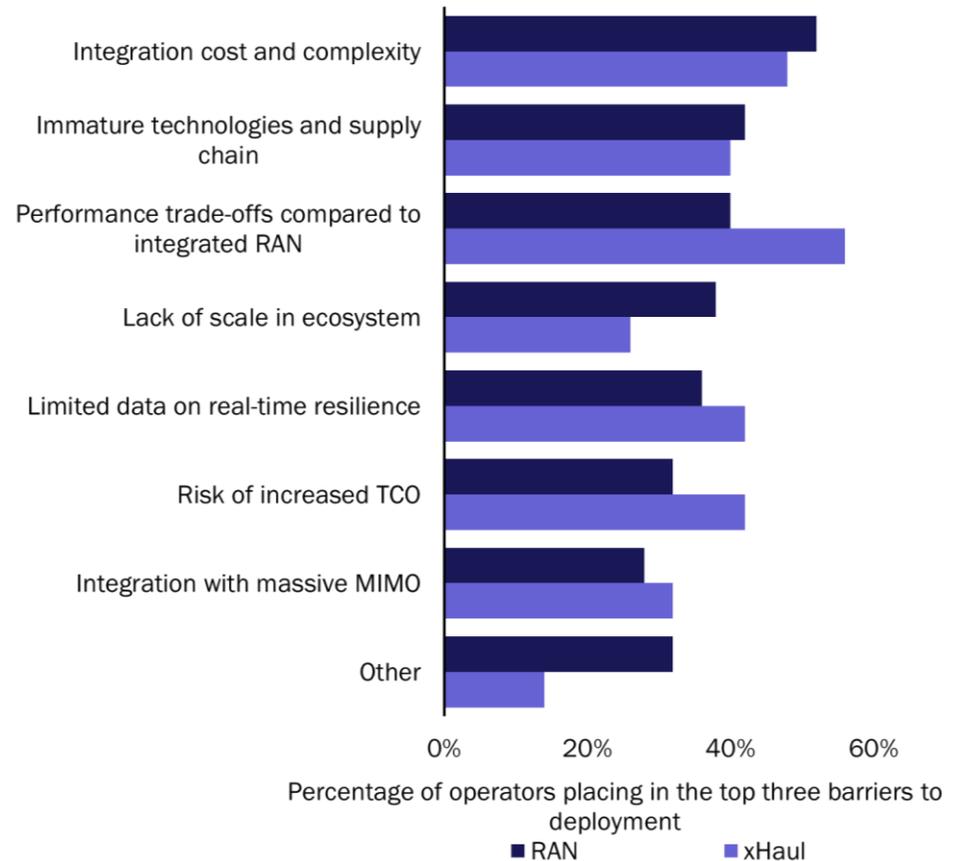
Challenge: RAN disaggregation places huge demands on xHaul; no single solution addresses all the cost and performance trade-offs, which may delay deployment

A disaggregated vRAN places enormous demands on the physical connectivity and protocols of xHaul. There are many deployment options, but each comes with trade-offs that may be unacceptable for macro networks.

The cost of deploying fibre of the quality needed to support fronthaul was the primary barrier to 4G cloud-RAN adoption. Modern vRAN is even more complicated because the baseband may be split into two separately located elements (the distributed unit (DU) and the centralised unit (CU)), which introduces a midhaul link. If the impact of deploying vRAN in the macro network on cost and performance is too great, operators will be deterred from doing so until the issues are addressed, which could potentially be too long for the fledgling Open RAN ecosystem to survive. This, in turn, could divert, postpone or cancel an estimated cumulative spend of USD82 billion on Open RAN between 2022 and 2028,¹ plus a cumulative USD16 billion on xHaul (excluding backhaul).

Some of the barriers to the deployment of a multi-vendor disaggregated RAN are closely linked with xHaul, especially the risk of performance trade-offs and/or increased costs, and the need for accelerators to optimise the fronthaul interface, particularly for massive MIMO. vRAN architecture and xHaul connectivity choices address these concerns to varying extents, but they all have trade-offs, and some mitigations, such as a more distributed edge, add new cost and risk.

Figure 2: Barriers to deployment of a disaggregated multi-vendor RAN²



Source: Analysys Mason

¹ For more information, see Analysys Mason's [Radio access networks: worldwide forecast 2021-2026](#).

² Survey of 76 operators conducted by Analysys Mason in July 2022. Respondents were asked to provide a list of all key barriers to the deployment of vRAN. They were then asked to select the three of the greatest importance to them from the top ten most-cited.

Solution: vendors must develop flexible platforms to enable many options without fragmentation and address the multi-dimensional challenge of xHaul

There are many RAN transport innovations, but no single solution can address all the issues related to vRANs. Broad ecosystem development is the key in order to provide 'true' xHaul (that is, unified fronthaul, midhaul and backhaul on a common packet-based transport network), thereby enabling the software-defined reconfiguration of networking elements in a service-oriented management framework.

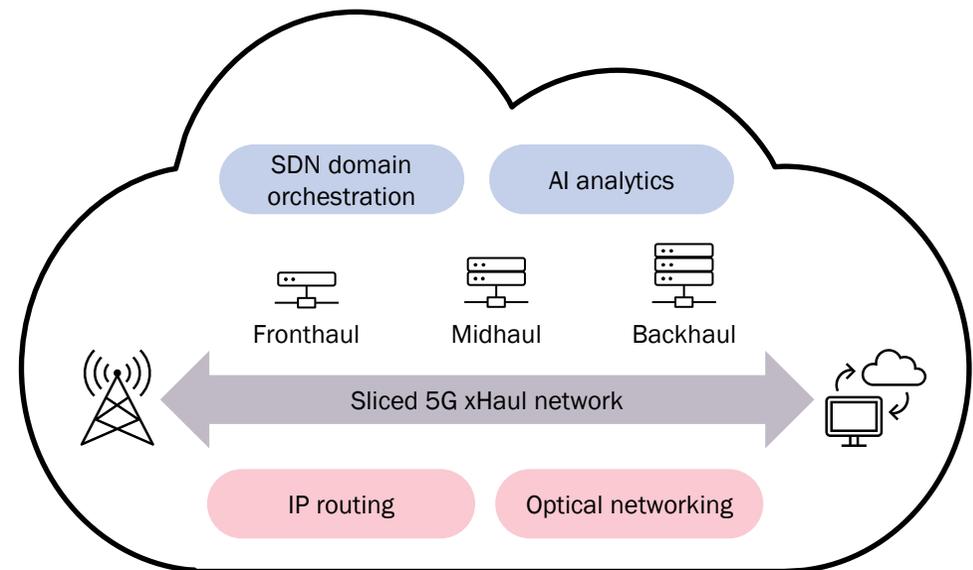
Ecosystem co-operation, open fora and a focus on flexibility are critical to realise true xHaul and to reduce the risk associated with any technology choice that operators make at this early stage in the development of the 5G vRAN market.

Operators should initially deploy vRAN and xHaul in relatively undemanding use cases (such as rural extension), as seen in Telefónica's Open RAN roll-outs in Peru.

Operators will then have to decide which vRAN architecture and physical xHaul connections support the optimal price and performance for a given environment.

There is no ideal solution for all scenarios, and requirements will change and scale up in the future. Vendors must prioritise developing common interfaces with flexibility and scalability to boost confidence, futureproof deployments and unlock xHaul spending. This, in turn, will enable operators to futureproof their first vRANs, while taking advantage of new developments that will, eventually, enable an affordable fronthaul that can support 5G massive MIMO.

Figure 3: Overview of a unified, software-defined xHaul platform



Source: Analysys Mason

Recommendations

1

Operators must identify the vRAN architecture that suits their use case and understand the xHaul cost implications to assess viability.

There are several vRAN architecture choices, defined by their functional split, their degree of centralisation and whether they are multi-vendor. Fronthaul is the biggest factor in determining whether a particular architecture is cost-viable. Operators must map different architecture to their deployment scenarios, but should be aware that fronthaul costs may force them to compromise, especially in urban macro networks.

2

Operators should identify an initial vRAN use case with a clear ROI and establish a roadmap towards future, more-ambitious architecture, particularly 5G massive MIMO.

Most operators will find it difficult to generate sufficient financial benefits from vRAN to justify the cost of xHaul in a high-end network, especially one with massive MIMO. However, that does not mean that they should not start on the vRAN journey. They can initially deploy vRAN in environments with lower xHaul demands in order to gain the benefits of cloudification, and can set out a roadmap to support massive MIMO as solutions and costs improve.

3

Vendors must make that future attainable by developing flexible, open platforms that will reduce risk and broaden the innovation base, thereby encouraging near-term adoption.

It will be challenging to make vRAN cost-effective for high-end networks within the 4–6-year timeframe that large operators have set out. Siloed, single-vendor developments will address individual challenges, but vRAN xHaul economics will only be truly transformed by a cross-industry effort to develop an open, software-defined and scalable platform with the flexibility to enable different vRAN architecture in different scenarios.



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About the author



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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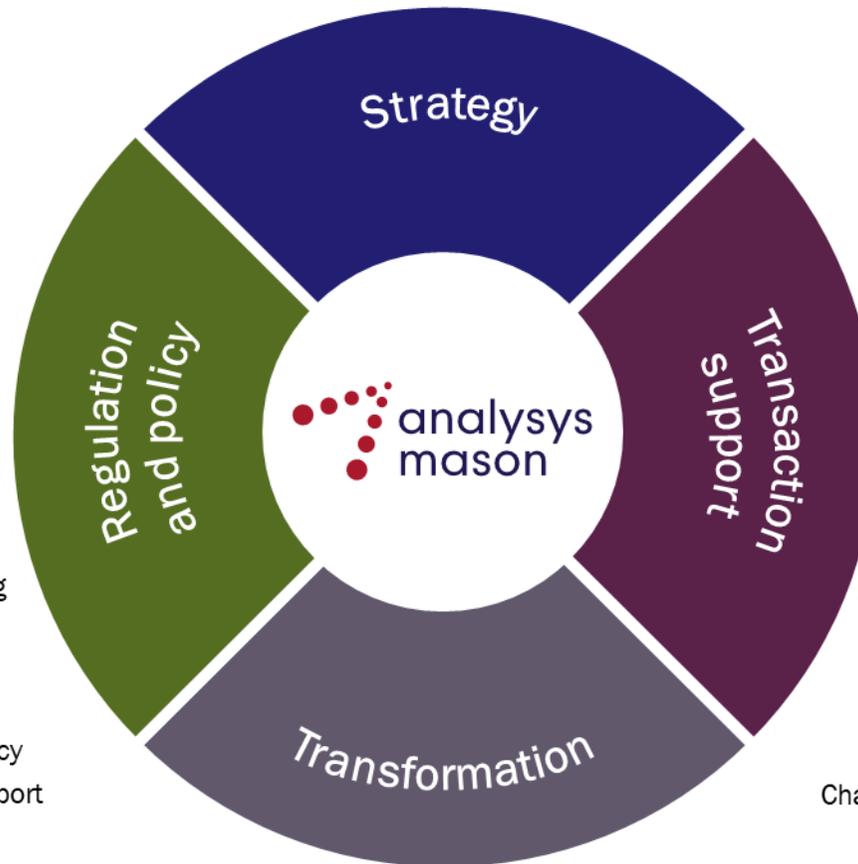
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