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Executive Briefing

FIVE WAYS TO GET OPEN RAN DEPLOYMENT BACK ON TRACK

The first commercial deployments of open RAN networks have been announced. But operators are unsure whether to deploy quickly for first-mover advantage or play it safe and wait for more proof points. We explore the causes of open RAN inertia and how operators can get deployments back on track.

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Executive Summary

Based on our insights and recent interviews with telcos, vendors and RAN Intelligent Controller (RIC) application developers, we have identified three causes of scaled open RAN inertia among established (brownfield) operators. In this report we set out five routes operators can take to get open RAN back on track.

Since the peak in open RAN buzz in 2020, a delta has emerged between the number of open RAN proof of concepts (POCs) and the number of actual deployments. There have been several scaled commercial deployments to date. However, these have primarily been by a handful of greenfield (new entrant) 5G operators. Our research found that low ecosystem capacity and readiness for commercial deployments have precluded the development of a virtuous circle of innovation with established operators. Specifically, we identified three reasons for the inertia:

1. **Direct comparisons between open RAN and legacy are not compelling enough.** In particular, legacy operators need to be convinced that open RAN is at least equivalent in terms of energy and network performance, customer experience and immediate return on investment (ROI).

2. **Lack of parity proof points on energy efficiency and performance.** With few deployments from brownfield operators, there is little real-world evidence of actual open RAN performance and efficiency. This lack of proof points is contributing to a cycle of hesitation.

3. **Shortage of cloud-native networking skills and know-how. CSPs also sometimes perceive this as a lack of ecosystem maturity and/or ecosystem capacity.** Whilst more progress on open RAN component interoperability is always welcome, operators should not expect the same plug-and-play deployment as with traditional system solutions. Indeed, CSPs' goal should be to upskill, tool-up and evolve their culture and operating model to deliver agile growth. Cloud-native networking is an enabler of this. Finally, CSPs also point to a shortage of experienced open RAN practitioners to support them and that this expertise is concentrated on a handful of mainly greenfield deployments.

While there has only been a small number of commercial deployments to date, our research revealed that operators still believe in the promised benefits of open RAN. Plus, 2023 is set to be an important year for ecosystem maturation, which should allow operators to build a stronger business case for scaled deployments.

Our five key recommendations for operators seeking to speed up their commercial open RAN deployments are:

1. **Adopt new silicon as soon as possible.** New chipsets (notably from Intel as well as rivals, Marvell, Qualcomm and NVIDIA) are better designed to meet the computational demands of open RAN workloads and will significantly improve network performance and energy efficiency.

2. **Understand and account for the impact of new silicon and the RIC on network performance and efficiency, albeit over time.** The RIC will enable operators to customise their RAN to meet specific business objectives through automation, artificial intelligence (AI) and machine learning (ML). Together, new silicon and the RIC will not just close the gap with legacy but accelerate past it.

3. **Consider the fact that performance benefits will be realised over time when calculating ROI[1].** New silicon plus RIC-enabled programmability will mean that network performance and efficiency are expected to increasingly outperform legacy over time. This constant innovation cycle is central to the open RAN philosophy. Future ROI modelling must account for this, rather than projecting a static performance, based on one instance of testing.

4. **Transition to "RIC-based" non-real-time controllers on legacy networks to smooth the transition and realise some open RAN benefits sooner.** Do not think of the RIC as the prize of open RAN – as operators can realise some of the benefits of RIC-like functionality on legacy networks. This can smooth the transition by allowing the decoupling of the "brains" of the radio from the hardware on the legacy network in a more repeatable way that re-uses existing interfaces.

5. **Leverage and learn from the expertise of systems integrators (SIs).** SIs can play a pivotal role in helping to manage the transition to open RAN, bringing integration expertise and component vendor know-how from other deployments. At the same time, CSPs must foster the internal skills, processes, organisations and incentives to continuously improve the new network after deployment.

[1] STL Partners has developed an open RAN ROI model specifically designed to run ROI calculations on various open RAN deployment scenarios at brownfield operators over the 2021 to 2030 period.

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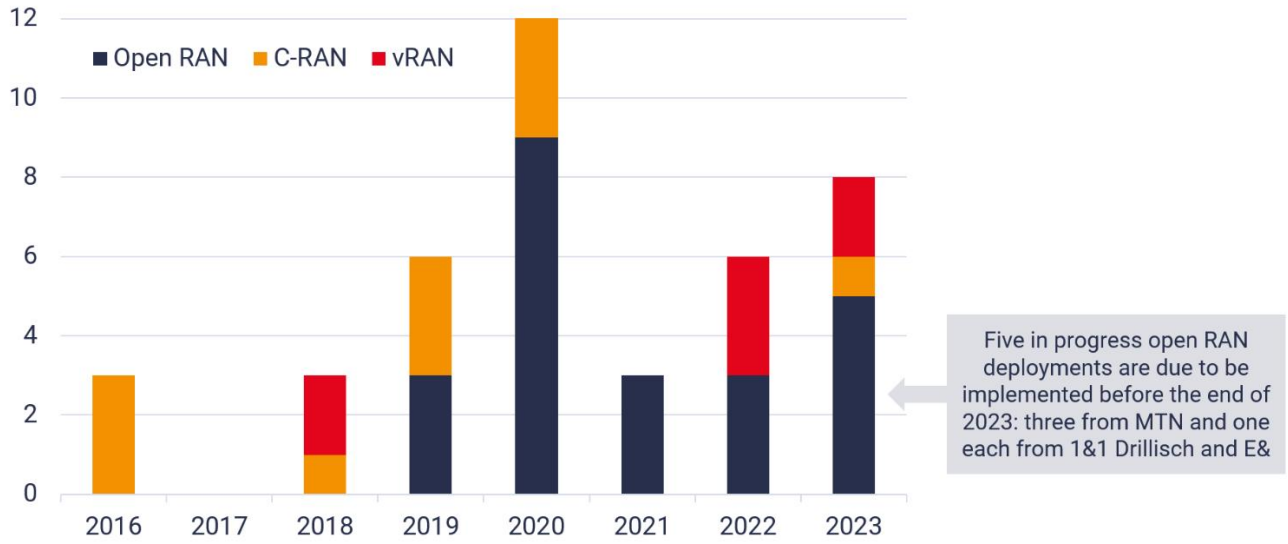
Consensus for open RAN has crystallised but only trailblazers are deploying at scale

The state of open RAN deployment

The goal of open RAN is to drive mobile network innovation by creating a diverse ecosystem of vendors which can stimulate competition and drive innovation. For operators, the open RAN aspiration is also part of a wider move to cloud-native architectures in networking. Cloud-native architectures leverage the scalability, flexibility and automation of cloud computing to improve networks. Therefore, cloud-native should be understood as an enabler of business transformation and generative of a new operational paradigm. It is not something operators buy to replace what they had before, unlike the norm for previous network technology generations.

The scale and depth of transformation required by cloud-native networking is one of the reasons that open RAN deployments have been pushed back by operators who are grappling with the extent of the organisational and technological development it requires. For this reason, there remain only a handful of commercial open RAN deployments despite the large number of trials and POCs carried out since 2016 (see Figure 1). Despite this, it is important that the industry acts now to reignite open RAN ambition to achieve better and more efficient networking.

Figure 1: Global deployments of open RAN, 2016-2023

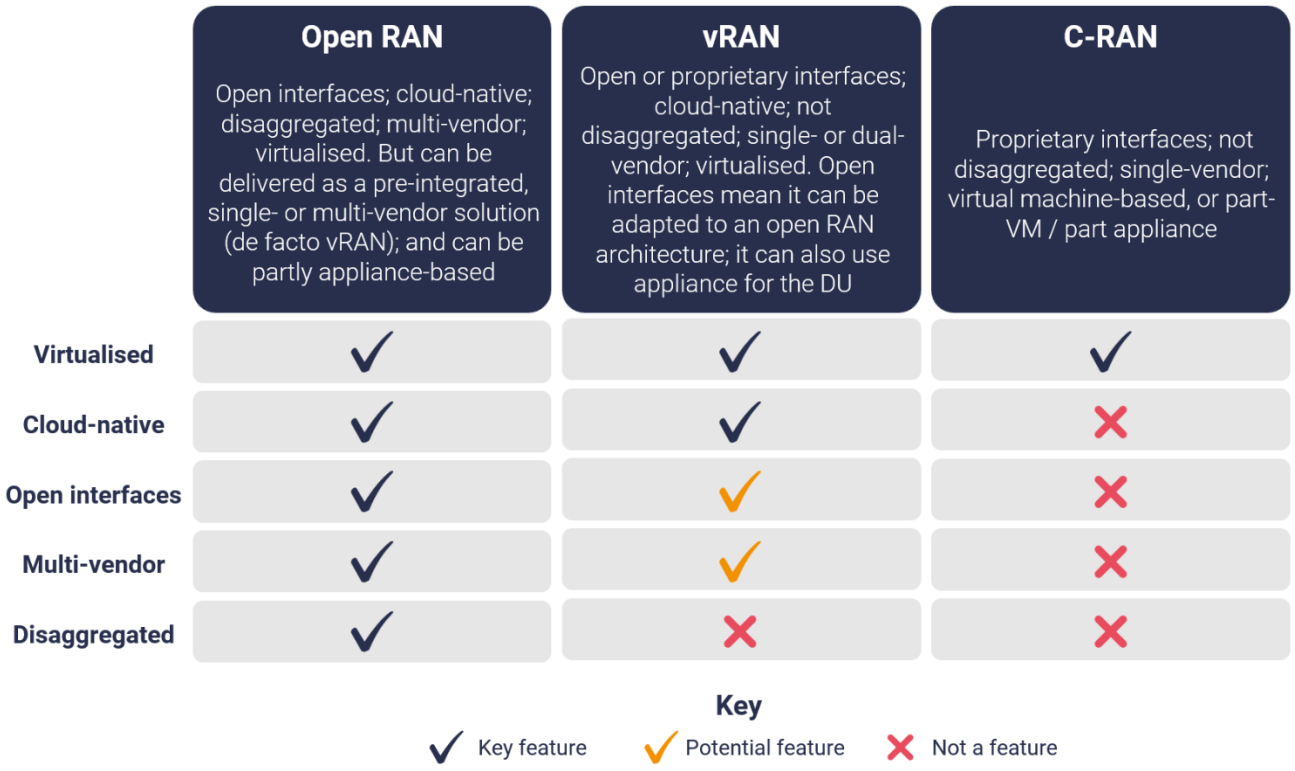


Source: STL Partners Telco Cloud Deployment Tracker

Operators should eagerly pursue open RAN because it will introduce a multi-vendor ecosystem that will allow them to assemble and quickly evolve customisable stacks comprised of innovative "best-of-breed" hardware and software network components. In legacy RAN it has been difficult for operators to upgrade, customise or differentiate their own networks beyond the roadmap(s) of their selected vendor(s), a situation referred to as vendor lock in. Open RAN turns the legacy single-vendor network paradigm on its head. A truly multi-vendor ecosystem should give rise to more innovations that unlock network programmability and automation, reduce the total cost of ownership in the long term, and generate new revenue opportunities for operators. We explore open RAN-enabled benefits extensively in our research.[2]

The ethos of openness and competition embodied by open RAN was developed by, among others, the O-RAN Alliance, an industry organisation formed at Mobile World Congress Barcelona in 2018. Founding members include Deutsche Telekom, AT&T, NTT Docomo, Orange and China Mobile. The O-RAN Alliance has since grown to include over 300 members who are working towards developing and promoting open standards and interfaces across the industry. Operators have begun to favour open networking principles and believe that it is the future of their networks, even if few are ready to deploy open RAN at scale. Figure 2 sets out the differences between the various forms of virtualised RAN: cloud RAN (C-RAN), virtualised RAN (vRAN) and open RAN.

Figure 2: Open RAN, vRAN and C-RAN characteristics

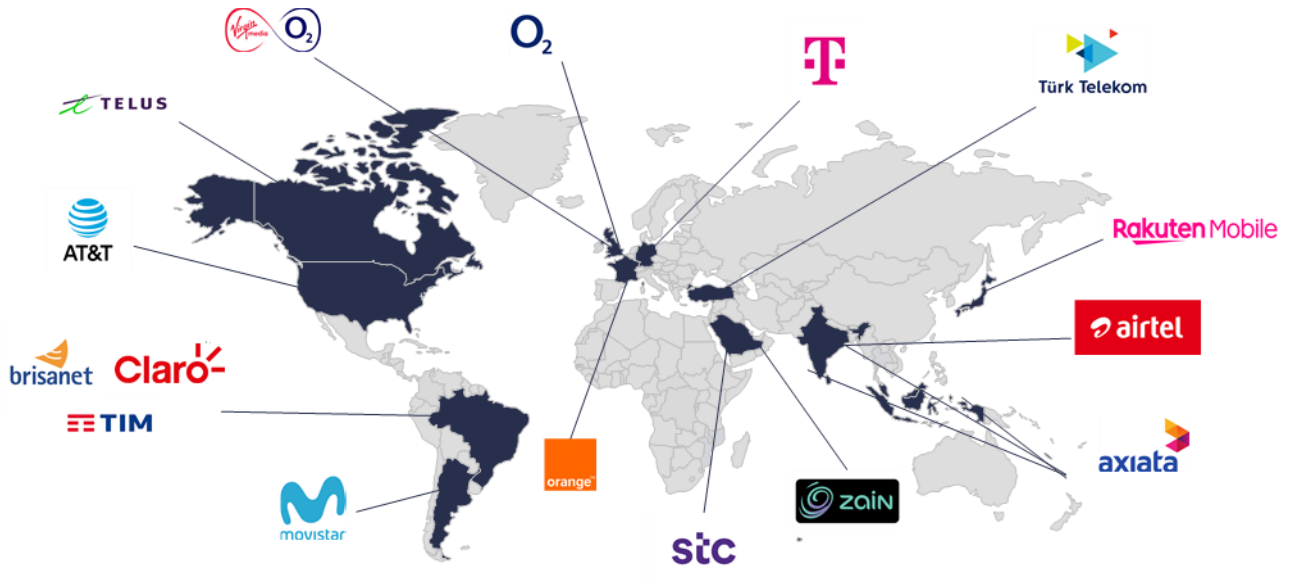


Source: STL Partners

[2] See the resources on our Telco cloud hub

The desire among operators to adopt this technology is reflected in the large number of recent trials and pilots. See Figure 3.

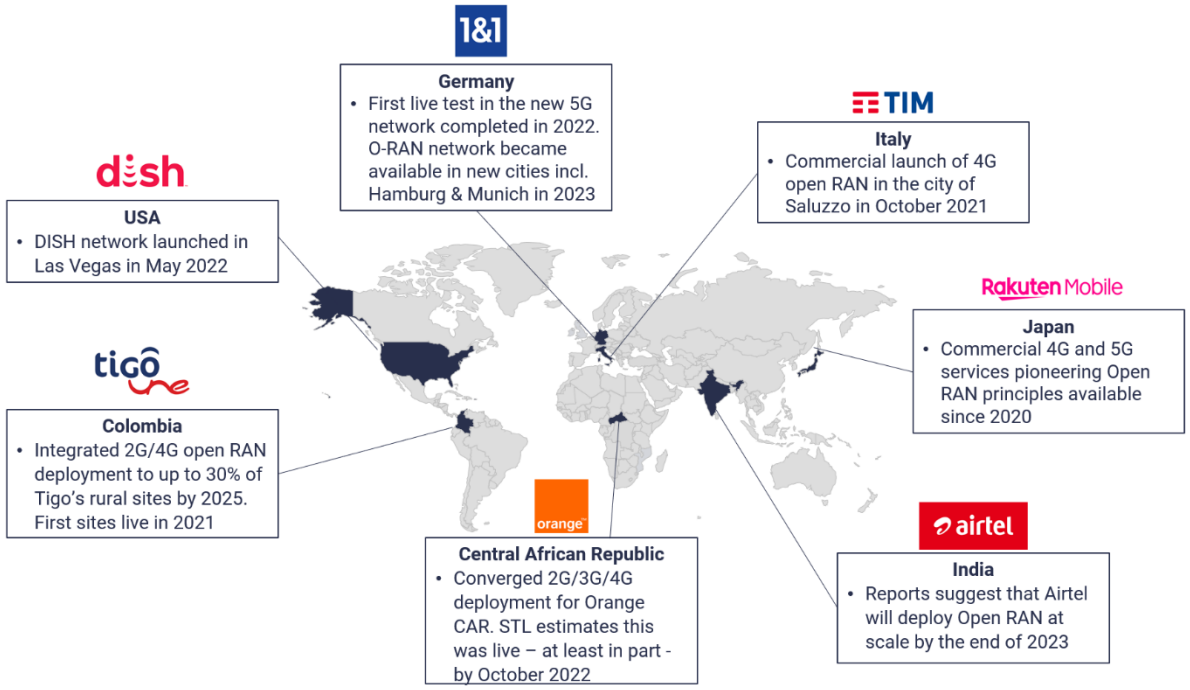
Figure 3: Open RAN trials and pilots by leading players up to 2022



Source: STL Partners

But the delta between the number of trials and the number of commercial deployments is evidence of the fact that while consensus for openness has crystallised among operators, actual deployments are being repeatedly deferred. The large volume of trials, combined with some operators' announcements of plans to pursue commercial deployments from 2023 onwards, have generated an impression that open RAN solutions and the ecosystem around them are finally maturing. Despite this, there has been very few commercial deployments of open RAN, as stated in a recent webinar. Where there have been commercial deployments of open RAN, these have been by trailblazers – greenfield operators like DISH and Rakuten and agile brownfield operators, including Airtel and Orange. See Figure 4.

Figure 4: Commercial open RAN deployments, 2020-2025



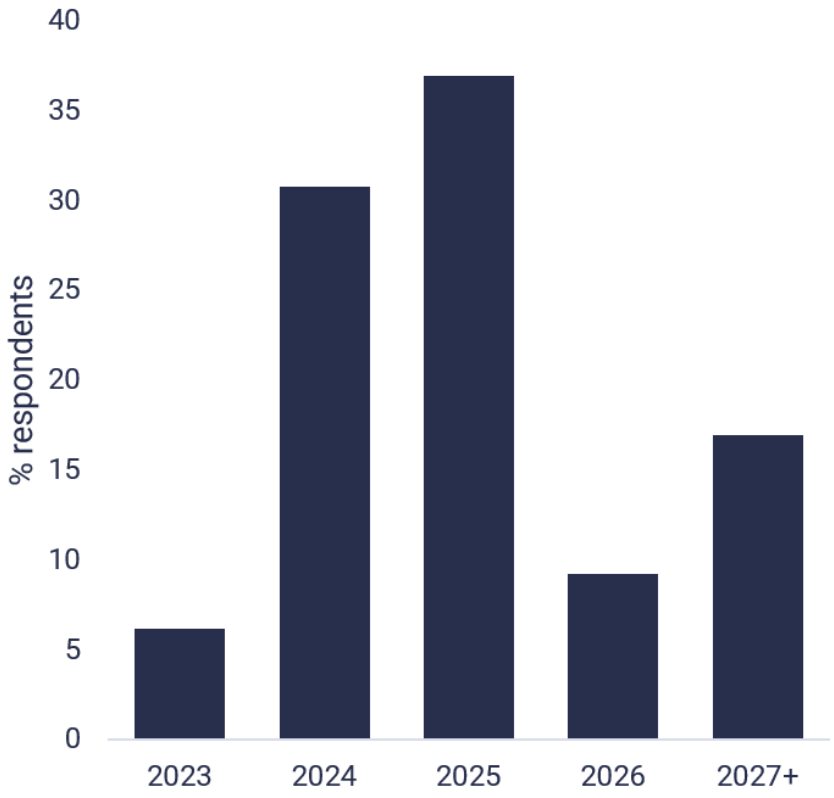
Source: STL Partners Telco cloud deployment tracker

The following sections explore why most operators are deferring open RAN deployments.

Ecosystem immaturity and transformation inertia are holding back open RAN roll out

In order to understand the deferral of commercial open RAN deployments by brownfield operators, we conducted interviews with telcos and technology providers globally. We validated the operators' commitment to open RAN and open ecosystems and discussed the challenges, both internal and external, hindering large-scale deployments. Figure 5 shows when most operators predict they will implement open RAN.

Figure 5: Operators' predictions for the implementation of open RAN



Source: STL Partners, June 2022, n=65

We found that low ecosystem capacity and readiness for commercial deployments have precluded the development of a virtuous circle of innovation. In open RAN, vendors working within specific layers of the stack (hardware, cloud native functions, RIC application developers) and across it (SIs and managed services providers [MSPs]), must work with operators to test and integrate their solutions. With open RAN still nascent, the commercial incentive for these vendors is weak, and many are viewing complex testing and integration exercises with other vendors, operators, standards bodies and regulators, as learning opportunities rather than taking them on in a commercial sense. In turn, this has meant that there are few vendors who have experience beyond trials and POCs to support commercial deployments. This is an issue because many of the benefits of open RAN are predicated on starting the flywheel of innovation within the ecosystem. Our research has identified three specific causes of ecosystem inertia:

> **"We anticipate that larger-scale deployments are at least three years away; we currently think 2025 could be the turning point for adoption."**
>
> *Vice President Core Network, Tier 1 EMEA operator*

- **Direct legacy comparison ROI case is weak**
- **Lack of parity proof points on energy efficiency and performance**
- **Perceived barrier of bringing in the skills, processes and culture of cloud-native**

Direct legacy comparison ROI case is weak

> **"We aren't expecting capex, opex or energy efficiency benefits from open RAN deployments in our current projections, based on the use of currently available servers."**
>
> *Access Network Architecture Manager, Tier 2 MENA operator*

Many of the benefits of open RAN are predicated on starting the flywheel of innovation within the ecosystem. Because this has not begun, operators are currently testing an impoverished version of open RAN, without all the benefits that will ultimately come with programmable networking.

For example, programmable networks need applications to optimise the network for key performance indicators (KPIs), like energy efficiency and user experience. Application developers need access to real world data to feed the AI/ML algorithms so that they can learn how to optimise the network to achieve those KPIs. But most developers do not have access to the data needed to do this. In turn this means that, at the outset, programmable networks are not achieving the best

performance that they can for a variety of KPIs, which in turn drives down ROI predictions for operators and means that open RAN networks compare less favourably to legacy. The example of hesitation on data sharing is just one of many that shows how inertia in any part of the open RAN ecosystem has a ripple effect that prevents operators and vendors from realising benefits.

Besides the absence of a virtuous cycle of innovation, the second key reason that operators have struggled to establish parity efficiency with legacy is because open RAN workloads run on commercial off the shelf (COTS) hardware. COTS servers typically use all-purpose processors, with earlier generations of silicon that were not designed to run RAN workloads, leading to workarounds (e.g., FPGAs and other hardware acceleration) to avoid poor performance.

Lack of parity proof points on energy efficiency and performance

Telecoms operators are hyper-aware of their responsibility to safeguard their networks in order to provide guaranteed performance to their customers. Given this concern, the imperative to balance upgrading the network and maintaining reliability and performance for customers has created a tricky path for operators to negotiate. In tests, some operators have found that open RAN, in its current state of maturity, cannot deliver the same reliability as the legacy RAN at the outset and have held off scaled deployments. Ultimately this cycle of hesitancy contributes to ecosystem inertia, hampers innovation and slows deployment timelines.

> **"There is scepticism among risk-averse brownfield operators about the ability of open RAN to deliver the same stability and performance of legacy RAN; they won't make the switch until they are reassured that reliability is on par."**
>
> *Senior Business Development Manager, cloud technology vendor*

> **"We haven't seen an improvement in energy efficiency in open RAN testing, but we ultimately expect this and will question our choices if we don't see a reduction in energy use."**
>
> *Access Network Architecture Manager, Tier 2 MENA operator*

In addition to concerns about the performance of open RAN, operators are having to consider the energy impact of network improvements. This is top of the agenda for many operators and a major deployment of new infrastructure is a sustainability risk that they must contain, often within the context of ambitious Scope 1 to 3 emission targets. Open RAN promises to bring improvements to network energy consumption through optimisations brought about by programmability. Yet many of these expected improvements are not available to operators at trial stage and telcos still struggle to achieve energy parity with the legacy network in open RAN POCs and trials.

Concerns about the proven performance and efficiency of open RAN have created a hesitancy to deploy among operators who were once more enthusiastic about the prospect. Operators want more real-world evidence that the technology is mature enough to perform at least on par with legacy RAN and can integrate with legacy equipment without impacting service quality for customers.

> **"Open RAN deployments have to achieve energy parity with, and eventually outperform, integrated solutions."**
>
> *Vice President Core Network,*
>
> *Tier 1 EMEA operator*

Perceived barrier of bringing in the skills, processes and culture of cloud-native

> **"Operators who deploy open RAN without the accompanying mindset change won't realise its full benefits. But many are still in the 'full stack' mindset and are finding integration to be a major hurdle."**
>
> *Senior Business Development Manager, middleware vendor*

Removing the packaged system vendor that manages the full end-to-end stack and replacing it with an assortment of disaggregated vendors that telcos must directly manage and integrate is proving strenuous. STL Partners' view is that cloud-native is something that telcos must do, rather than something they can buy. By that, we mean that operators need to commit to a mindset change in order to move away from proprietary RAN and realise the full benefits of open RAN. Cautious carriers waiting for open RAN to become fully mature before testing and validating it for their own networks risk missing the point of cloud transformation.

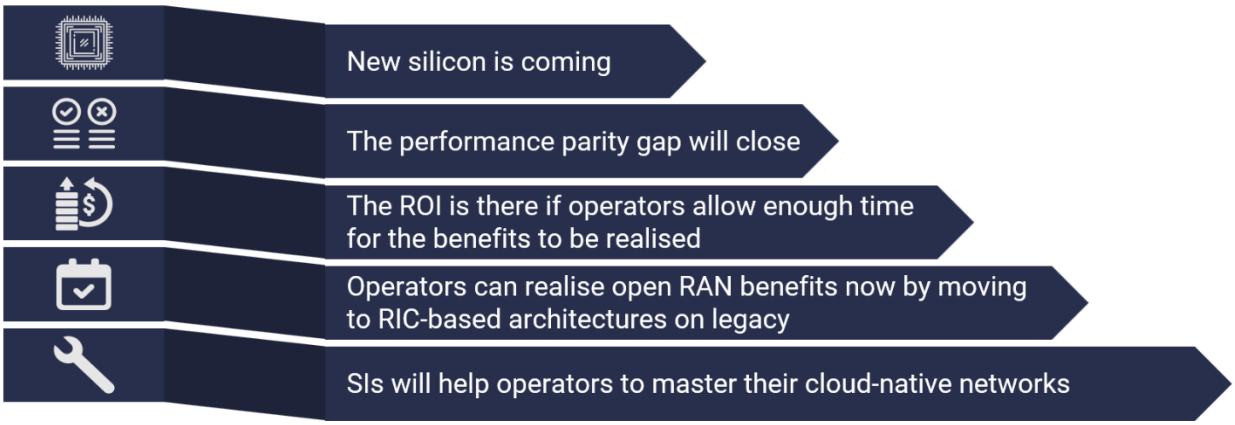
At the same time, most operators cannot take on this magnitude of transformation on their own. They are used to having a single point of contact for support and maintenance, and their internal expertise, capabilities and management structures have been built around this operating model. SIs are one option for operators to make sense of the complexity of the open vendor ecosystem that underpins open RAN by becoming that single point of contact. But operators still need to decide whether to use SIs and how to use SIs effectively.

In our conversations with operators, we learned that there is a lack of available resource and experienced open RAN practitioners in the ecosystem who can support operators in this journey. One CSP we spoke to said that with vendor expertise predominantly concentrated on a small number of greenfield deployments, other operators are struggling to get the support they need to press on with the transformation required by open RAN.

Identifying the causes of ecosystem inertia led us to ask whether the wider operator community can get open RAN back on track and, if so, how. The following section outlines the five reasons why we believe open RAN can get deployment back on track, as shown in Figure 6.

> **"Open RAN vendors don't have the manpower to support several simultaneous deployments and so are focused on a few big greenfield projects."**
>
> *Access Network Architecture Manager, Tier 2 MENA operator*

Figure 6: Five reasons why open RAN will get back on track



Source: STL Partners

Five reasons why open RAN deployments will get back on track

New silicon is coming

New silicon technologies are anticipated and the chip vendor ecosystem is expected to grow and diversify in 2023. Better silicon will enable higher-performance processors and accelerators, which can better handle the workloads of open RAN systems. For example, at Mobile World Congress Barcelona in March 2023, Marvell announced new chips in its OCTEON 10 Fusion family that, according to the company, include specialised accelerators for processing massive multiple input, multiple output beamforming algorithms while also providing up to 40% power savings. Intel also unveiled new processors specifically tailored for optimal performance in vRAN workloads with integrated Layer 1 acceleration that reportedly delivers an added 20% in compute power savings. As mentioned, open RAN workloads are currently running on general-purpose processors, that struggle to meet the computational demands of open RAN capabilities like real-time signal processing and baseband processing while also achieving parity with the legacy network on energy efficiency and reliability. But new silicon will lead to improved open RAN network performance by lowering latency and improving capacity. In turn, these innovations in silicon will enable faster development cycles for open RAN components and systems, kickstarting the ecosystem and allowing operators to deploy new features and capabilities more quickly and keep pace with the changing demands of their customers. It also means that network performance and energy efficiency will improve faster and more so over time.

The performance parity gap will close

> **"The RIC will unlock a world for operators where they no longer have to rely on the same priorities as their vendors"**
>
> *Director Product Management RIC, technology vendor*

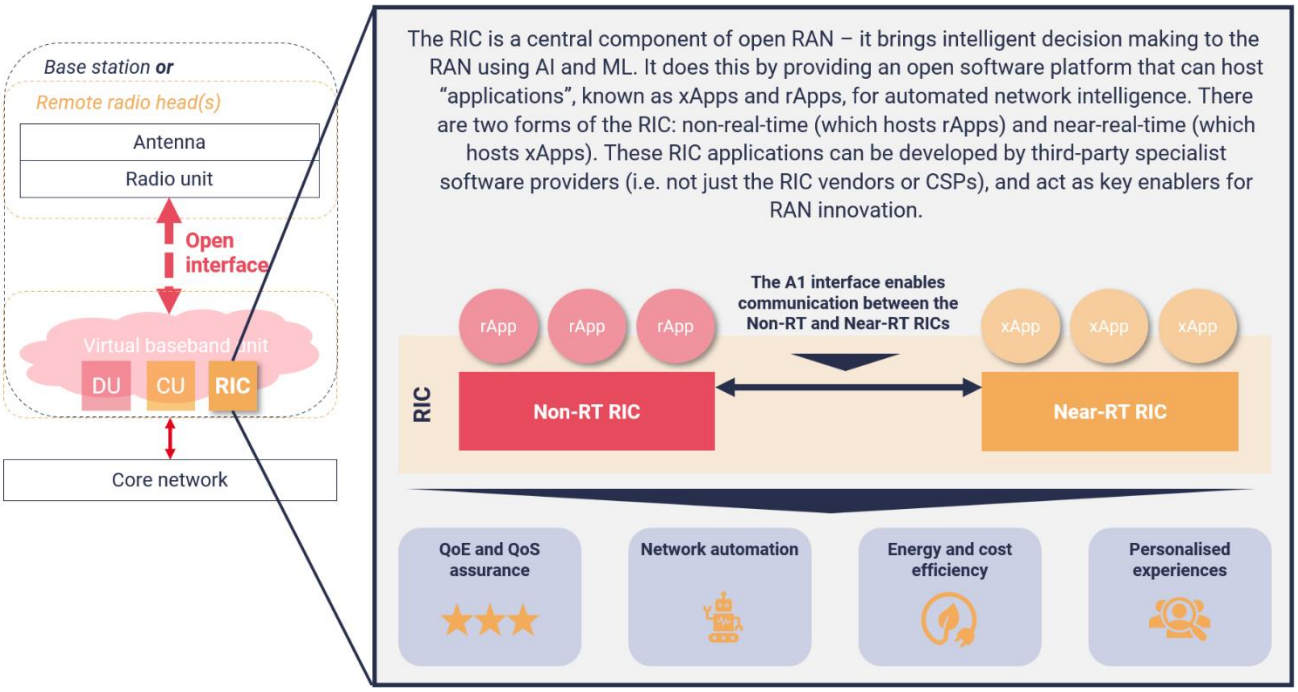
New silicon has a crucial role to play in closing the performance parity gap with legacy, but utilising the programmability of the network will also be fundamental. As operators move away from the tightly integrated solutions of the legacy networks and towards modular and programmable solutions, they will become able to customise their RAN to meet their specific business objectives. The RIC is central to this as it brings intelligent decision making to the RAN using AI and ML to optimise the network to specific KPIs. See

Figure 7 for more detail. This will unlock a whole host of opportunities for operators who will no longer have to depend on vendor innovation cycles. Instead, they will be able to build networks that are tailored to their business needs, so that

they might differentiate themselves from the competitions on the basis of factors impacting customer experience including, network quality, customer cost or energy efficiency. The RIC is revolutionary in that it allows developers to access the network and create solutions to optimise the network in ways that could not be imagined before. In open RAN, the deployment of multiple AI/ML solutions on the RIC will improve the network through lots of small optimisations that will ultimately greatly improve network energy efficiency and performance. This will not just close the gap with legacy but eventually allow open RAN to accelerate past it. This is an important consideration when calculating open RAN ROI.

> **"The major benefit of open RAN and the RIC is that it opens the network up to developers, who will all make marginal gains to improve network quality and efficiency far beyond what it is today."**
>
> *Software Developer, RIC application developer*

Figure 7: RIC location and functionality explained



Source: STL Partners

The ROI is there if operators allow enough time for the benefits to be realised

When modelling expected ROI from open RAN deployments, operators must consider how network performance and efficiency are expected to improve faster and more so over time when performing their calculations. This will be true both because of new silicon, and because of the programmability enabled by the RIC. Power management is a priority for operators on both their legacy and cloud-native networks and the RIC is expected to make a tangible difference to energy-related opex spend. The near readiness of many energy optimisation applications for the RIC (see Figure 9) and applications that enable innovation and rearchitecting (see Figure 88) are some of the reasons why much of the interest in RIC is coming from speculation about what it can do for efficiency both in open RAN systems and on legacy. STL Partners' modelling predicts that the fastest-growing operators can expect a reduction of up to 8% in energy-related opex, 13% in RAN capex and 10% in RAN opex in 2030, following open RAN deployment.[3] In summary, when operators consider the impact of new silicon and the RIC on their opex and capex ROI calculations they will find that the ROI is good enough to justify investment.

Figure 8: Indicative matrix of RIC application solutions' scope and impact

Some solutions are mainly focused on optimising the performance of existing RAN infrastructure while others are trying to foster innovation and enable re-architecturing of the RAN, with the potential of unlocking greater benefits

Source: STL Partners

[3] STL Partners' Open RAN ROI tool

Figure 9: RIC applications for power management

Use case	Benefit	Expected availability
Power reduction of RAN components	Temporary reduction in power or switched off for a period plus ability to switch off certain parts of antenna	Short term
Carrier and cell switch on/off	Aims to reduce O-CU/DU/RU power consumption by switching off/on carriers or cell of given technology	Short term
Advanced sleep mode	Reduce power consumption by partly switching off O-RU components	Short term
RF channel switch off/on	Reduction of power consumption of O-RU for MIMO and massive MIMO by switching on/off certain RF channels	Short term
Traffic steering	Direct traffic to optimise energy e.g., voice-to-macro, MBB small cell	Mid-term
Enhanced beamforming	Use of machine learning-basedoptimisation of MIMO beamforming, reducing RAN resource needs	Mid-term
CU resource optimisation	Using RU data to predict real-time CU requirements, reducing capex and opex needs for CU	Mid-term

Source: Charlotte Patrick Consult, STL Partners

Operators can realise open RAN benefits now (by deploying aspects of the RIC on legacy networks)

Until now, operators and vendors have largely seen the benefits of the RIC as contained within the broader open RAN project. As a consequence, they are finding it hard to justify investment into open RAN while the benefits of the RIC remain distant, and for some future applications, theoretical. This is why operators should not view the RIC as "the open RAN prize," – instead, they should be reassured by the programmability enabled by non-real-time capabilities already deployed on some legacy networks being ported to RIC-based architectures. As such, they should consider bringing the essence of the RIC onto their own legacy network, as an advancement of the programmability they kicked off with the introduction of self-organising networks. This pragmatic approach would allow operators to decouple the "brains" of the radio from the RAN hardware on the legacy network, which lays the foundation for creating competition between RAN vendors later in their open RAN journey. This approach ought to mollify operator concerns about the distant and abstract benefits of the RIC by realising some of its benefits immediately on the legacy network and smoothing the transition to cloud native.

"At the moment it's all about what the RIC can do for the legacy network… Telcos are starting conversations with us now about adopting RIC-based approaches on their legacy networks, this is part of their pragmatic pivot to O-RAN."

Senior Director Sales Engineering, RIC vendor

"The major benefit of open RAN and the RIC is that it opens the network up to developers, who will all make marginal gains to improve network quality and efficiency far beyond what it is today."

Software Developer, RIC application developer

SIs will help operators to master cloud-native networks

Engaging SIs has been one option for operators to make sense of the complexity of the open vendor ecosystem that underpins open RAN. Telefónica is an example of an operator that has opted for this path. In a recent announcement of pre-commercial trials in its core global markets, the operator shared that NEC would serve as the primary SI. Other operators have developed SI skills, with the intention of reselling those skills to other operators.[4] Rakuten Mobile took this route, working with and then acquiring Altiostar, and then developing its own SI-adjacent entity, Rakuten Symphony.[5]

These operators have found the SI proposition appealing because they can provide a blueprint to accelerate operators' own deployments – integration expertise, including pre-integrated and pre-tested elements from across the RAN stack. They might also assure this pre-integrated, pre-tested stack, so that it looks to operators more like a legacy-style vertically integrated, single-vendor solution, and gives operators the reassurance of having one point of contact when things go wrong. [6] World Wide Technology (WWT) is an example of an SI that has developed such a proposition, positioning itself as "the single hand to shake" by offering a pre-integrated, pre-tested, open RAN stack in partnership with VMware, HPE and Mavenir. Other similar initiatives have been announced by NTT Data, Capgemini and Atos. Vendor collaborations play a critical role in the development of these pre-integrated solutions – they fully test and validate interoperability between vendors, which reduces the SI effort and increases speed of deployment for operators.

[4] Telefónica and NEC to build Open RAN live pilots
[5] Open RAN and vRAN deployments by operators
[6] Open RAN: What should telcos do?

At the same time, it is crucial that operators do not surrender all technological control of open RAN deployments to SIs; they must endeavour to develop new network management skills, learning from their SI partners during deployment, so that they know intimately how the system works. Otherwise, the running of the network would become solely the domain of SIs and MSPs, to whom operators would then become beholden. To avoid this, operators need to make a sustained effort to get up to speed with the technology and practices involved in managing a multi-vendor solution (e.g., continuous integration and continuous deployment, and DevOps), so as to eventually take charge of the stack's ongoing evolution. Developing these technical skills is closely coupled with the importance of mindset change, as has already been outlined, and the view that operators cannot buy cloud-native, they must become it through sustained engagement with new technologies and business models. In other words, operators should build internal capabilities, including network automation and orchestration, to manage the open RAN transition and have a clear strategy for engaging and working with SIs. Orange is an example of a telco embracing this change, they plan to act as their own SI for open RAN deployment.

> **"Our deployments took longer, and were more complicated, than was expected, this created the need for SIs to step in and support."**
>
> *Senior Vice President, Head of Network Architecture,*
>
> *Tier 1 EMEA operator*

> **"O-RAN requires operators to be continually integrating and testing new equipment, they need to move away from the 'once or twice a year' upgrade culture associated with legacy networks."**
>
> *Senior Business Development Manager, technology vendor*

Conclusion

Although there are several challenges ahead for telecoms operators looking to deploy open RAN at a commercial scale, we anticipate that new developments in the vendor ecosystem and the maturation of silicon and RIC technologies will unlock the business case for many.

Our research found that while a disparity has been observed between the number of open RAN POCs and scaled deployments, many operators accept that open RAN is the path forwards for their networks, even though a cycle of hesitation has slowed deployment timelines. The present hesitancy primarily stems from three key factors – an inappropriate ROI comparison with legacy networks, the scarcity of energy efficiency and performance proof points, and the perceived hurdle of building the cloud native skills, processes and culture that must accompany the technology adoption which is required for business transformation.

Advancements in silicon and the network programmability enabled by rApps and xApps deployed on the RIC will not only bridge the performance gap with legacy systems but will ultimately surpass it. The adoption of these technologies will shift the needle on ROI calculations, especially when they include the future benefits of open RAN. Additionally, a strategic approach leveraging the expertise of SIs can help smooth the transition to open RAN, while gradually building internal competencies. The deployment of RIC on legacy systems can also provide an immediate taste of open RAN benefits, mitigating the resistance to change.

In essence, it is still the case that most operators have to develop new operational skills internally that will allow them to take a more hands-on approach to managing their networks. Only then, will it be possible for them to pursue the long-term rewards of open RAN and embrace the transformation that must accompany it, even if it is not as simple as buying a new network off-the-shelf, to kickstart the virtuous circle of innovation in open RAN networks.

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