SURVEY REPORT

Operators embrace virtualised, open networks with agile automation to meet future demands

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Executive Summary

Virtualised, automated mobile networks that leverage open architectures and cloud technologies are clearly the path forward for forward-thinking operators. To find out where mobile network operators (MNOs) are on their journeys, GSMA's ***Mobile World Live*** surveyed executives from 156 global network operators. We asked them about virtualisation, public and private cloud strategies, multi-generation networks, Open Radio Access Network (Open RAN) and network automation.

The results show most mobile networks are moving to software, with a healthy portion also implementing Open RAN and moving some operations to the cloud. Almost all operators surveyed are investigating these technologies to some degree.

Operators recognise a need for tools that will enable them to maximise their returns on these investments and to keep up with changing demands. With virtualisation comes the opportunity to adopt automated processes that speed upgrades, provision new services dynamically, and enable network slicing for specific customers and use cases and, importantly, manage cost. Automation is classified as "critical to progress" by three quarters of the operators interviewed.

These survey results reinforce trends seen in the larger market, as multiple industries invest in technologies that will enable open, automated mobile networks. From semiconductors to servers to software, companies are investing in virtualised, automated platforms that support mobile networks because they recognise the role these networks will play in the future economy. Mobile is becoming foundational to industry and commerce, and innovative vendors that align with the larger ecosystem of investment will be best positioned to help operators prepare to capitalise on the future.

Key Findings

Virtualisation and open architectures are table stakes for operators that want to keep pace with both the opportunities and challenges of 5G and beyond. Our survey results indicate MNOs understand this imperative, with a massive **95 per cent of those surveyed saying they understand the importance of virtualisation and have it on their roadmaps.** Virtualisation enables automation, which in turn helps operators use 5G to deliver bespoke services for enterprise customers.

Three quarters of operator executives surveyed classified open architecture adoption as an essential process or a critical step. Managers who were previously unsure about Open RAN are deepening their understanding and gaining confidence, as evidenced by responses regarding security: more than half the executives surveyed ranked **increased security** through visibility into network functions as **one of the top three reasons** to adopt Open RAN (with a total of seven reasons from which to choose).

Survey respondents said their companies are moving network functions to the cloud, and for some that means public cloud. The majority are looking at a hybrid public/private approach to cloud.

Another key finding was the need for multi-generation network support. Although most operators want to open their networks, they need to do so with vendors who can support previous standards, particularly 2G, which many of those surveyed continue to use today and plan to keep.

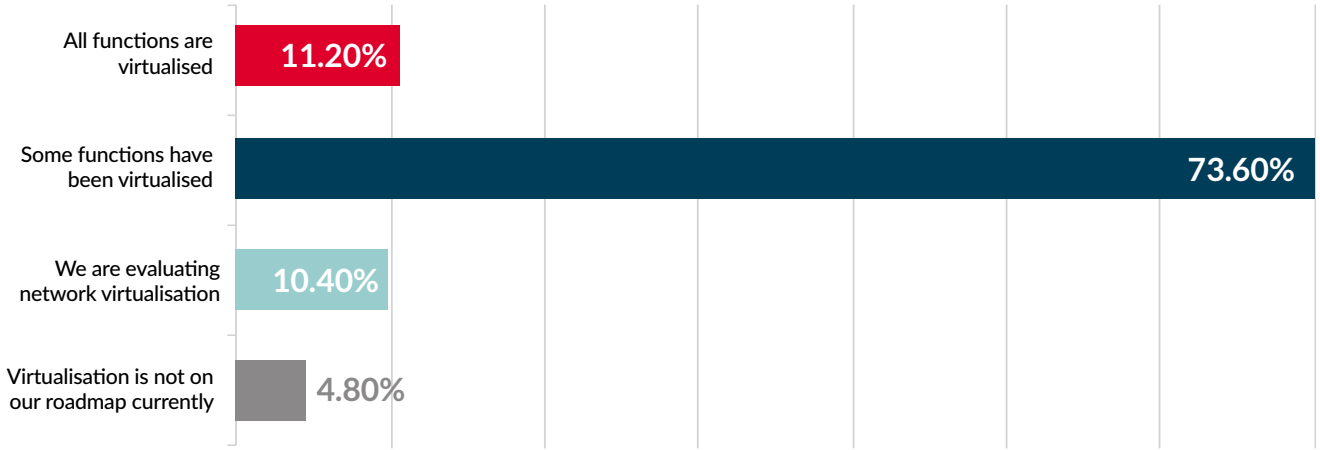
Methodology

Among the 156 respondents to the survey there was a fairly even split between operators with more than $10 billion in annual revenue and those with less than $10 billion. Geographic representation was also even, with 29 per cent of respondents representing European operators, 29 per cent Asian operators, 24 per cent North American, and the rest scattered throughout South America, Africa and the Middle East.

Virtual gets real for network operators

Just under three quarters of survey respondents said some network functions have been virtualised, and already 11 per cent said all functions have been.

In your mobile network, how prevalent is virtualisation?



Bejoy Pankajakshan, chief technology and strategy officer at Mavenir, sees operators moving to software in order to automate more network functions. With 5G, networks are evolving from scheduled releases to continuous integration/continuous delivery, or CI/CD. In a virtualised, automated network, new functions can be added through software updates rather than by installing new hardware or manual operations, and testing and integration can typically be accomplished more quickly. CI/CD requires orchestration of multiple elements, and a fully virtualised network, including an Open RAN solution for the access networks, enables operators to use a common toolset to automatically coordinate and monitor various functions across the end-to-end network, instead of being restricted by one set of automation tools for access versus a different set of CI/CD tools for core.

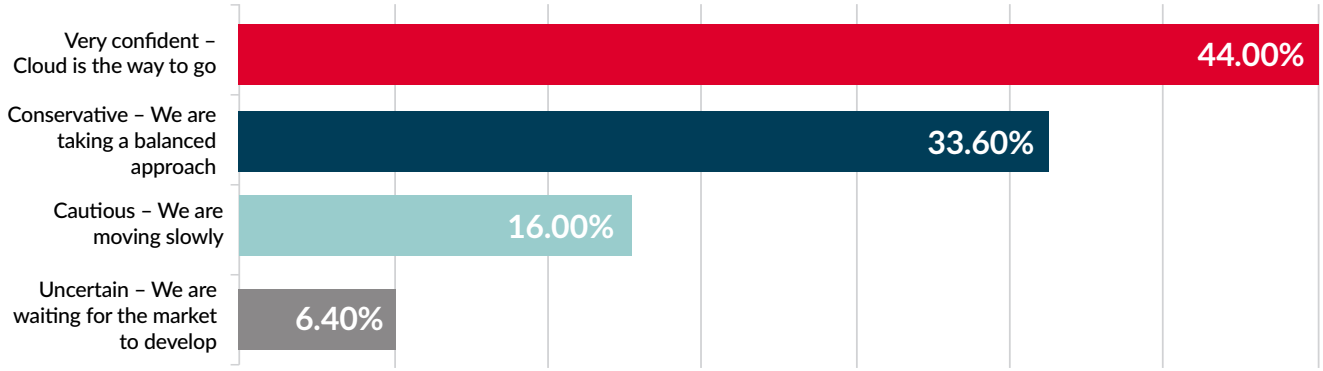
In the US, for example, Dish is building its 5G network in software, virtualising not just the core but also the RAN which will be hosted by AWS. The network is set to go live in 2022, and as buildouts are completed, the operator will activate cell sites quickly, by pushing instructions to software. In the future, Dish wants to be a "network of networks", offering slices to enterprise customers, also through software.

Virtualisation is also helping operators control costs, even as they add complexity to their networks. The automation enabled by virtualisation reduces the number of people needed to manage the day-to-day operation, freeing engineers for development and innovation. This is the advantage of software defined networks.

Clarity on the cloud

The operators surveyed have multiple reasons for moving operations to the cloud, but it is clear to them that cloud is the future.

How would you classify your company's approach to private or public cloud?



The vast majority of respondents (78 per cent) are moving towards the cloud, and only 22 per cent expressed caution or uncertainty with respect to cloud migration.

Less than 3 per cent of respondents said their organisations are relying solely on public cloud partners, but that doesn't mean operators aren't leveraging the likes of AWS Microsoft Azure and Google Cloud. 78 per cent said they are adopting a hybrid cloud or other cloud model.

Operators may choose to move select functions to public cloud, as in the case of Telefónica, which partnered with AWS and Mavenir to offer managed IoT services. By running Mavenir's cloud native functions on AWS, Telefónica gains agility to rapidly introduce new features and provide its customers with a consistent experience anywhere in the world, reducing time to market compared to traditional manual deployments. Enterprise customers can leverage the AWS cloud to process and store data and connect to other cloud-based services.

In the survey, capacity expansion and redundancy were chosen by operators as the number one reason to leverage public cloud. Other reasons include upfront capital expenditures (CAPEX) savings, the ability to adopt cloud native technology in telco workloads, and the future promise of subscription, as-a-service models.

Private networks deployed by operators may also leverage the public cloud. After AWS announced plans to use CBRS spectrum to offer private 5G directly to US enterprise customers, Verizon CEO Hans Vestberg told investors his company now has the option to participate if and when it chooses.

Verizon also has edge compute partnerships with the top three US hyperscale cloud providers: AWS, Microsoft Azure and Google Cloud. While these do not involve migrating the operator's network functions to a public cloud, they marry 5G with cloud-based services, and from the enterprise point of view, these joint offerings will begin to blur the line between telco networks and public clouds.

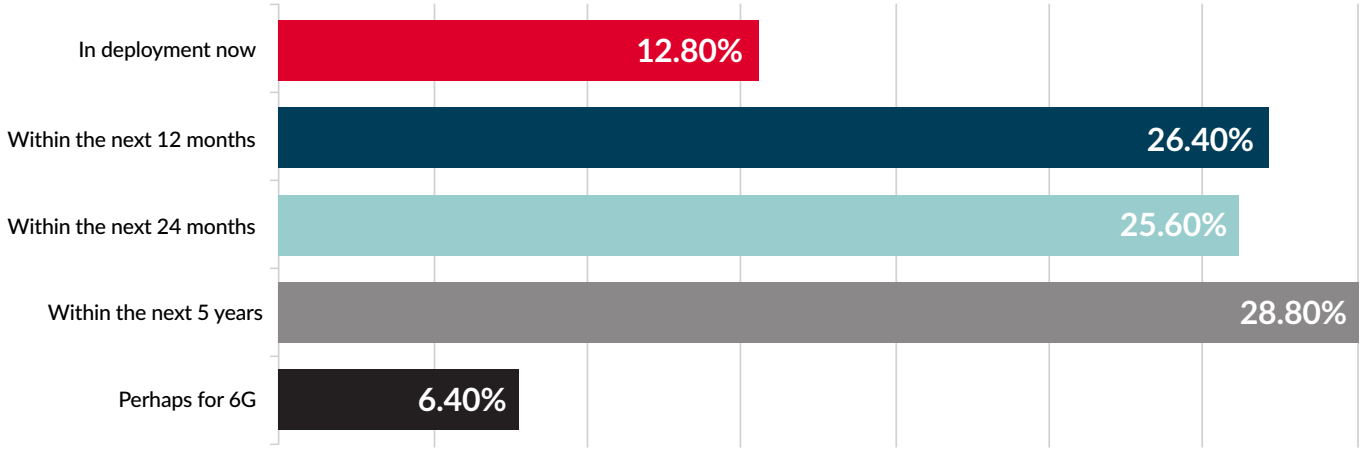
Meanwhile Dish is building its network in AWS from the start and will partner with AWS in the lucrative market for private 5G networks. And, Microsoft has taken over AT&T's virtualised core and is now running it in Azure, with plans to market the technology to other operators.

For MNOs, the advantages of public cloud partnerships are not just technical, according to Mavenir's Pankajakshan. He said cloud service providers have large enterprise customers and those relationships can provide another go-to-market path for operators.

Open RAN is coming

Among the operator executives surveyed by *Mobile World Live*, 54 per cent consider opening network architectures an essential process and 75 per cent characterised opening network architectures as an essential process or a critical step. All told, 98 per cent of operator executives said they are considering open architectures, and 94 per cent have plans to deploy within the next five years.

In what timeframe do you expect to deploy Open RAN?



Operators surveyed by *Mobile World Live* named the ability to mix and match vendor solutions, and agility for network upgrades, as the two top benefits of Open RAN.

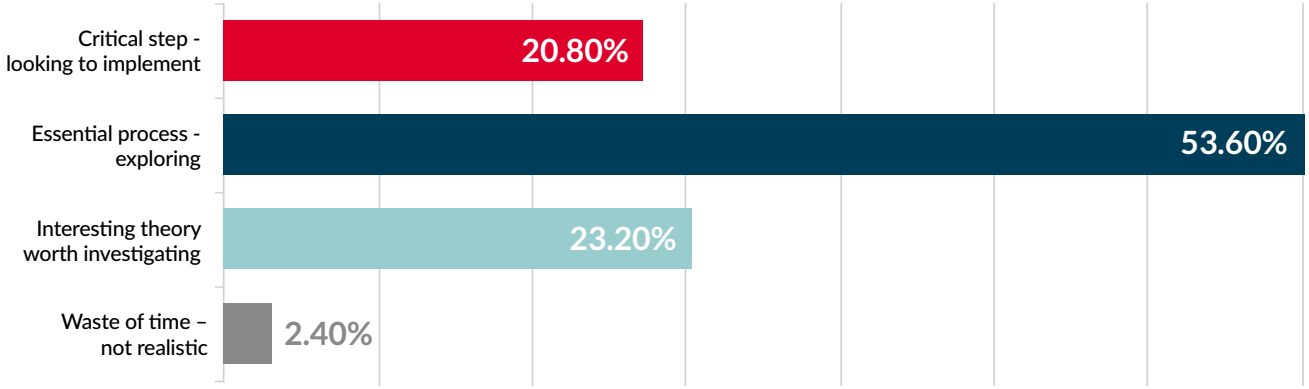
Mavenir's Pankajakshan said open architectures are enabling operators to combine Open RAN Remote Radiohead Units (RRUs) from one vendor with base stations from another. Open RAN splits the base station into Centralised Units (CUs) and Distributed Units (DUs), and Pankajakshan said these typically are supplied by a single vendor.

Pankajakshan added the traditional network equipment providers (NEPs) are holding back the Open RAN market acceleration as their RRUs are not open, adding operators can do more to force this interface to be opened.

Agility for network upgrades is the number two reason operators are adopting Open RAN solutions, according to the survey. Open architectures afford the ability to leverage innovation across an ecosystem of contributors rather than just a handful. But operators will not be able to take advantage of Open RAN for faster upgrades unless they have virtualised and automated their networks. Implementing Open RAN with traditional network management processes could lead to significant integration and maintenance expenses.

CAPEX and operating expenses (OPEX) savings are often touted as the primary benefit of Open RAN, but the operators surveyed by *Mobile World Live* ranked other benefits higher. As stated, the freedom to mix and match vendor solutions ranked highest, and agility for network upgrades was second. Procurement cost savings was third, followed by security.

Do you consider open architectures or the opening up of network architectures (often referred to as network re-architecture) as a:



Although security was initially seen, by several industry participants as a vulnerability of Open RAN, as the technology has made its way into the market operators are learning that it's actually the opposite. When networks are open, and include equipment and software from multiple vendors, a breach in one element can be less likely to spread. In addition, Open RAN gives operators more visibility into network interfaces, making it possible to detect security threats before they impact operations. This is especially true when operators are running automated network analysis software to help detect threats.

According to the Open RAN Policy Coalition (ORPC), Open RAN distributes security analytics throughout the network, creating opportunities for edge-focused analytics that can stop malicious traffic from reaching the core. The coalition also argues Open RAN will enhance the ability of operators to integrate new security platforms without implementing custom adaptors for vendor-proprietary protocols and interfaces.

Open architectures are expected to create new opportunities for enterprises to deploy and leverage 5G, vastly expanding the addressable market for radio access solutions. Chip giants including Intel, Qualcomm, Marvell, Nvidia and Xilinx are all investing in Open RAN. Leading software and radio vendors are partnering with these semiconductor companies to validate their solutions. Mavenir, for example, has implemented all elements of the radio access network in software that can run on commodity hardware, and has validated the solution with leading silicon vendors. The result is an end-to-end Open virtualized RAN (Open vRAN) stack that can run on any cloud.

"The investment in this ecosystem far outweighs that of any one company investing in proprietary solutions", said Pankajakshan. "That's what Open RAN enables".

Europe already has four Open RAN innovation centres, led by Vodafone, Deutsche Telekom, Orange and Telefónica. In Asia, Rakuten is leading the charge with its greenfield Open RAN LTE network, and in the US, Dish is rolling out an Open RAN 5G network early in 2022.

Greenfield operators like Rakuten and Dish are building their networks completely in software since they are unencumbered by legacy infrastructure, and they are starting with open interfaces.

Established MNOs have a different set of challenges because they need to continue to support existing subscribers. As they open their networks, they need to choose vendor partners who have a future vision and can accommodate these customers along with new use cases.

An agile, multi-generation network is defined as "critical to progress" by 74 per cent of the operators surveyed by *Mobile World Live*. A significant number have no plans to sunset 2G, and will continue to use it for voice fallback, emergency services and/or IoT. In addition, 2G is foundational to global roaming, meaning operators will need to choose Open RAN vendors who can support it.

A network that can support multiple standards and leverage open architectures requires automation. In addition, automation enables new revenue opportunities. MNOs are well aware of this; those surveyed named network slicing as their leading driver for 5G network automation.

Conclusion: open, automated, networks are the future

The *Mobile World Live* survey results clearly show that operators are moving to virtualised, open, cloud-native systems. They want to have freedom to select vendors, choose best of breed software, run it in their chosen cloud environment, and use it to monetise network slices.

This will require end-to-end automation tools that MNOs can use to manage and upgrade their networks through CI/CD, customising service-level agreements through slicing and maintaining security through threat detection.

The opportunities ahead of mobile network operators are too expansive to be addressed by networks managed and monitored in a traditional hardware-based fashion. Operators that choose holistic automation tools that run across multiple cloud environments will be able to meet the future head-on and create value for customers and shareholders.

The value of agile, autonomous networks is clear, but this transformation will require commitment and discipline from operators. Some may pay lip service to cloud-native architectures and autonomy, but fail to fully execute, because people and processes are inherently resistant to change. Other operators may eschew these principles altogether, considering them too risky. But the real risk is in postponing network transformation, because tomorrow's mobile networks will need to support much more than voice and mobile broadband. Operators that fail to adapt may be marginalised by competitors that embrace open, cloud-ready networks and invest in orchestration solutions to enable end-to-end automation.

Mavenir is building the future of networks and pioneering advanced technology, focusing on the vision of a single, software-based automated network that runs on any cloud. As the industry's only end-to-end, cloud-native network software provider, Mavenir is focused on transforming the way the world connects, accelerating software network transformation for 250+ Communications Service Providers in over 120 countries, which serve more than 50% of the world's subscribers.

Learn more at www.mavenir.com

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