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# Benchmarking edge-native cloud stacks for vRAN and MEC



Caroline Chappell and Gorkem Yigit

# Executive summary

The development of cloud stack capabilities that are needed to support virtualised radio access networks (vRANs) and ‘far’ edge locations is a work in progress. Operators should evaluate the possible vendors for this new cloud environment against a set of requirements that do not exist in the central cloud.

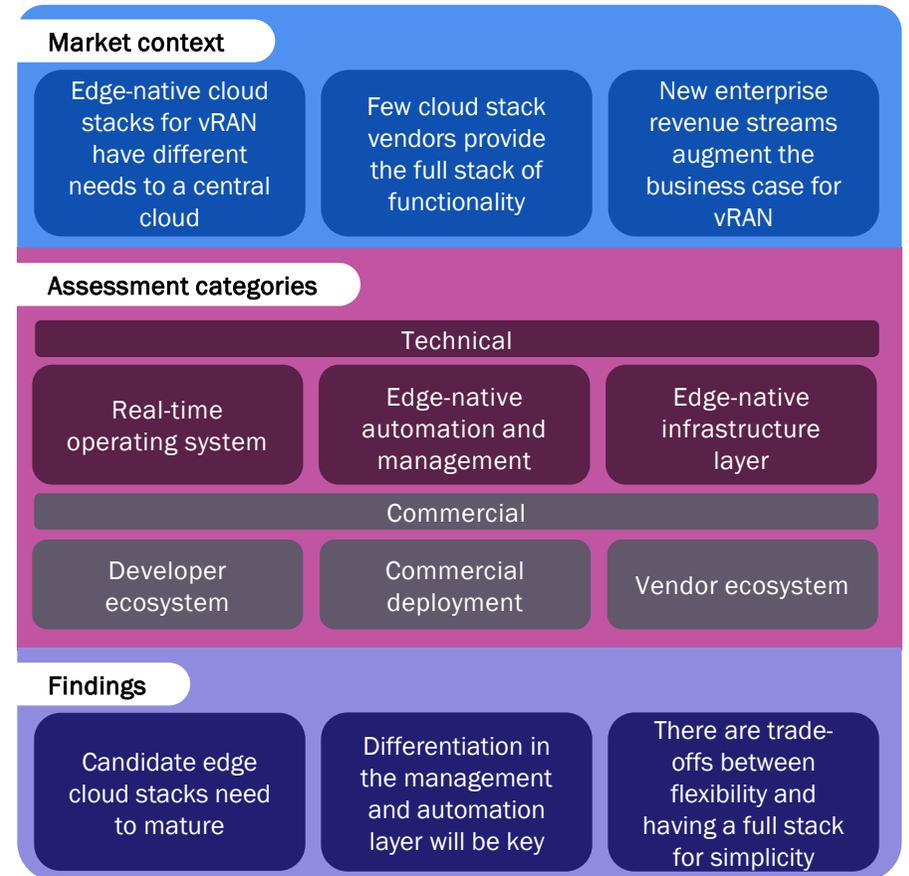
This abbreviated version of the full report provides a framework for such an evaluation, as well as an early mapping of the vendors that have products for one or more layers of the edge cloud stack to key technical capabilities. It also assesses the commercial properties that such vendors bring to vRAN and enterprise edge deployments. No vendor dominates this emerging market yet, and each has both strengths and weaknesses. This abbreviated version contains a profile of VMware’s cloud stack.



## KEY RECOMMENDATIONS

- Operators should decide whether to remain with an existing cloud stack provider that is making the transition to edge-native for continuity or to adopt a new edge-native cloud stack from a greenfield vendor.
- Vendors should strengthen their developer and vendor ecosystems, for example by using an enterprise ecosystem as network and IT edge use cases converge.
- Operators and vendors should focus on the capabilities of an edge cloud stack’s automation and management layers as a key area of differentiation for edge-native operations.

Figure 1: Overview of the analysis carried out in this report



Source: Analysys Mason

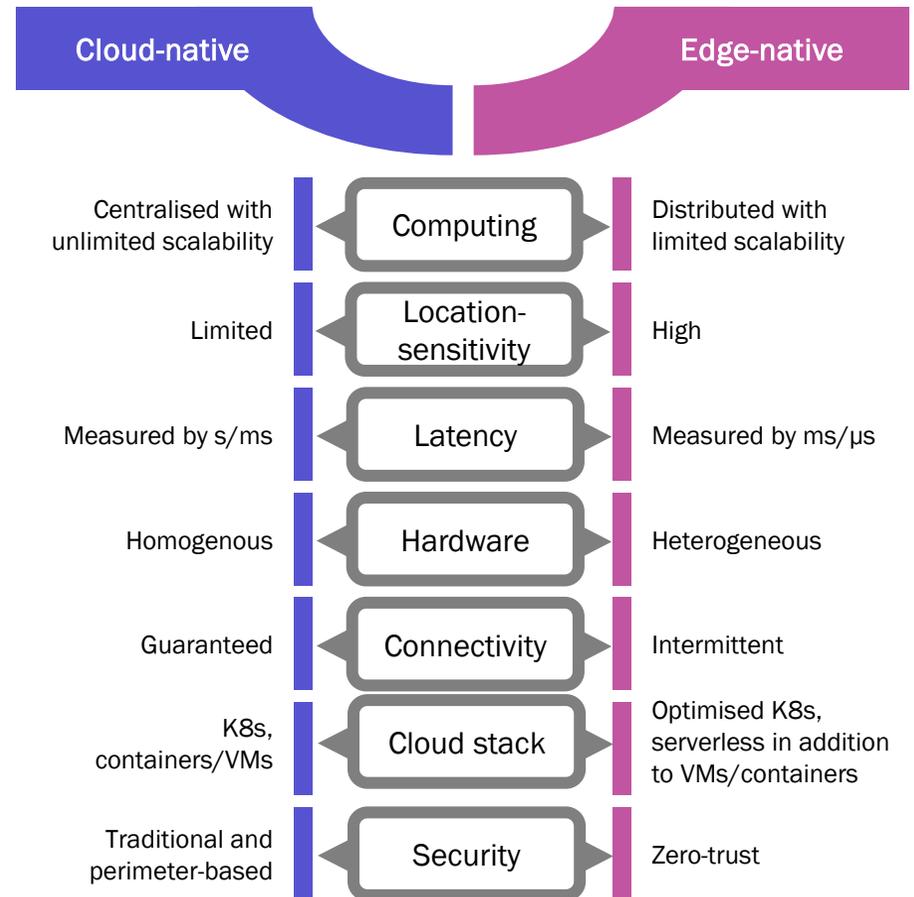
# Introduction: Operators will find that the properties needed for a vRAN cloud stack will be very different from those in a centralised NFV cloud

The cloud stacks that operators have used for network function virtualisation (NFV) will not necessarily provide the required capabilities for deploying cloud-native 5G network functions across a highly distributed fabric of edge computing nodes, as required for the virtualised/open RAN, for example.

Operators will increasingly need many more cloud computing locations to support virtualised, distributed network functions such as the vRAN and 5G standalone (SA) core. Cloud stacks that were developed to support centralised private and public cloud computing do not have the right properties to support computing across tens of thousands of footprint-constrained nodes at the network edge. Managing virtual-machine-based applications in a central cloud data centre is very different from managing thousands of microservices-based application instances across thousands of edge compute nodes, especially if the location of a specific application instance is important and cannot be moved to another location for resilience reasons. Cluster management, location awareness, autonomous management and support for a heterogeneous hardware environment are more important than elasticity in an edge cloud stack, while elasticity is the key feature of a central, cloud-native cloud.

Operators that solve the cloud stack challenges for their own network functions will be well-placed to serve enterprises that are seeking new cloud locations that are close to end devices for latency, sovereignty and cost reasons. It is therefore doubly important that operators choose the right cloud stack to support future edge-native applications.

Figure 2: Comparison of cloud-native and edge-native infrastructure



Source: Analysys Mason

# vRAN cloud stack framework assessment categories and definitions

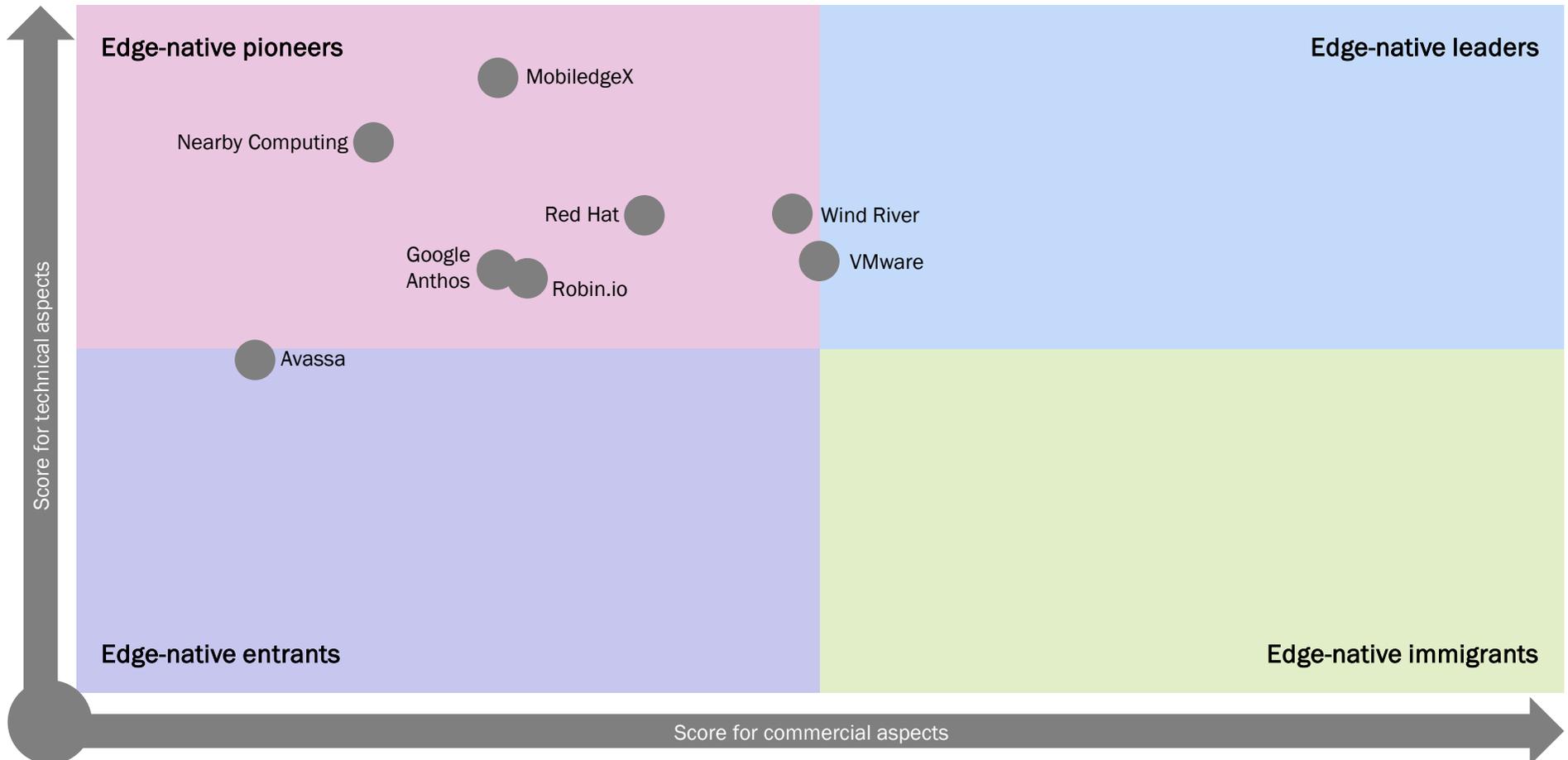
Figure 5: Overview of the assessment categories used in this abbreviated report

Category	Definition
Edge-native automation and management layer	<p><b>Edge cloud stack lifecycle management at scale (millions of managed endpoints)</b></p> <ul style="list-style-type: none"> <li>• Single pane of glass management of edge applications and infrastructure (including deployment, healing, monitoring, back ups and replication) across distributed clusters/edge nodes at scale.</li> <li>• Advanced implementations support the lifecycle management (day 0, 1 and 2) of applications, digital infrastructure and bare metal in a single automation pipeline, thereby reducing the number of truck rolls.</li> </ul> <p><b>Cluster management at scale (tens of thousands of clusters) and edge-native infrastructure agnosticism</b></p> <ul style="list-style-type: none"> <li>• The ability to carry out policy-based scheduling of container-based workloads in a location-sensitive manner across a highly distributed network of clusters.</li> <li>• The most advanced implementations support diverse edge-native infrastructure layers (that is, multi-cloud) and autonomous edge control planes that can cope with intermittent and remote connectivity.</li> </ul> <p><b>Bare metal abstraction and orchestration</b></p> <ul style="list-style-type: none"> <li>• The ability to ‘light up’, install software on and configure remote hardware in a zero-touch manner and to provide an abstraction layer across different types of hardware, including different types of processor, compute capabilities (such as NUMA and huge pages support) and acceleration technologies, to support the appropriate placement of workloads on the right hardware environment.</li> </ul>
Edge-native infrastructure layer	<ul style="list-style-type: none"> <li>• Digital infrastructure optimised for edge-native resource constraints (small footprint), carrier-grade, cloud-native networking (such as Multus support) and hardware heterogeneity (for example, support for multiple hardware acceleration technologies and third-party bare metal/cloud infrastructure).</li> <li>• Most advanced implementations orchestrate virtual machines, containers and serverless functions, without the overheads of a hypervisor and/or OpenStack controller.</li> </ul>
Operating system	Ownership of or partnership for a Linux distro streamlined and optimised for real-time applications in an edge context (that is, a small footprint), with deterministic performance, priority scheduling and mission-critical features.
Developer ecosystem	Base of developers that are familiar with the brand and cloud stack components.
Commercial deployment	Evidence of use in production deployments at scale, not just in trials.
Vendor ecosystem	Evidence of a multi-vendor ecosystem. The cloud stack should support multiple CNF/hardware vendors and cloud infrastructure partners.

Source: Analysys Mason

# Positions of cloud stack vendors assessed against the framework criteria

Figure 7: Overview of the scores of vendors in this report according to our framework



Source: Analysys Mason

# VMware's Telco Cloud Platform RAN has an optimised version of its ESXi hypervisor, can co-locate and manage B2B edge apps and has a leading vendor ecosystem

## Background

VMware's renamed Service Provider and Edge business unit is positioning a version of the company's Telco Cloud Platform (TCP) that has been optimised for the vRAN as a high-performance cloud stack for operators' 5G network function and enterprise edge (MEC) deployments.

## Products and solutions

**Telco Cloud Platform RAN** consists of **Telco Cloud Infrastructure** (vSphere with ESXi-RT optimised for RAN and Edge functions), **Tanzu for Telco**, an optimised CaaS platform running on VMware's real-time Photon OS, and **Telco Cloud Automation** (TCA) for automated infrastructure provisioning and RAN function lifecycle management.

## Analysis

### Strengths:

- Most extensive vendor ecosystem and certification programme on the market
- Consistent across multiple third-party cloud infrastructure options
- Strong customer references for NFV telco cloud and notable 5G vRAN/edge cloud wins

### Weaknesses:

- Lack of support for containers on bare metal
- No purely cloud-native approach to management and automation

## Key features for vRAN edge cloud

- Dish's decision to base its open RAN cloud on VMware's stack is a powerful endorsement, though Dish may demand modifications.
- VMware is betting on operators wanting a hypervisor-based edge cloud stack to support co-located vRAN and enterprise workloads using VM-based isolation and its own cloud infrastructure performance optimisation. It says that running vDUs on x86 infrastructure with real-time vSphere delivers comparable performance to bare metal, as tested in Intel labs.
- VMware is positioning itself to enable operators to monetise vRAN edge cloud locations. It cites its credentials in multiple enterprise vertical markets and the extensive developer ecosystem that is familiar with its tools and capabilities.
- Its edge automation and management layer is well-suited to the telecoms sector, which may appeal to operators that already have NFV MANO-based orchestration and are not ready to adopt a pure cloud-native, K8s-based approach.
- VMware has an extensive ecosystem and is integrated with major vRAN players.

## Target market

VMware's target customers are operators that are seeking to deploy a common cloud stack for 5G network functions, specifically the disaggregated, virtualised 5G RAN, with or without support for open interfaces.

## CSP customers (edge and RAN)

- Dish
- NTT
- SKT

## Key partnerships

- Dell/Intel/Nvidia
- WWT
- Over 40 VNF and CNF vendors run on the Telco Cloud Platform, including Affirmed, Altiostar, Athonet, ASOCS Fujitsu, Mavenir and Nokia.
- Over 200 certified Telco Cloud Platform partners overall.

## 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.



**Gorkem Yigit** (Principal Analyst) is the lead analyst for the *Cloud Infrastructure Strategies* and the *Edge and Media Platforms* research programmes. His research focuses on the building blocks, architecture and adoption of the cloud-native, disaggregated and programmable digital infrastructure and networks that underpin the delivery of 5G, media and edge computing services. He also works with clients on a range of consulting projects such as market and competitive analysis, business case development and marketing support through thought leadership collateral. He holds a cum laude MSc degree in economics and management of innovation and technology from Bocconi University (Milan, Italy).

# We are experts in the telecoms, media and technology sector



## Strategy

- Corporate growth strategy
- Business unit strategy
- Infrastructure strategy



## Transformation

- Business transformation
- Digitalisation
- Operational excellence
- Data, BI, steering and insights
- Change and programme management
- Sustainability



## Transaction support

- Commercial due diligence and market review
- Technical due diligence
- Post-merger integration
- Periodical business monitoring and loan technical advisory
- Opportunity scouting and pre-deal support



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## Regulation and policy



- Network and platform
- Public sector broadband intervention
- Accelerating digital transformation of society
- Price controls and cost modelling
- Regulatory accounting
- Regulatory benchmarking and analysis
- Spectrum management and policy
- Expert witness and litigation support
- Postal regulation and policy

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- Cloud Networks

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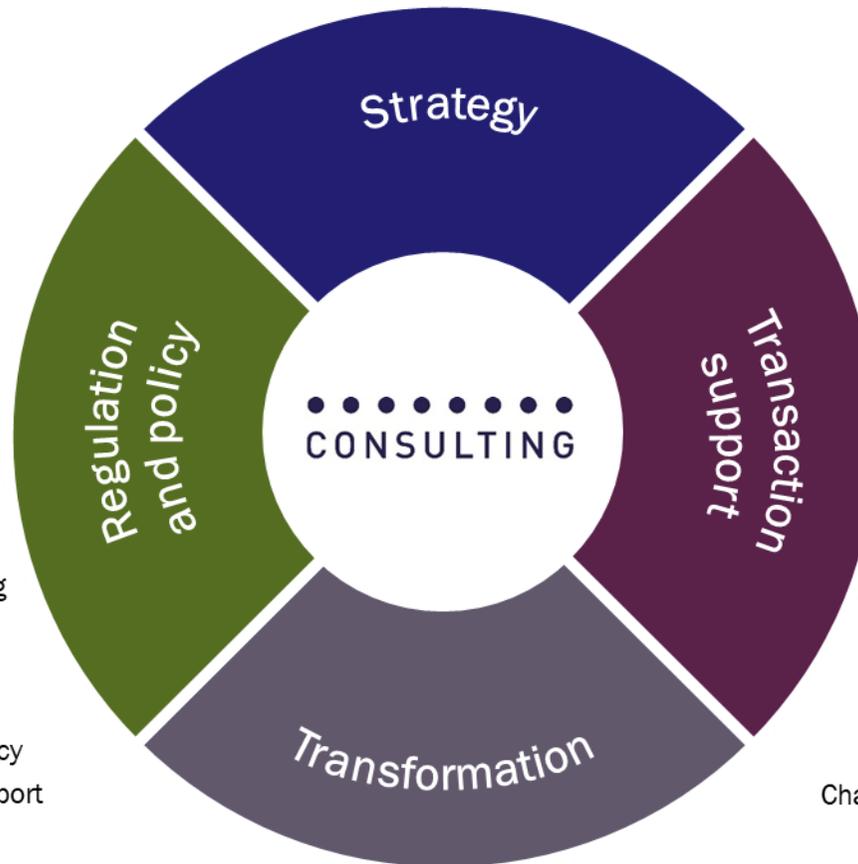
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