Independent market research and competitive analysis of next-generation business and technology solutions for service providers and vendors

HEAVY READING
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Virtualized RAN: 4G/5G Strategies, Opportunities, and Pitfalls

A Heavy Reading white paper produced for Red Hat

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INTRODUCTION

Network functions virtualization (NFV) was first conceived only 7 years ago. Since then, carriers have lowered their costs and created a more agile infrastructure by deploying a variety of virtual network functions (VNFs), including virtual firewalls, DNS, SBC/IMS, virtualized 4G network cores (or virtual evolved packet cores [vEPCs]), and virtualized radio access networks (vRANs).

Today, at the start of 2020, industry focus is on the transition to 5G – specifically the 5G RAN. This transition brings with it several enabling technologies, such as network slicing and edge computing, that in turn set the stage for the dominant 5G use cases: Enhanced Mobile Broadband (eMBB), Ultra-Reliable Low Latency Communications (URLLC), and Massive Machine-Type Communications (mMTC). To support these technologies and use cases, the 5G network transformation increasingly assumes a virtualized RAN – one that is container-based and cloud-native.

How far down the path toward vRAN are the carriers, what are the drivers and inhibitors, and what vRAN architectural choices are they making? To answer these questions, Heavy Reading conducted a survey in November 2019 of 81 service providers:

- 50 converged fixed/mobile operators
- 28 mobile operators
- 3 mobile virtual network operators and enablers (MVNOs/MVNEs) with infrastructure

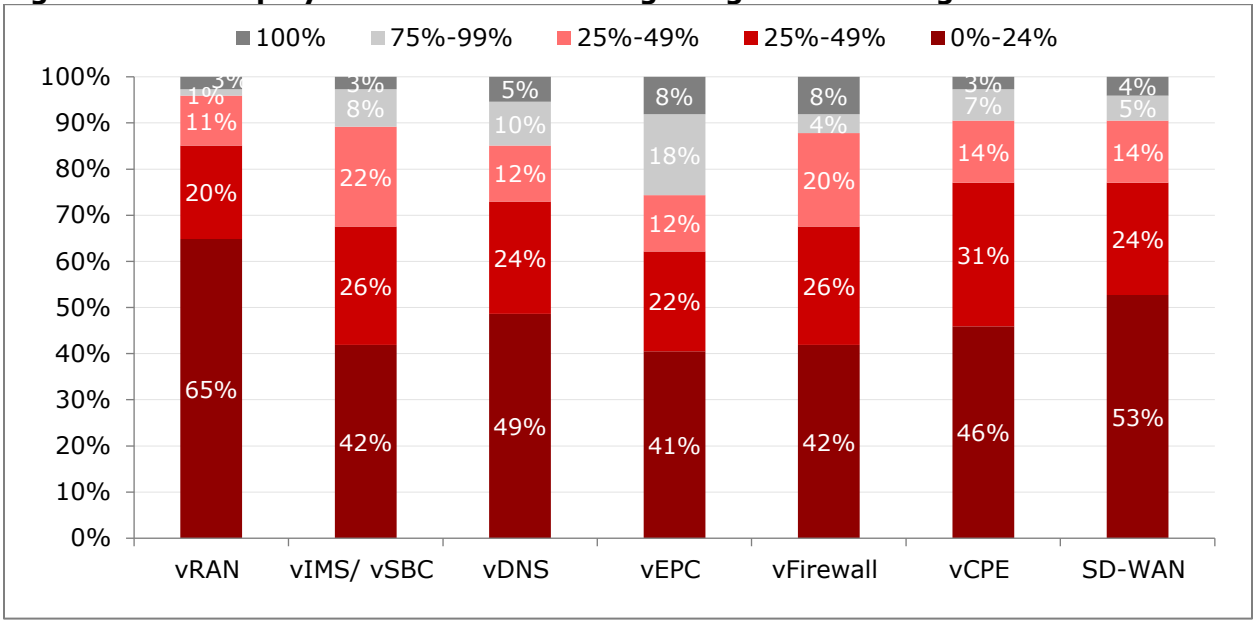
This survey was global: half of the respondents were from North America and about 20% were from Asia Pacific. The remaining respondents were from Central and South America (13%), Eastern and Western Europe (10%), and the Middle East & Africa (6%).

Most respondents, 73%, were in technical and networking roles such as network operations, network planning and engineering, R&D, and technical strategy. Of the remaining respondents, 10% were in corporate management and 17% were on the data center side in IT and cloud domain roles.

THE BASELINE: NFV IN CARRIER NETWORKS TODAY

Heavy Reading wanted to understand not only the penetration of vRAN solutions, but also how these compared to the deployment of other popular VNFs. With this in mind, we asked respondents what VNFs they had deployed and to what percentage of their network (see **Figure 1** below).

Figure 1: NFV Deployments Are Penetrating a Higher Percentage of the Network



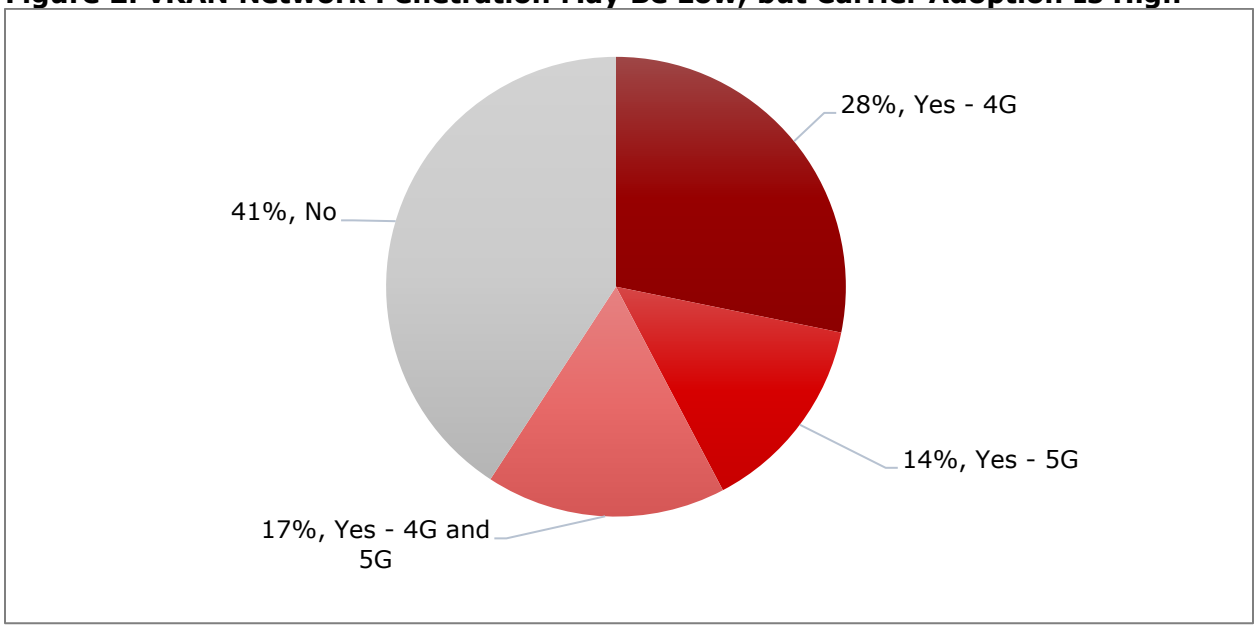
Question: Which of the following virtual network functions (VNFs) have you deployed? To what percentage of your network? (N=74)
Source: Heavy Reading

vEPC was by far the most popular response – with more than a quarter of the survey base claiming that 75% or more of their network was running on a vEPC. This was followed by vDNS and then the other VNFs. Interestingly enough, vRAN showed the least amount of penetration into the network. Why is this?

Many of the VNFs, including EPC, IMS/SBC, and (authoritative) DNS are centralized functions – located in service provider central offices where they can be trialed and managed by onsite network operations. In the case of the EPC, it is already a collection of discrete functions, lending itself to a virtualized solution. The RAN, on the other hand, is highly distributed. Today, there are over 6.5 million physical cellular base stations worldwide, according to Omdia. Multisector antennas account for many more logical base stations. Heavy Reading estimates that the implementation of 5G will increase this number by an order of magnitude over the next 10 years. In addition, most RAN installations are on real estate and towers that are not owned by the carrier. Just getting into the RAN enclosure costs the operator $500 or more. As carriers move to distributed and cloud RAN for either 4G or 5G, the pooling of baseband units (BBUs) into a carrier-controlled data center has a double advantage. This pooling simplifies RAN management logistics/costs and creates an environment that can easily benefit from virtualized, shared resources.

The responses to Heavy Reading's survey reflect these considerations (see **Figure 2**). While vRAN may not have penetrated a high percentage of their network, 59% of respondents have deployed vRANs and 31% have done so in 5G or both 4G and 5G networks.

Figure 2: vRAN Network Penetration May Be Low, but Carrier Adoption Is High



Question: Do you have a vRAN today? (N=71)
Source: Heavy Reading

Our survey results also indicate that the next 2 years will see a sharp uptick in vRAN deployments. Some of these will be into LTE and LTE Advanced networks. Respondents are not waiting for the technology transition to 5G to justify the opex/capex involved in moving to vRAN. Less than 10% of respondents are implementing vRAN solutions in exclusively new RAN deployments.

WHAT ARE CARRIERS EXPECTING FROM VRAN SOLUTIONS?

Heavy Reading queried the service providers regarding what benefits vRAN would bring to the network. Over 40% of the respondents saw benefits across the board in terms of the following:

- Faster time-to-market
- Improved performance
- Lower total cost of ownership (TCO)
- Increased revenue
- Better customer retention/satisfaction

Time-to-market and performance are seen as the most tangible benefits. While customer satisfaction ranked the lowest, it is the direct beneficiary of faster time-to-market. TCO and revenue were each seen as benefits by 51% of the respondents, indicating that the service providers, at least in these early years of virtualization, are pragmatic about the impact of virtualization on cost and revenue.

A drill-down into the TCO issue shows that carriers expect, on average, a cost savings of between 10% and 25% for a vRAN in comparison to an appliance-based solution. These cost savings are achievable, even in the near term, but will be offset by the growth in network load (with traffic still doubling every 3 years) and the number of base stations.

These perceived benefits translate almost one-to-one to the attributes that carriers expect from a vRAN platform. In choosing vRAN solutions, carriers have indicated they care about the following (in order of importance – most to least important):

- Security
- Performance
- Cost efficiency
- Reliability
- Energy efficiency
- Management

Security tops the list of concerns in almost every survey we conduct at Heavy Reading, and we do not expect that to change anytime soon.

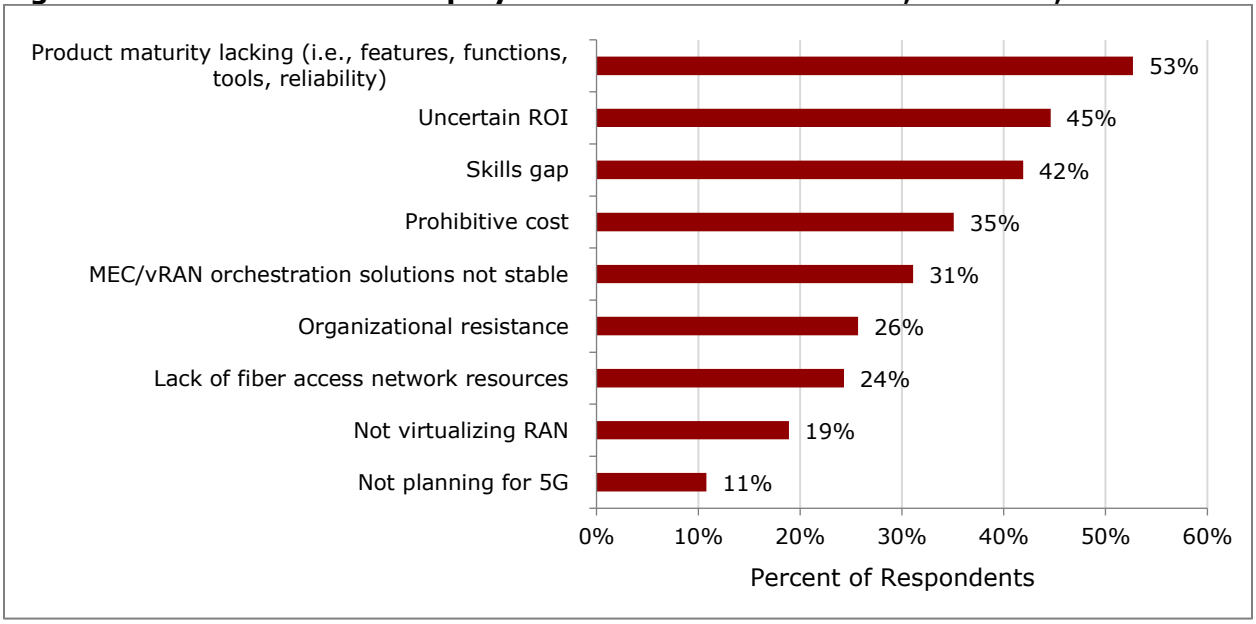
Given the current state of the art in network orchestration and number of participating standards committees and work groups, it is surprising that "management" is of least concern to the respondents. It is an indication, to some extent, of the relative simplicity of NFV implementations in terms of number of VNFs, number of domains, and complexity of service chains. It is also an indicator, however, of the strides that solutions providers have made in management life cycle tools that leverage new artificial intelligence and machine learning capabilities.

WHAT IS STANDING IN THE WAY OF VRAN DEPLOYMENT?

The survey respondents cited several barriers to the deployment of vRAN solutions. None of the barriers are outliers or alarmingly high in percentage of respondents. It is interesting to note that the top reason (product maturity) is under the control of the vendors.

The second reason, uncertain ROI, brings into question the market overall, and responsibility for the third highest response, skills gap, lies with the telco (see **Figure 3**). This is an indication of a market that is still maturing.

Figure 3: Barriers to vRAN Deployment Can Lie in the Telcos, Products, or Market



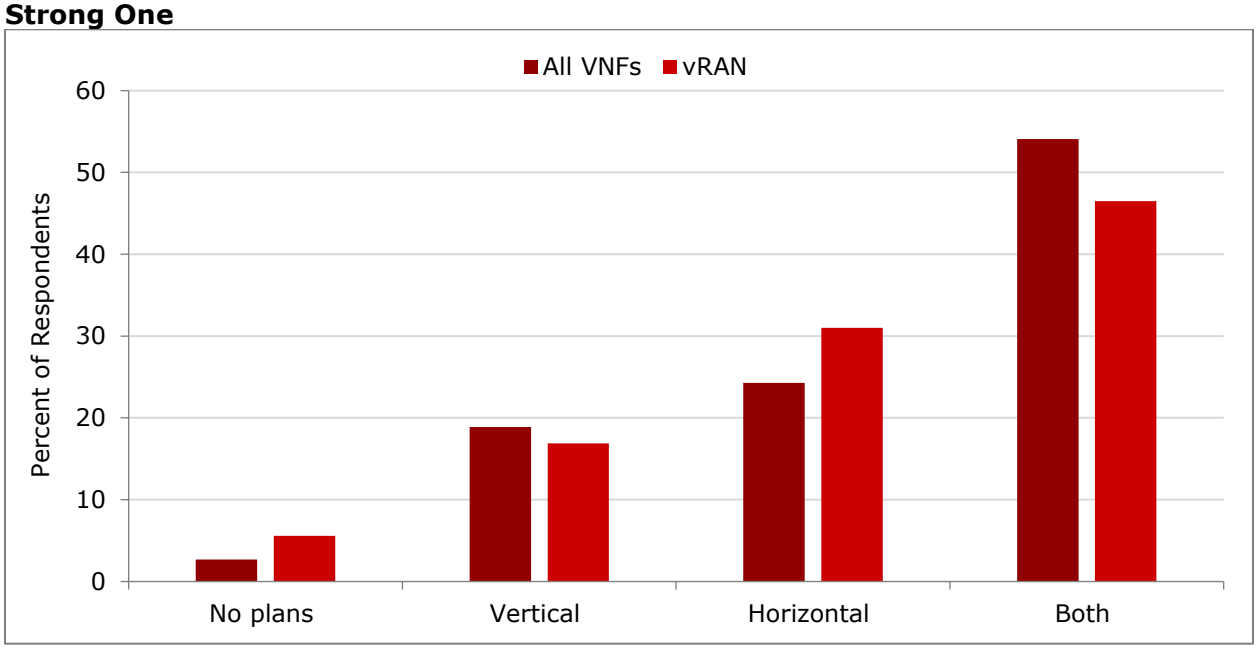
Question: What barriers do you see to vRAN deployment? Check all that apply. (N=79)
Source: Heavy Reading

THE MOVE TO CONTAINERS AND CLOUD-NATIVE

Seven years after the concept of NFV was introduced, carriers are still not satisfied with today's VNFs in terms of functionality, ease of implementation, or management. Equipment providers have translated their physical appliances into virtual appliances, but few have taken the next step to cloud-ready applications and fewer still to cloud-native applications.

Cloud-native applications are packaged as lightweight containers and designed as loosely coupled microservices. From a carrier perspective, some of the most attractive aspects of cloud-native applications are their lower cost to develop, improved ease of upgrade and modification, ability to scale horizontally, and perhaps most importantly, the fact that they avoid vendor lock-in. While avoiding vendor lock-in is a fundamental goal of the communications service providers (CSPs), some choose to go with a single vendor, or vertical, solution for the frictionless implementation it enables in terms of management and interoperability (see **Figure 4**).

Figure 4: Carriers Have a Bias toward Horizontal Deployments – But It's Not a Strong One

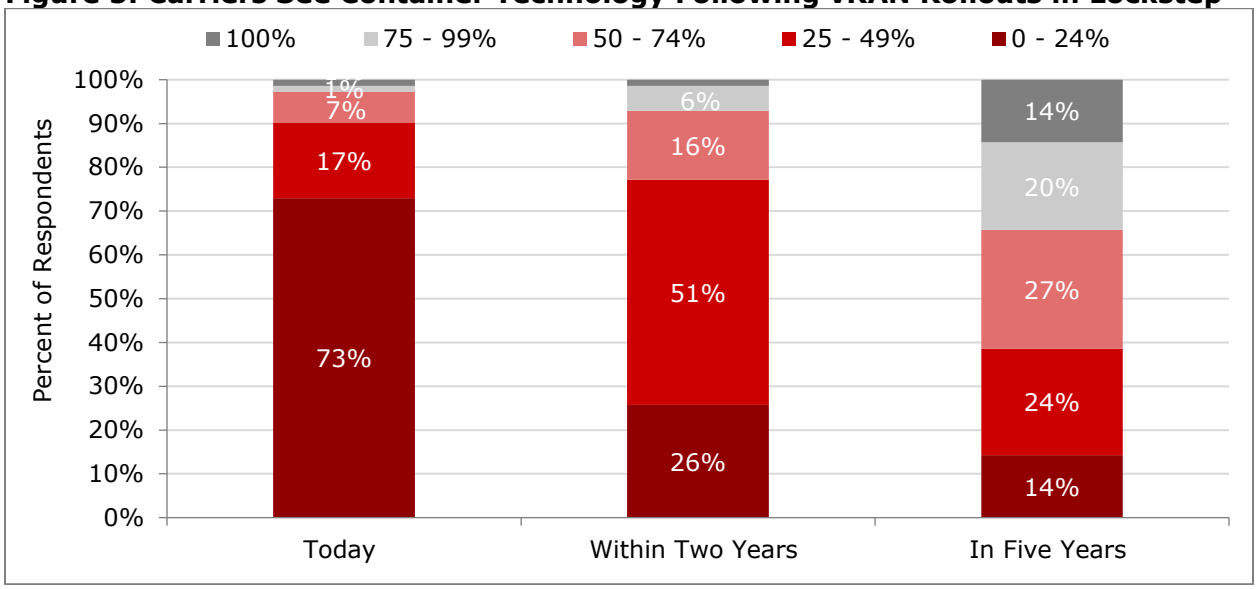


Question: Are you implementing, or do you plan to implement, a horizontal or vertical solution for your VNFs, overall? For vRAN specifically? (N=71)
Source: Heavy Reading

This is one aspect of the market that will change as virtual solutions evolve and carrier implementations mature. With the move to cloud-native and container-based implementations over the next 5 years, carriers will see the need to adopt a horizontal implementation strategy in order to remain competitive.

This is supported by Heavy Reading's survey results. We asked our respondents for details about their rollout of 5G technology overall and, as shown in **Figure 5** below, about what percentage of the 5G infrastructure would use container technology. The responses to the two questions were virtually identical – *the 5G rollout will be container-based*.

Figure 5: Carriers See Container Technology Following vRAN Rollouts in Lockstep



Question: What percentage of your 5G RAN infrastructure will use container technology in the following timeframes? (N=79)
Source: Heavy Reading

According to Omdia's Q4 2019 5G Service Provider Tracker report, 69 5G commercial services have been deployed, globally as of year-end 2019. Many are field trials or limited deployments, with South Korea being the standout. (The country's three mobile carriers claimed over 4 million 5G subscribers at year end 2019.) In addition, there are 12 5G fixed wireless access (FWA) deployments. Omdia forecasts that 1.31 billion people will subscribe to the next-generation 5G network by 2023. With the pace of 5G deployments accelerating, service providers will also be trialing and implementing cloud-native and container-based solutions at an increased rate.

SUMMARY FINDINGS

Each major technology transition starts out in a fog of standards, tangential technologies, and use cases. As the industry progresses toward implementation, the non-essential falls by the wayside and the path forward comes into focus. There are differences in Heavy Reading's survey responses regarding what network functions the carriers are moving to NFV and in what timeframe. However, there is strong commonality of opinion that the transition to 5G is a transition to containers and cloud-native network applications, in particular vRAN. Heavy Reading's vRAN survey has further clarified the following points:

- Cloud-native 5G and vRAN are real and happening now.
- Implementation of vRAN should be seen in context with other technology transitions such as 5G and edge compute.
- Operators are making decisions today on how they are evolving their infrastructure to cloud-native models.
- Service providers/operators must learn from the virtualization mistakes of vertical silos. They must aim to build more horizontal platforms for cloud-native 5G and RAN to build in agility and flexibility and to avoid vendor lock-in.