HEAVY READING
WHITE PAPER

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

Operator Strategies for 5G Transport:
2020 Heavy Reading Survey

A Heavy Reading white paper produced for Anritsu, Ericsson, Fujitsu, and Infinera

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EXECUTIVE SUMMARY

5G commercial progress to date has been impressive. By the end of May 2020, a total of 81 operators in 42 countries had launched one or more 3GPP-compliant services, according to the Global Mobile Suppliers Association (GSA), and 386 operators had announced they are investing in 5G.

It is now well understood that transport networks are crucial to 5G's success. But the early commercial deployments have not yet had a big impact on transport network architectures, aside from driving more fiber rollouts. Many of these early builds are small-scale builds in select markets. Additionally, these non-standalone deployments (supporting Release 15) boost radio capacity, but do not incorporate the massive machine-type communications (mMTC), ultra-low latency, and ultra-high availability functions that truly set 5G apart from previous mobile generations.

The real race begins when 3GPP Release 16 (completed in July 2020) opens up the full functionality of 5G. Heavy Reading operator survey data shows that the majority of operators expect to reach mass-market adoption in the 2021–23 timeframe. Survey data also shows that operators intend to complete their transport networks upgrades in advance of their mass-market rollouts.

There is much work to be done to meet operators' ambitious timelines. Many technology options are available under the banner of xHaul. In fact, as time goes on, the number of technology options has been expanding. Combined with the functional split variations made available to operators in 5G, the transport network situation is complex.

At a crucial time for 5G xHaul decision-making, Heavy Reading launched the 2020 edition of the **Operator Strategies for 5G Transport** survey project. Building on its successful 2019 version, this report focuses on packet innovations, strategies, and architectures.

Conducted in May 2020, this year's survey received 86 qualified network operator responses from around the world, all of which reported involvement in network planning and/or purchasing of network equipment. Geographically, 57% of respondents come from North America. This Heavy Reading white paper is based on the survey results and provides the industry's most in-depth look at the current state and future trajectory of 5G transport (or xHaul) based on operators' views and plans.

Additional details on the demographics of the survey group are included in the ***Appendix*** at the end of this paper. The following sections detail Heavy Reading's key findings from this study.

Key findings

General deployment issues and timelines

5G transport network upgrades have begun. The survey shows that backhaul and fronthaul upgrade plans are the furthest along, with 55% of respondents reporting that backhaul upgrades have either already begun or are expected by end of 2020 and 48% reporting the same deployment status for their fronthaul networks. Midhaul networks lag behind a bit, but midhaul upgrades are expected to accelerate through 2021–23. By the end of 2023, upgrade statuses will be fairly evenly aligned.

In modernizing their transport networks for 5G, operators are motivated by speed, capacity, and reliability. The focus on higher speed interfaces and greater overall capacity is consistent with the trend Heavy Reading has seen in backhaul network upgrades in which operators have been migrating from 1Gbps Ethernet to 10Gbps Ethernet (and boosting overall systems capacities when they do so). The finding is also consistent with requirements for early 5G commercial launches, which focus on enhanced mobile broadband (eMBB) use cases that are characterized by higher data rates compared to 4G. The importance of reliability is tied to advanced 5G use cases, such as ultra-reliable low latency communications (URLLC), which will be enabled by 3GPP Release 16 and beyond.

Centralizing the RAN and fronthaul

Physically centralizing basebands is important for both improved 5G performance and cost savings. Results show that, at 46%, nearly half of respondents view physical centralization of baseband processing as equally important for reducing their network costs and improving radio access network (RAN) performance. For respondents with a single goal of baseband centralization, improving RAN performance (22% of respondents) was widely selected over cost reduction (chosen by just 13%).

While there is no single functional split winner among operators' planned 5G architectures, survey results give a strong endorsement for split architectures generally. Taken as a whole, traditional distributed macro cell site architectures will account for roughly a one-quarter share of emerging 5G networks based on the results, while the remaining three-quarters share will be some form of partial or full centralization.

Fronthaul demands capacity and operators will largely choose direct fibers or wavelength-division multiplexing (WDM) wavelengths to deliver it. On average, the expected fronthaul connectivity mix is relatively balanced, but at 32%, active and passive WDM connectivity is the top 5G fronthaul choice, followed closely by dedicated dark fibers at 27%.

On average, microwave/millimeter wave will account for 18% of global 5G fronthaul connectivity, according to survey respondents. From past surveys, Heavy Reading knows that operators view microwave as an important technology for 5G backhaul, but fronthaul presents additional demands in terms of capacity and performance. The survey reveals that operators increasingly view microwave connectivity as a fiber alternative for both backhaul and fronthaul.

Routing and synchronization

Driven by 5G requirements, the migration to network-based synchronization is a clear global trend. Network-based synchronization, including Precision Time Protocol (PTP) and Synchronous Ethernet (SyncE), ranked first on the list of 5G synchronization preferences and by a wide margin, scoring well ahead of the second choice, global positioning system (GPS)/global navigation satellite system (GNSS) receivers. Significantly, the network-based synchronization trend also holds true for North America, which, historically, has been addressed through satellite. Filtering on North America only, network-based PTP/SyncE ranked first in preference and, again, by a large margin.

Interest in white box switching and routing is high, not just generally, but specifically for 5G transport networks. Two-thirds (66%) of respondents reported that white box switches/routers are at least "very important" for their 5G transport plans, with 14% of the group reporting that 5G transport will not be deployed without a white box.

Interest is highest among North American respondents, 86% of whom said that box switches/routers are at least "very important" for their 5G transport plans, with nearly a quarter (21%) reporting that 5G transport will not be deployed without a white box.

For transport network slicing, operators strongly prefer soft slicing with virtual private networks (VPNs), regardless of the VPN flavor. Ranking at the top of the list was Layer 3 VPNs (selected by 66% of respondents), but Layer 2 VPNs, Ethernet VPNs (EVPNs), and segment routing also ranked highly at 47%, 46%, and 46%, respectively. The point is underscored by the low preferences among all of the hard slicing technologies—those that physically partition resources among slices. Hard slicing options formed the bottom tier among preferences.

Testing 5G networks

Packet-based latency measurement verification for URLLC applications and packet-based bandwidth throughput verification for eMBB applications topped the list of most challenging next-generation fronthaul performance requirements, according to the survey. The two challenges essentially tied for first among a list of five challenges presented.

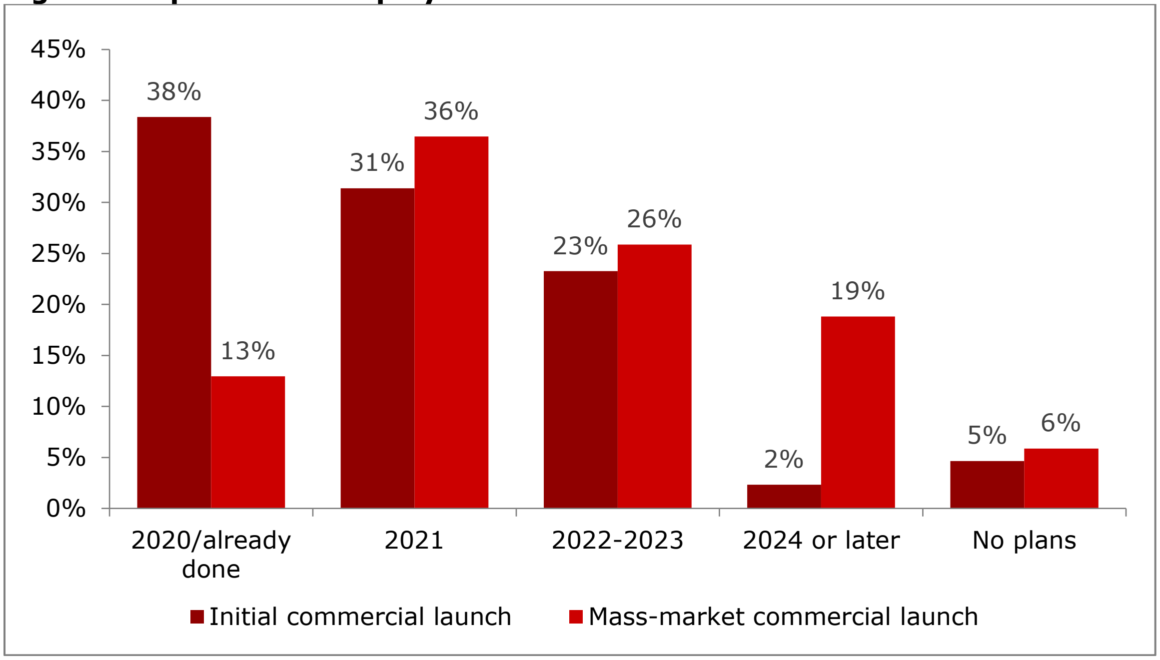
Results also show clearly that 5G fronthaul performance testing timelines are directly linked to the magnitude of the challenges posed. In fact, the performance test implementation rankings lined up exactly with the performance challenge requirements. Operators plan to tackle the biggest challenges first, including packet-based latency measurements for URLLC and packet-based bandwidth throughput verification for eMBB. At the bottom of the implementation priority list was eCPRI/O-RAN 7.2x functional split verification, which is the least challenging of the performance requirements.

GENERAL DEPLOYMENT ISSUES AND TIMELINES

In this study, Heavy Reading wanted to better understand operators' 5G launch plans, including when they expect to make their initial 5G launches and then when they expect their mass-market launches to begin. In the survey, 38% reported they have either launched 5G services already or expect initial launches by the end of 2020. The data is consistent with commercial 5G launch tallies compiled by the GSA, Ookla, and Omdia, among others.

Mass-market launches have not happened yet, but they are not far off. In the survey, 63% of operator respondents expect mass-market launches to occur in the 2021–23 timeframe, with 37% reporting mass-market launches in 2021 alone. While the survey did not ask specifically about COVID-19 impacts on timing, it was fielded in late May and, thus, reflects the latest thinking through that time (see **Figure 1**).

Figure 1: Operator 5G deployment status



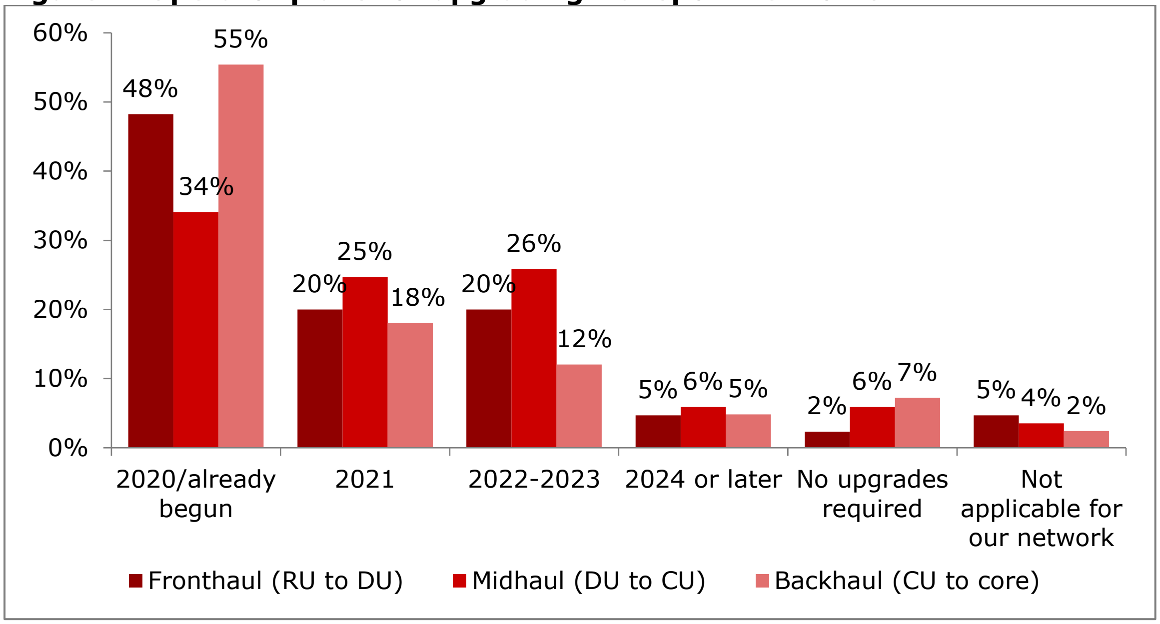
n=86

Source: Heavy Reading

A great deal of media attention, including in the business media, focuses on 5G commercial launches and rightly so, but the big question for the transport industry is: When will operators upgrade their transport networks to support 5G? This question has received far less attention, to date, but Heavy Reading tackled it in in the survey. For even more granular detail on transport upgrade timing, Heavy Reading separated responses for fronthaul, midhaul, and backhaul (see **Figure 2**).

The data shows that backhaul and fronthaul upgrade plans are the furthest along, with 55% of respondents reporting that backhaul upgrades have either already begun or are expected by end of 2020 and 48% reporting the same deployment status for their fronthaul networks. Midhaul networks lag behind a bit, with 34% reporting that upgrades have already begun or are expected by year end, but midhaul upgrades are expected to accelerate through 2021–23. By the end of 2023, upgrade statuses will be fairly evenly aligned, ranging from 85% to 88% across the three xHaul segments based on the survey results. Not surprisingly, very few operators see no need for xHaul upgrades during the time period.

Figure 2: Operator plans for upgrading transport networks



n=85

Source: Heavy Reading

With a basic understanding of 5G service launch plans and xHaul network upgrade plans, Heavy Reading also wanted insights into operators' motivations for upgrading their transport networks. Why do operators need to modernize their transport networks for 5G?

Heavy Reading asked operators to rank a list of nine transport network modernization motivations (or drivers) from most significant to least significant. The ranked items were also scored by assigning a weight to each rating based on the highest priority (see **Figure 3**).

Figure 3: Motivations to modernize transport networks for 5G

Item	Overall rank	Score
Higher speed interfaces	1	560
Increase overall transport capacity	2	547
Increase network reliability	3	413
Increase revenue	4	410
Support for network slicing	5	364
Enhance timing/synchronization for phase/frequency	6	350
Reduce opex	7	297
More programmable infrastructure	8	293
Reduce capex	9	282

n=81

Note: The score is calculated by assigning a weight to each rating where the highest priority rating holds the highest weight.

Source: Heavy Reading

The need for higher data rates (speed) and increased transport capacity topped the list, ranking first and second, respectively, followed by the need for greater reliability. The focus on higher speed interfaces and greater overall capacity is consistent with the trend Heavy Reading has seen in backhaul network upgrades in which operators have been migrating from 1Gbps Ethernet to 10Gbps Ethernet (and boosting overall systems capacities when they do so). The finding is also consistent with requirements for early 5G commercial launches, which focus on eMBB use cases that are characterized by higher data rates compared to 4G.

The relatively high priority placed on reliability (ranking third) is interesting, as it also placed above the requirement for generating revenue. Reliability is a hallmark of the URLLC set of advanced use cases that require 3GPP Release 16 (completed in July). The survey data indicates that operators are looking to adopt these advanced use cases in the near future and that the transport network will play a critical role in deploying these new applications.

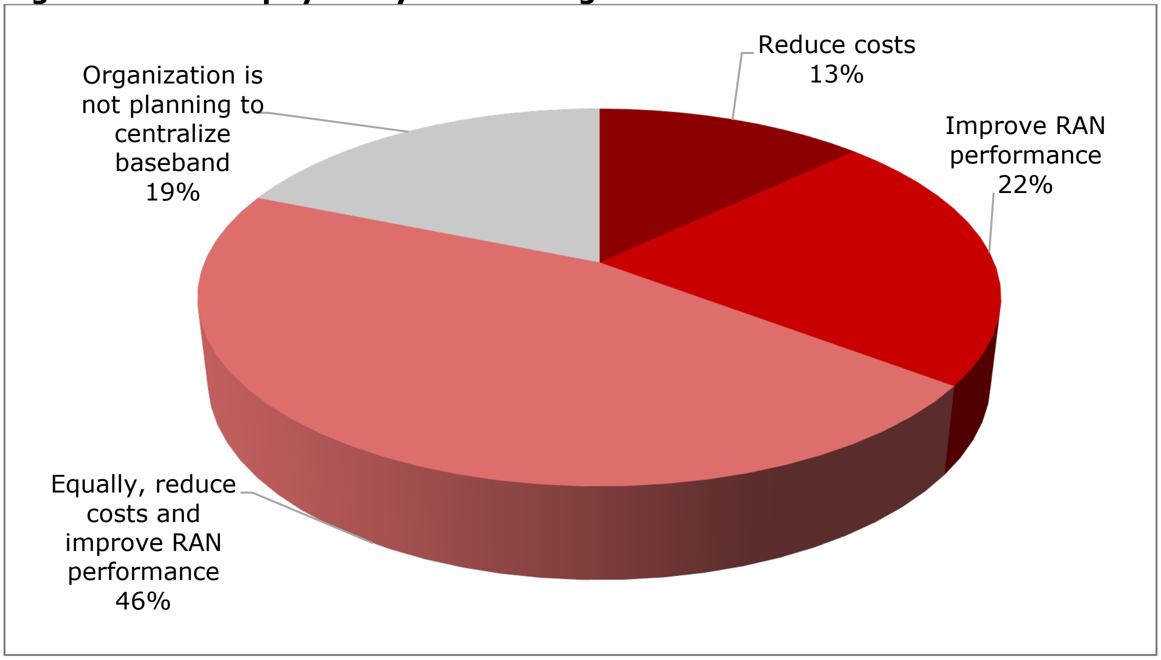
Heavy Reading also noted the motivations that formed the bottom tier of the ranked list, specifically, reduce opex (ranked seventh), more programmable infrastructure (eighth), and reduce capex (last at ninth). The survey results do not indicate that these goals are generally unimportant to operators, but they do say that the goals are not particularly important factors in operators' decisions for upgrading the transport network for 5G. In other words, the 5G transport network investments are not driven by the need to save money. Rather, they are driven by the need to support the services, generate revenue, and activate the required network features. This is an important finding in the study.

CENTRALIZING THE RAN AND FRONTHAUL

Centralizing the RAN is top of mind for operators building networks for 5G and comes up in nearly every operator transport discussion. The reason is that, architecturally, the biggest transport network change in moving from existing 4G to new 5G networks is the centralization of the RAN functionality. The creation of the fronthaul segment between the remote unit (RU) and the distributed unit (DU) and, for some, the new midhaul segment between the DU and the centralized unit (CU) functions represents a big change. Some operators moved to centralized RANs (C-RANs) with advanced 4G technologies, but for most operators around the world, 5G marks the beginning of the C-RAN migration.

Heavy Reading asked operators to identify their primary goals in physically centralizing baseband processing to understand whether decisions are based on reducing costs, improving performance, or equal combinations of both (see **Figure 4**).

Figure 4: Goal of physically centralizing basebands



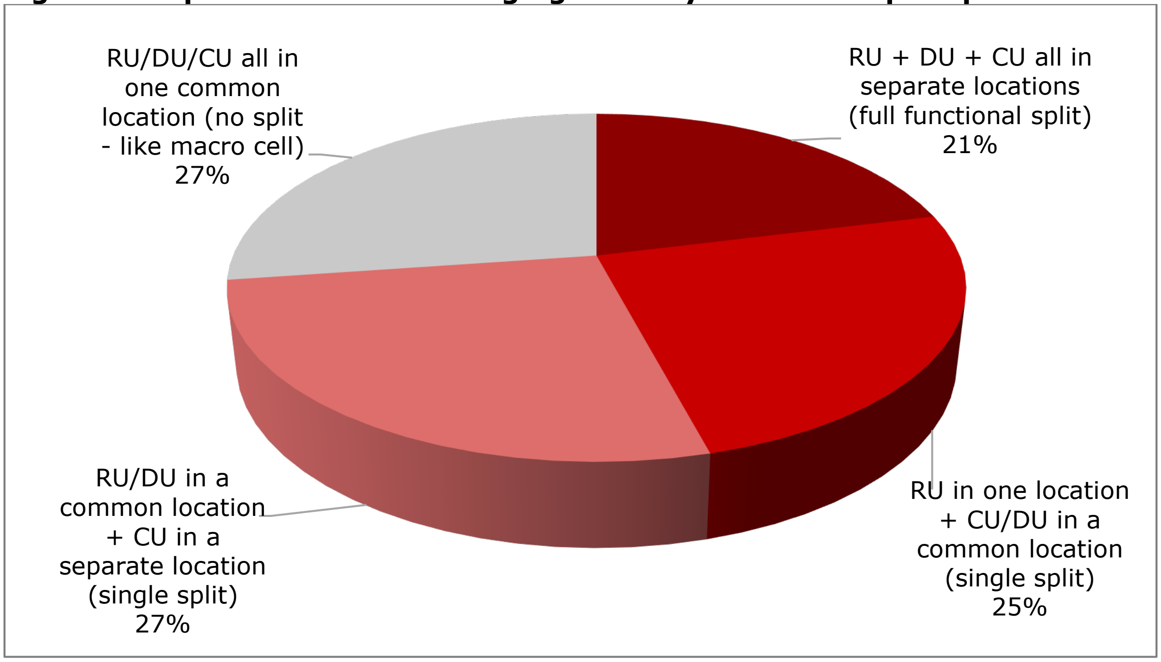
n=85
Source: Heavy Reading

Results show that, at 46%, nearly half of respondents view the physical centralization of baseband processing as equally important for reducing their network costs and improving RAN performance. For respondents that have a single goal of baseband centralization, improving RAN performance (22% of respondents) was widely selected over cost reduction (chosen by just 13%). But not all operators seek physical centralization. In the survey, 19% of operators reported they have no plans.

Functional decomposition in the RAN presents operators with several architectural options for the transport network. These options include fully distributed RANs (like traditional macro cells), a fully centralized RAN, and split RAN options. Heavy Reading asked operators to estimate the 5G RAN functional splits options they expect to deploy in their emerging 5G RANs between 2020 and 2023.

For each individual respondent, functional split percentages had to tally 100%. **Figure 5** shows the average functional split breakdown for the full survey group.

Figure 5: Expected share of emerging RANs by functional split options



n=81

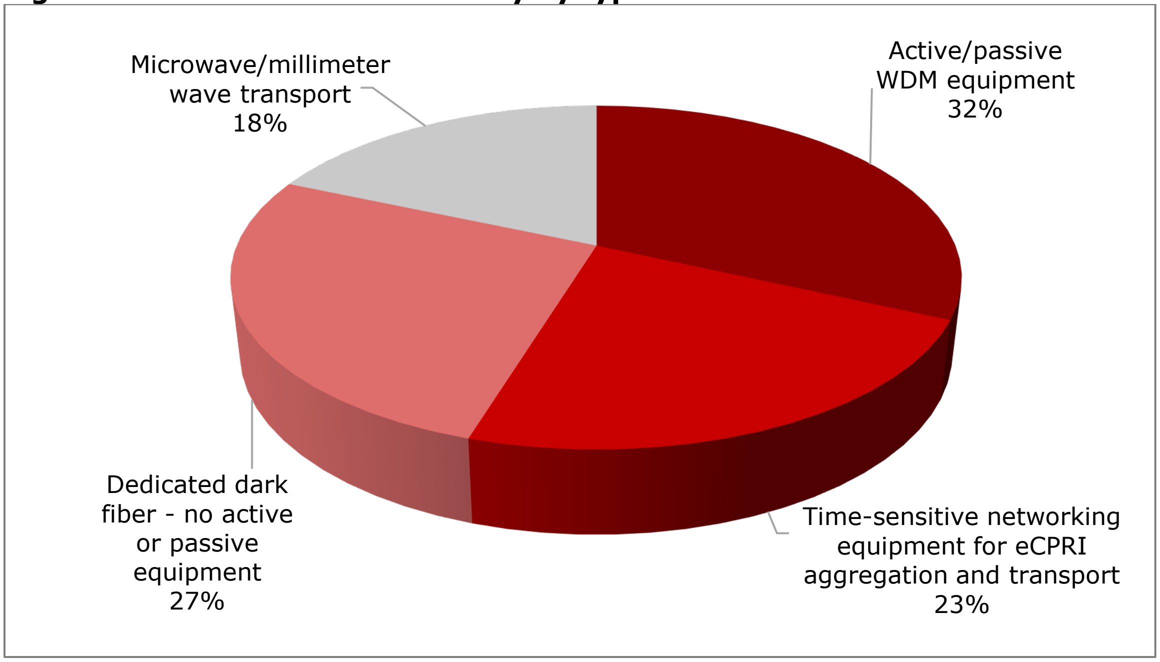
Source: Heavy Reading

While individual preferences swing widely across the options, on average, the results show a remarkably even breakdown among the four options. At the high end, the traditional macro architecture and the RU/DU+CU option each garnered 27% share, while the single split C-RAN gained 25%. At 21%, the full functional split option (RU+DU+CU) took the lowest share, but again, the key point is that the range is tight between the most and least favored options.

While there is no single standout, the results, nonetheless, are a strong endorsement for split architectures generally. Taken as a whole, traditional distributed macro architectures will account for roughly a one-quarter share of emerging 5G based on the results, while the remaining three-quarters share is expected to be some form of partial or full centralization. Heavy Reading finds this result to be a strong endorsement of centralized/split architectures and a departure from Heavy Reading surveys in previous years in which the majority of respondents favored traditional macro architectures for 5G.

The survey also asked operators about their expected mix of 5G fronthaul connectivity types, including fiber, microwave, and time-sensitive networking (TSN) options. For each individual respondent, connectivity options had to tally 100%. **Figure 6** shows the average connectivity mix for the full survey group. (Respondents with no fronthaul plans were asked to skip the question.)

Figure 6: 5G fronthaul connectivity by type



n=71
Source: Heavy Reading

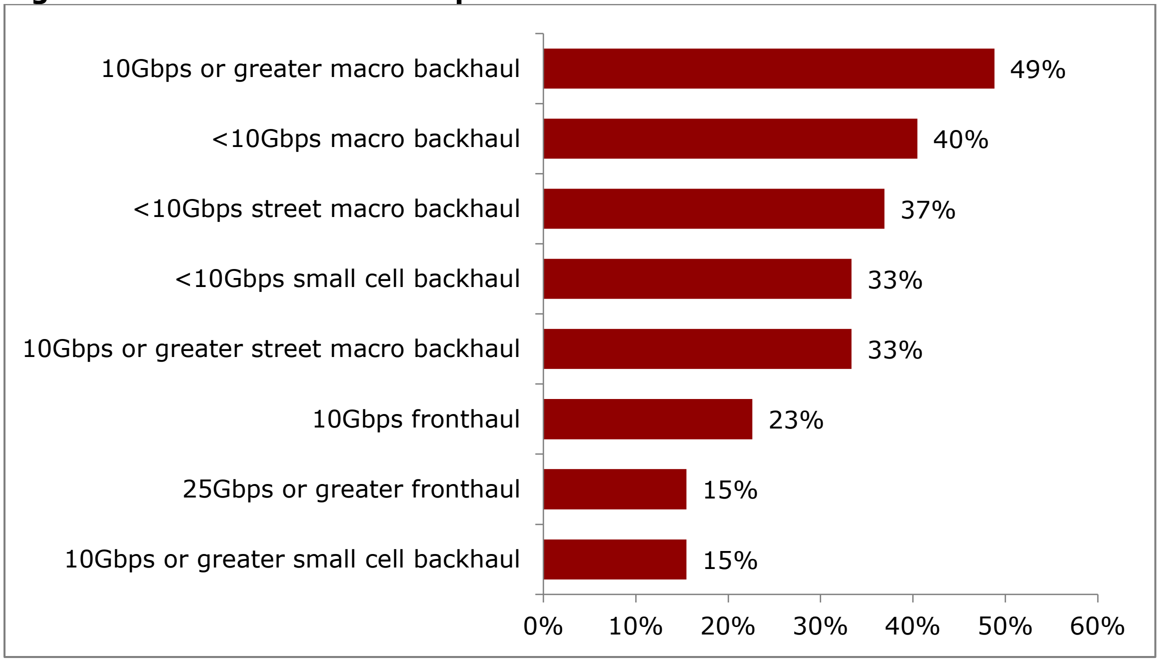
On average, the expected connectivity mix is relatively balanced, but at 32%, active and passive WDM connectivity was the top 5G fronthaul choice, followed closely by dedicated dark fibers (at a 27% share). Fronthaul demands capacity and operators will largely choose direct fibers or WDM wavelengths to deliver it, depending on their own availability of fibers. For the US market alone, operators largely chose an aggregation method of WDM (34%) or TSN (25%) for fronthaul connectivity. US respondents made up the largest geographic region in the survey.

Heavy Reading was surprised by the strong showing of microwave/millimeter wave connectivity (at 18%). From past surveys, Heavy Reading knows that operators see microwave as an important technology for 5G backhaul, viewing it as a viable alternative where fiber is physically or economically not an option. But fronthaul presents additional demands in terms of capacity and performance. These survey results show that operators increasingly view microwave connectivity as a fiber alternative for both backhaul and fronthaul networks.

Lastly, Heavy Reading notes the strong share garnered by TSN equipment, at 23% of the expected connectivity average. IEEE TSN for Fronthaul is a new standard, and products are just coming to market in 2020. By aggregating packetized traffic, TSN for fronthaul holds promise for operators to save on capex, and the message clearly resonates. As the technology matures, its potential (and fronthaul share) may increase.

Digging into microwave connectivity a bit deeper, Heavy Reading asked operators to identify their top use cases for microwave connectivity during the next three years across backhaul, midhaul, and fronthaul segments. Respondents were able to pick up to three priorities, and **Figure 7** shows their priorities in descending order.

Figure 7: Microwave use case priorities



n=84

Source: Heavy Reading

Among microwave priorities, macro backhaul use cases top the list, with 49% of respondents selecting 10Gbps or greater macro backhaul and 40% selecting less than 10Gbps macro backhaul. Street macro and small cell microwave use cases formed a middle tier across different data rate options. While microwave fronthaul use cases were in the bottom tier of priorities, the bigger takeaway is that microwave fronthaul is in play as an option. Twenty-three percent of respondents selected 10Gbps microwave fronthaul as a priority.

ROUTING AND SYNCHRONIZATION

From past research, Heavy Reading knows that high speed interfaces and overall capacity are critical factors in selecting routing equipment for 5G. Operator motivations for upgrading transport networks (highlighted earlier in **Figure 3**) reinforce this reality. But beyond speed/capacity, there are other big decisions to make in routed networks. In this section, Heavy Reading delves into some of these other important areas, including packet network synchronization, the importance of white box routing, and preferences for transport network slicing.

As operators plan for 5G, network timing and synchronization have become hot topics. 5G creates a new set of demands and challenges that must be addressed. Some regions (most notably, North America) rely on GPS as their timing source for existing mobile networks, but dense urban small cell environments pose challenges in signal reliability due to buildings and other obstructions. Antenna costs are also problematic, as operators need to keep small cell costs down.

Outside North America, most operators use network-based timing and synchronization, but they, too, face synchronization challenges in moving from 4G to 5G. The primary reason is that most of the network-based synchronization deployed, to date, is frequency synchronization. 5G brings new requirements for phase synchronization that are not covered by frequency-only implementations.

Against this backdrop of challenges, Heavy Reading asked operators to identify their preferred technologies for 5G New Radio (NR) frequency and phase synchronization by ranking options by order of preference. The migration to network-based synchronization, driven by 5G requirements, is a clear trend. Network-based synchronization, including PTP and SyncE, ranked first on the list and by a wide margin, scoring 208 on the weighted scale compared to 152 for the second choice, GPS/GNSS receivers (see **Figure 8**).

Figure 8: Technology preferences for 5G frequency and phase synchronization (global)

Synchronization technology	Overall rank	Score
Precision Time Protocol (PTP) / Synchronous Ethernet (SyncE)	1	208
GPS/GNSS receivers	2	152
Optical Timing Channel (OTC) out-of-band solutions	3	136

n=85
Note: The score is calculated by assigning a weight to each rating where the highest priority rating holds the highest weight.
Source: Heavy Reading

Significantly, the network-based synchronization trend also holds true for North America, which, historically, has been addressed through satellite. Filtering on North America only, network-based PTP/SyncE ranked first in preference and, again, by a large margin compared to the second choice in terms of weighted scores. PTP/SyncE scored 116 compared to the second choice, out-of-band timing, at 84. For North America, GPS timing ranked last on the list (see **Figure 9**).

Figure 9: Technology preferences for 5G frequency and phase synchronization (North America)

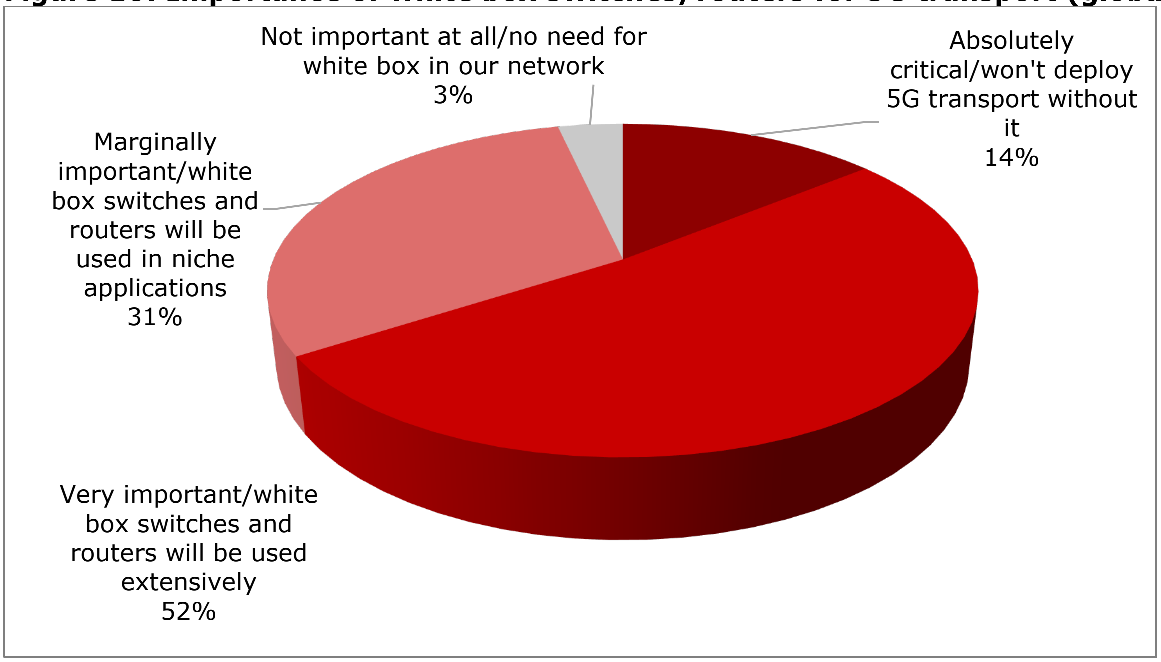
Synchronization technology	Overall rank	Score
Precision Time Protocol (PTP) / Synchronous Ethernet (SyncE)	1	116
Optical Timing Channel (OTC) out-of-band solutions	2	84
GPS/GNSS receivers	3	79

n=48
Note: The score is calculated by assigning a weight to each rating where the highest priority rating holds the highest weight.
Source: Heavy Reading

Another hot topic in 5G transport is white box switching and routing. White box is a specific subset of disaggregation in which the underlying hardware is based on open specifications defined in groups that include the Open Compute Project (OCP) and the Telecom Infra Project (TIP) and is produced to spec by contract manufacturers. White box is a further step along the disaggregation road and has both its own benefits and challenges. It has long been championed by hyperscalers, such as Google and Facebook, and the trend has moved into traditional telecom networks.

In the survey, Heavy Reading wanted to understand the extent to which white box switching and routing is gaining traction, specifically for 5G transport networks. Results show that on a global level, white box interest is high. Two-thirds (66%) of respondents reported that white box switches/routers are at least "very important," with 14% of the group reporting that 5G transport will not be deployed without white box (see **Figure 10**).

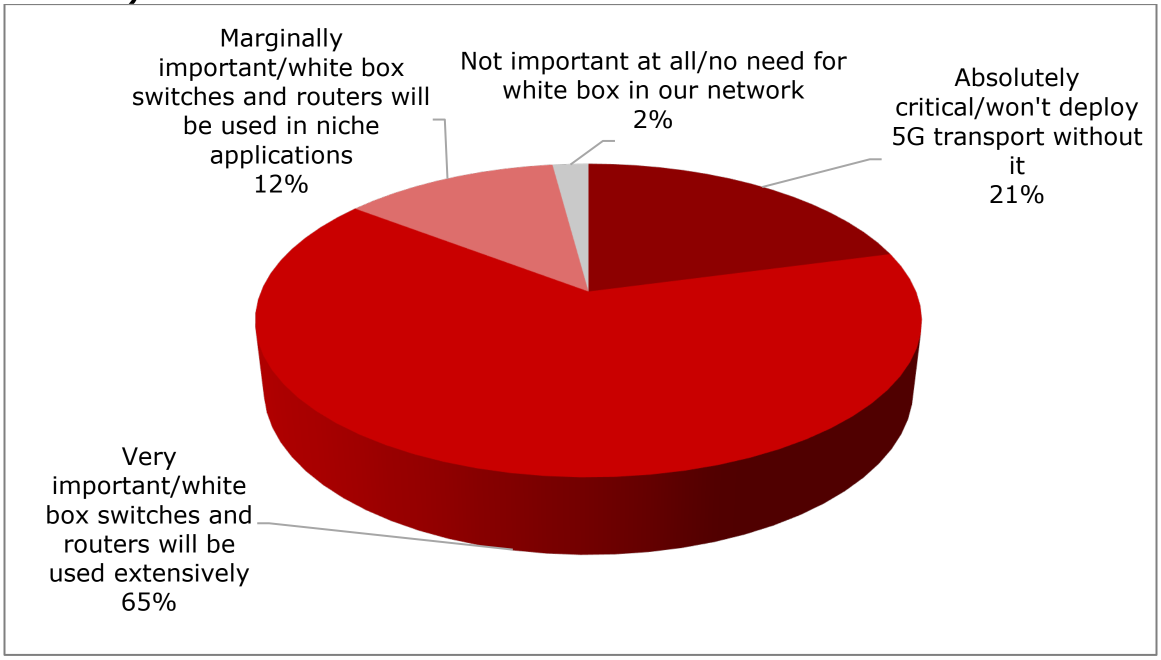
Figure 10: Importance of white box switches/routers for 5G transport (global)



n=85
Source: Heavy Reading

Heavy Reading research shows that white box routing in the telecom industry generally is driven most aggressively by North American operators, led by AT&T's highly publicized white box plans and progress. This surveys shows that the North American white box trend holds true for 5G transport applications. Among North American respondents, 86% reported that box switches/routers are at least "very important" for their 5G transport plans. Nearly a quarter (21%) reported that 5G transport will not be deployed without white box (see **Figure 11**).

Figure 11: Importance of white box switches/routers for 5G transport (North America)

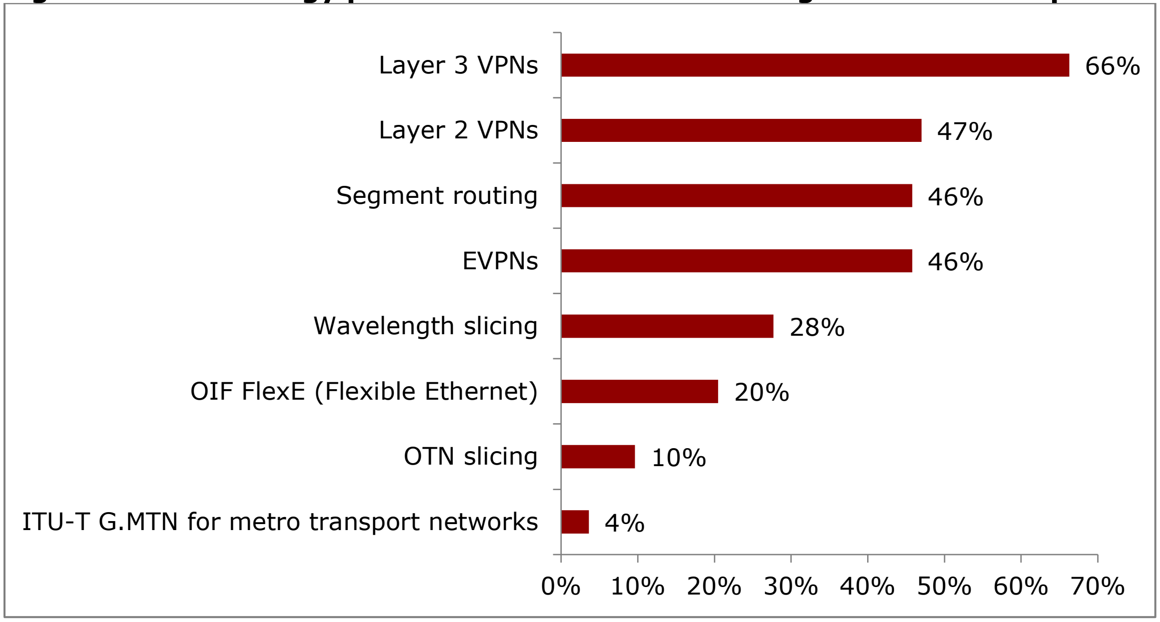


n=48
Source: Heavy Reading

End-to-end network slicing is a crucial topic for 5G because operators view slicing as the only means to economically meet the wide variety of use case requirements promised in 5G. Because slicing needs to be end-to-end, there are many moving parts, of which the transport segment is just one. Still, transport is an important component, and operators have many decisions to make.

One of the key decision points for operators is what technology (or technologies) do operators anticipate using in order to create slices in their transport networks. Heavy Reading asked this question and allowed operators to select up to three transport slicing options. The results are shown in **Figure 12**.

Figure 12: Technology preferences for network slicing in mobile transport network



n=83
Source: Heavy Reading

The key finding is that, for transport slicing, operators strongly prefer VPNs, regardless of the VPN flavor. Scoring at the top of the list was Layer 3 VPNs (selected by 66% of respondents), but Layer 2 VPNs, EPVNs, and segment routing also ranked highly at 47%, 46%, and 46%, respectively. Because it is new and receives so much industry attention, Heavy Reading called out segment routing specifically, though, in reality, segment routing is also a means of delivering a Layer 3 VPN. What all of the VPN options have in common is that they are ways of achieving soft slices that share network resources at some level. Thus, the operators surveyed expressed a strong preference for soft technologies for transport slicing.

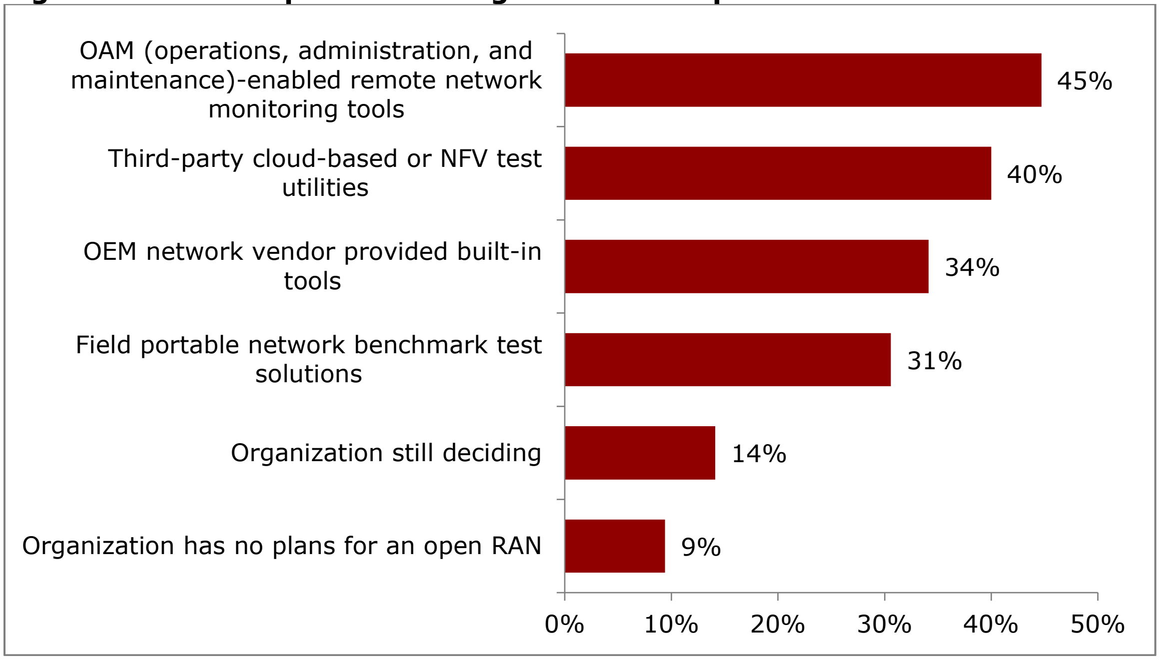
The point is underscored by the low preferences among all of the hard slicing technologies—those that physically partition resources among slices. These hard slicing options include wavelength slicing, Optical Interoperability Forum (OIF) Flexible Ethernet (FlexE), Optical Transport Network (OTN) slicing, and the new ITU G.MTN standard for hard slicing. All of these options formed the bottom tier in the survey, with G.MTN at the bottom, selected by just 4% of respondents. (Heavy Reading notes that G.MTN, to date, has been championed by Chinese operators, and this survey had no Chinese respondents.)

TESTING 5G NETWORKS

This section looks at 5G transport networks and operator plans from a testing perspective.

Looking at the trend in opening the RAN, Heavy Reading wanted to better understand how operators seek to ensure interoperability among the various RAN components. Specifically, the survey asked: For your organization, what are the most important testing methods to ensure interoperability in an open RAN environment, such as defined by the O-RAN Alliance and Telecom Infra Project (TIP)? Respondents could select up to two options (see **Figure 13**).

Figure 13: Most important testing methods in open RAN environments



n=85
Source: Heavy Reading

In the rankings, two methods rose to the top. Operations, administration, and maintenance (OA&M)-enabled remote network monitoring tools ranked first (selected by 45% of respondents) and was followed by third-party cloud-based or network functions virtualization (NFV) test utilities (selected by 40%). The remote and cloud-based testing ranked above both vendor equipment built-in tools (selected by 34%) and field portable tools (selected by 31%). Results indicate that operators want remote testing abilities when possible.

As described earlier in this paper, the centralization of the RAN and the creation of the new fronthaul transport segment pose particular challenges for operators due to bandwidth, combined with stringent performance requirements relative to other transport segments. The fronthaul networks pose challenges for operators from a testing perspective as well.

Heavy Reading asked operators to rank next-generation fronthaul performance requirements on a scale of 1 to 5, with 1 being the most challenging and 5 being the least challenging.

With weighted scores of 264 and 263, respectively, packet-based latency measurement verification for URLLC applications and packet-based bandwidth throughput verification for eMBB applications were essentially tied at the top of the performance requirement challenges list. Tied for third (with equal weighted scored of 214) were packet-based traffic priority and profiled verification for network slicing and packet-based timing/synchronization verification for 5G. At a distant fifth position, and the least challenging, was packet-based eCPRI/O-RAN 7.2x functional split verification (see **Figure 14**).

Figure 14: Most challenging performance requirements for next-gen fronthaul networks

Rank	Performance requirement challenge	Score
1	Packet-based latency measurement verification for URLLC	264
2	Packet-based bandwidth throughput verification for eMBB	263
3	Packet-based traffic priority and profile verification for network slicing	214
3	Packet-based timing and synchronization verification for 5G TDD RAN	214
5	Packet-based eCPRI/O-RAN 7.2x functional split verification for NGFI-I	125

n=76
Note: The score is calculated by assigning a weight to each rating where the highest priority rating holds the highest weight.
Source: Heavy Reading

Understanding the top fronthaul performance challenges (from **Figure 14**, above), Heavy Reading wanted to gauge operator timelines for implementing performance testing to address those challenges. In other words, will operators address fronthaul performance challenges sequentially according to priority? Or do operators plan to address performance testing in a different sequence?

Specifically, the survey asked: When does your organization plan to implement the following performance tests for 5G next-generation fronthaul networks? Respondents ranked the tests in implementation priority order from earliest (1) to latest (5). Respondents with no fronthaul plans were asked to skip the question (see **Figure 15**).

Figure 15: Performance test implementation priorities

Priority	Performance test	Score
1	Packet-based latency measurement verification for URLLC	262
2	Packet-based bandwidth throughput verification for eMBB	241
3	Packet-based traffic priority and profile verification for network slicing	245
4	Packet-based timing and synchronization verification for 5G TDD RAN	219
5	Packet-based eCPRI/O-RAN 7.2x functional split verification for NGFI-I	118

n=77
Note: The score is calculated by assigning a weight to each rating where the highest priority rating holds the highest weight.
Source: Heavy Reading

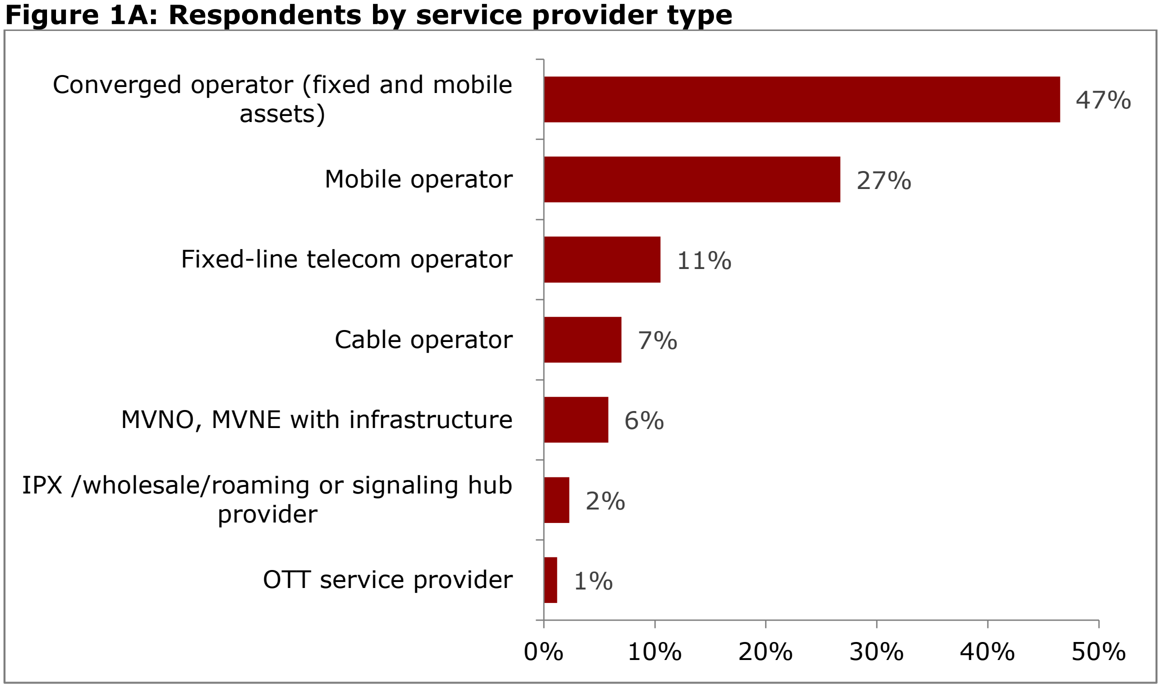
The results show clearly that 5G fronthaul performance testing timelines are directly linked to the magnitude of the challenges posed. In fact, the performance test implementation rankings lined up exactly with the performance challenge requirements. Operators plan to tackle the biggest challenges first, including packet-based latency measurements for URLLC and packet-based bandwidth throughput verification for eMBB. At the bottom of the implementation priority list was eCPRI/O-RAN 7.2x functional split verification—the least challenging of the performance requirements.

APPENDIX: SURVEY DEMOGRAPHICS

This Heavy Reading report is based on a web-based survey of network operators worldwide conducted in May 2020. Respondents were drawn from the network operator list of the Light Reading readership database. After reviewing responses, 86 were deemed qualified participants and were counted in the results. To qualify, respondents had to work for a verifiable network operator and be involved in network planning and/or purchasing network equipment. The full survey demographics are detailed below.

Figure 1A shows the type of service providers for which respondents work. Respondents who said they do not work for a service provider were rejected and could not complete the survey.

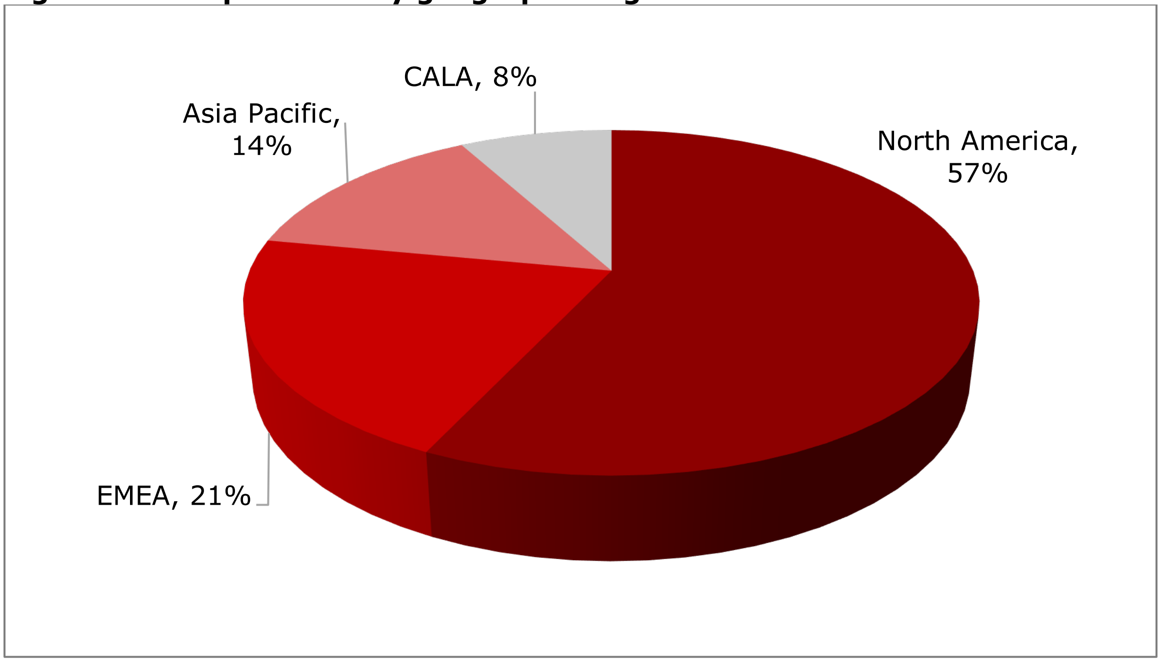
Figure 1A: Respondents by service provider type



n=86
Source: Heavy Reading

Figure 2A shows survey respondents broken down by geographic region.

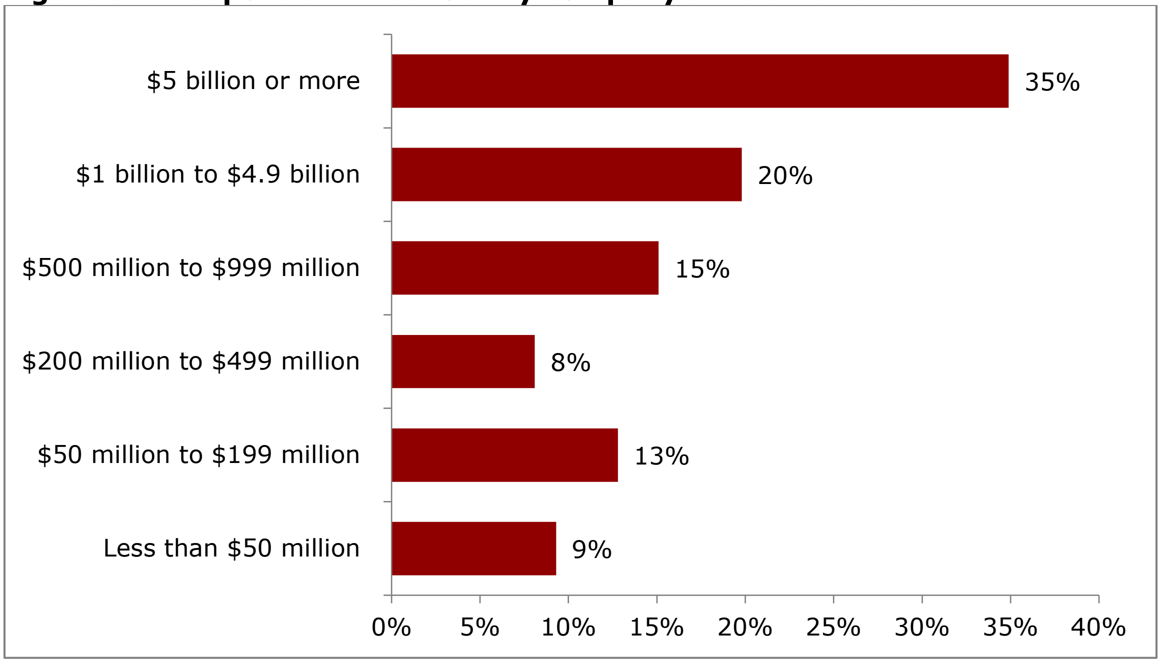
Figure 2A: Respondents by geographic region



n=86
Source: Heavy Reading

Figure 3A shows survey respondents broken out by company annual revenue.

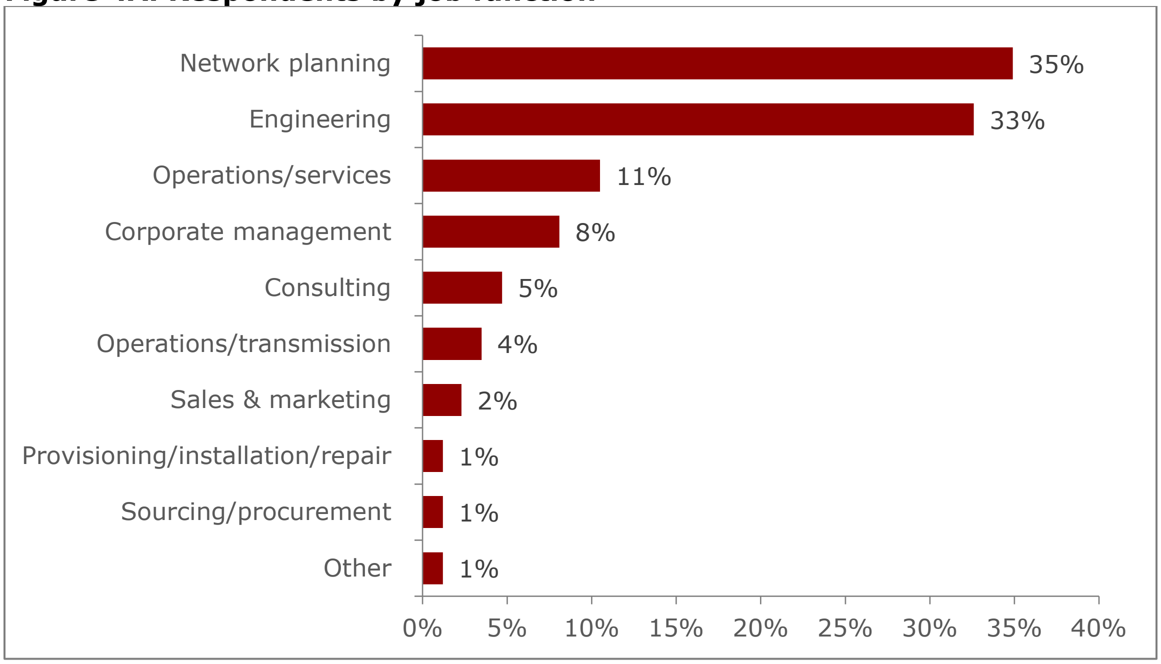
Figure 3A: Respondent breakout by company annual revenue



n=86
Source: Heavy Reading

Figure 4A shows survey respondents broken out by job function.

Figure 4A: Respondents by job function



n=86

Source: Heavy Reading