5G Network Strategies Operator Survey: Powering 5G SA Networks

NTNs/5G Satellite Services Section

Introduction

Heavy Reading's 2024 5G Network Strategies Operator Survey aims to provide insight into how operators are evolving their mobile networks and to explore how this evolution might impact the wider 5G technology and services ecosystem. This is the sixth annual edition of the survey.

Close to five years after the first commercial launches, 5G networks are now deployed by over 300 operators worldwide. As of the start of 2024, they support around 2 billion subscribers, with a forecast of close to 3 billion by the end of 2024 and 8 billion by 2028, according to research firm Omdia (a Heavy Reading sister company).

To serve this demand, operators worldwide will continue to deploy high capacity 5G RANs. In leading markets, attention is now also focused on the transition to 5G standalone (SA) and how to translate advanced network capabilities into compelling consumer and enterprise services. Given how essential the SA system architecture is to delivering a wider, richer set of 5G services, Heavy Reading has subtitled this year's survey *Powering 5G SA Networks.*

According to the survey, 25% of respondents expect to have nationwide SA networks generally available for "customers with compatible equipment" by the end of 2024, and a further 33% will offer nationwide SA for "specific customers / verticals" **(Figure 1).** These results give Heavy Reading the confidence to say that the SA transition is truly underway, and it will unlock a new wave of 5G native service offers and set the stage for 5G Advanced.

On an industrywide basis, SA is a long-term transition. Even once SA

is available, new capabilities will be introduced and scaled in phases as technology and market demand allow. It is also the case that 20% of respondents are still in the "soft launch" and 17% are in the "field trial or pilot" stages. Moreover, Heavy Reading expects operators to run SA alongside non-standalone (NSA) in their 5G networks for many years.

This report is based on an online questionnaire, developed in association with sponsors, that was fielded to respondents in the Light Reading service provider database in January 2024. It was open only to employees of telecom operators with mobile networks.

This document is an excerpt from the full survey report. It is focused
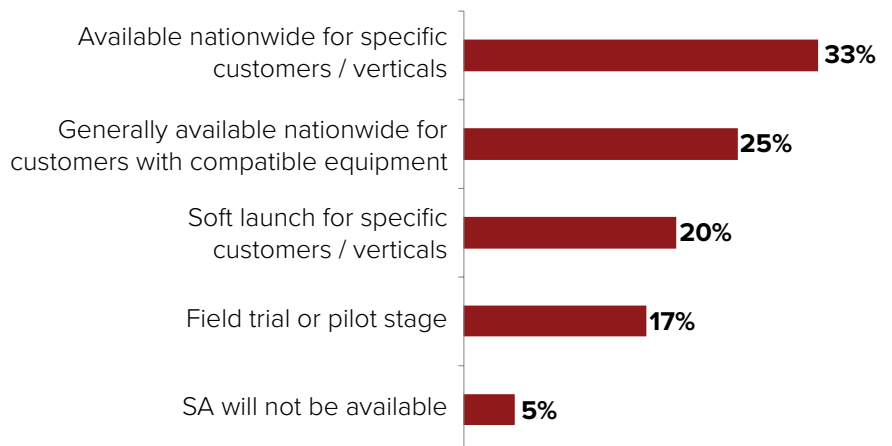
on the NTNs / 5G Satellite Services section of the survey. As a result, not all figure numbers are sequential. The full report is available on the Light Reading website.

The 2024 5G Network Strategies Operator Survey is supported by **5G Americas** and the **Alliance for Telecommunications Industry Solutions (ATIS).**

Thank you for reading. Please get in touch with any questions or comments.

Note: Numbers in percentage figures throughout this report may not total 100 due to rounding.

Figure 1: How widely available will your 5G SA wide-area public network be at the end of 2024?

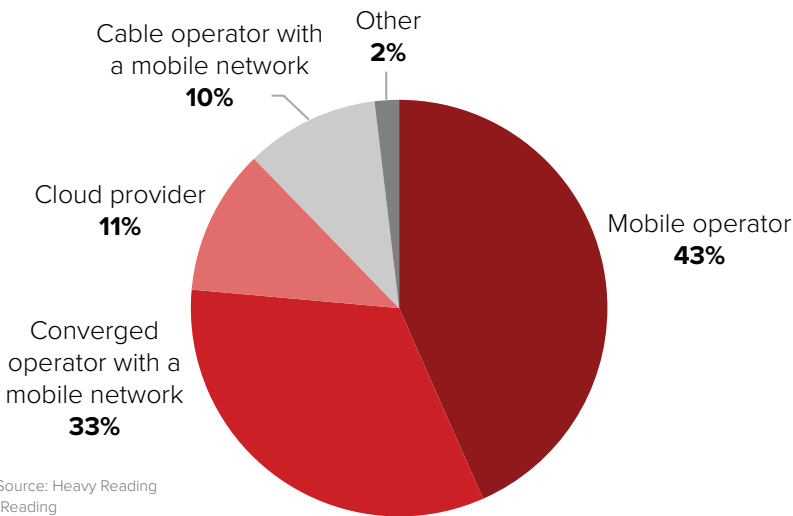| Category	Percentage
Available nationwide for specific customers / verticals	33%
Generally available nationwide for customers with compatible equipment	25%
Soft launch for specific customers / verticals	20%
Field trial or pilot stage	17%
SA will not be available	5%

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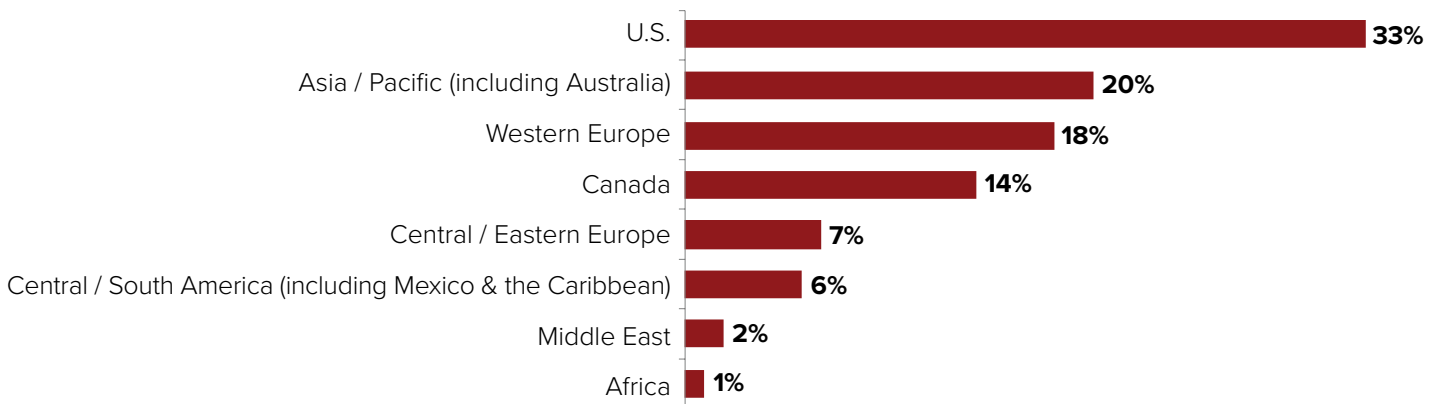
Survey Demographics

The questionnaire received 106 responses from individuals who self-identified as working for operators with mobile networks. Rogue, suspicious, and non-operator responses were removed. Network engineering, R&D and technology strategy, corporate management, and IT and cloud are the major job roles represented. Personnel from large operators in advanced markets account for the majority of the responses. North America is the dominant region with 33% of the response; however, most major global regions are represented.

Figure 2: **What type of telecom service provider do you work for?**

- Other **2%**
- Cable operator with a mobile network **10%**
- Cloud provider **11%**
- Converged operator with a mobile network **33%**
- Mobile operator **43%**

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Figure 3: **In what region is your organization headquartered?**

Region	Percentage
U.S.	33%
Asia / Pacific (including Australia)	20%
Western Europe	18%
Canada	14%
Central / Eastern Europe	7%
Central / South America (including Mexico & the Caribbean)	6%
Middle East	2%
Africa	1%

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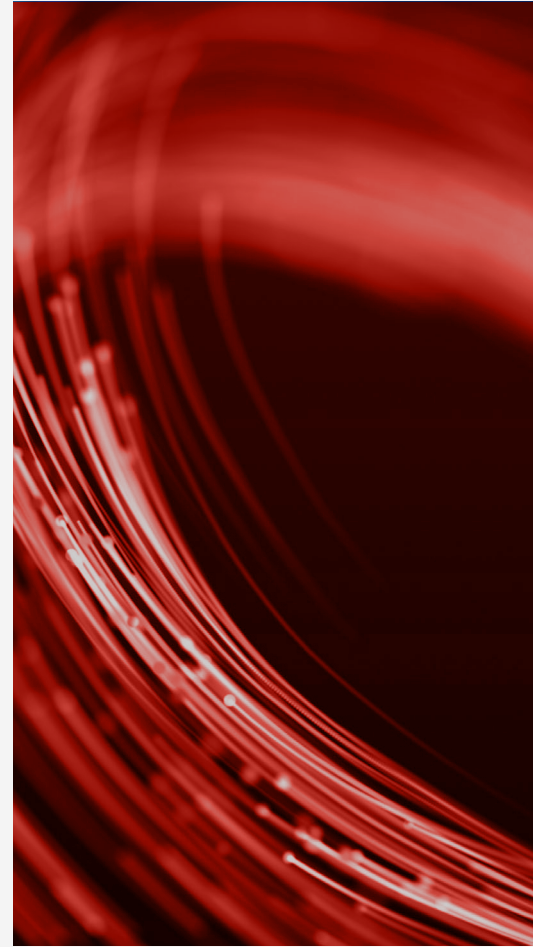
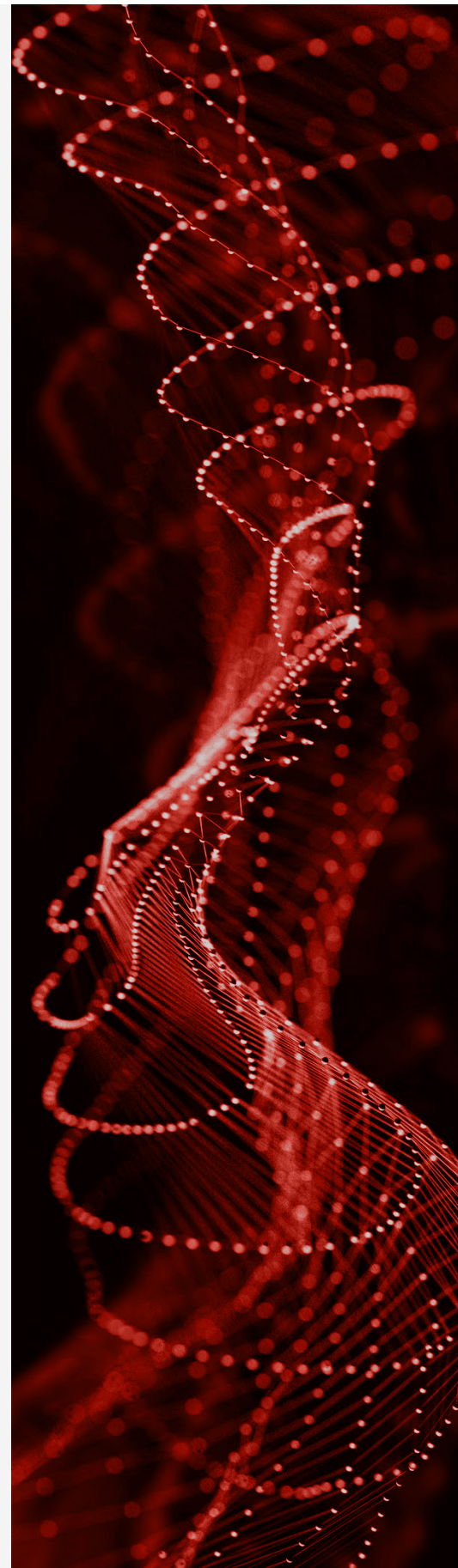**Figure 4: What is your primary job function?**

Job Function	Percentage
Network Engineering & Planning	22%
Corporate Management	18%
R&D and Technology Strategy	18%
IT and Cloud	18%
Network Operations	15%
Marketing / Sales	7%
Other	3%
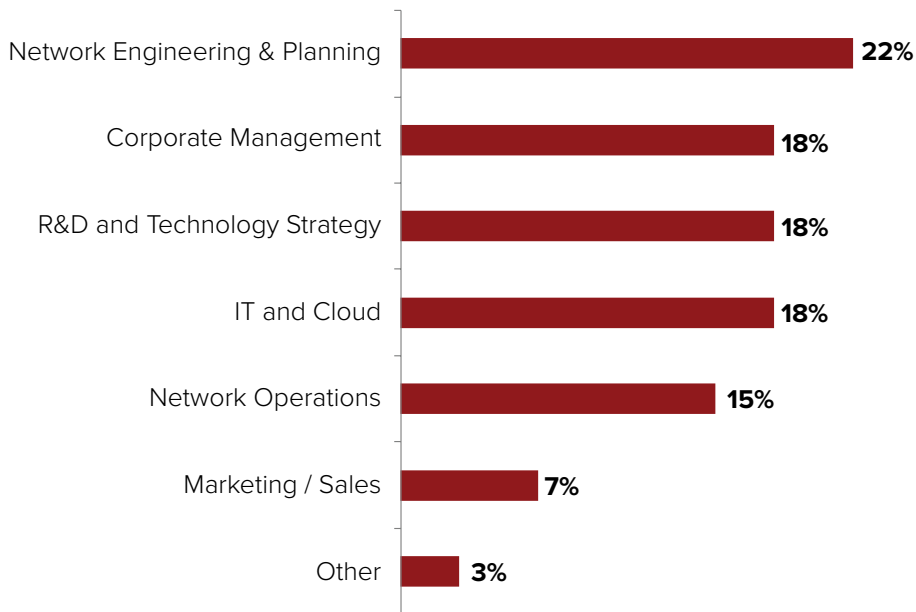
Figure 5: What are your company's approximate annual revenues?

Revenue	Percentage
Less than $250 million	5%
$250 million to $499 million	4%
$500 million to $999 million	30%
$1 billion to $4.99 billion	25%
$5 billion or more	36%
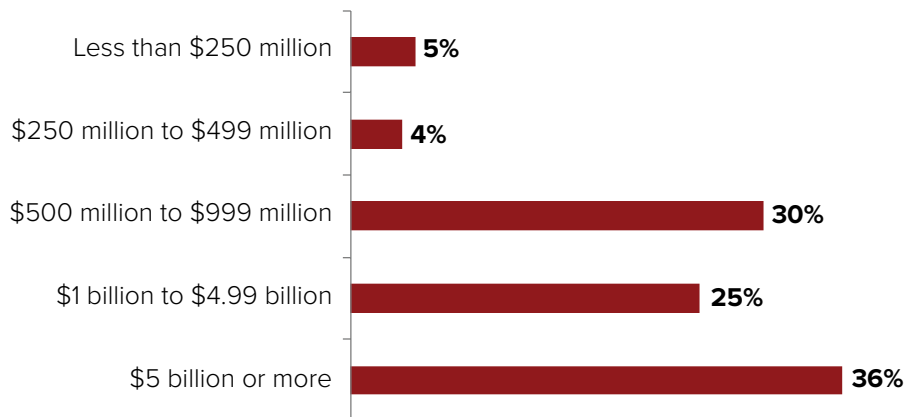
NTNs / 5G Satellite Services

Author: Ruth Brown | Principal Analyst, Mobile Networks & 5G, Heavy Reading

Key Takeaways

- Enthusiasm for satellite services is high. "Direct-to-cell" sees an exuberant 46% of operators "very likely" to offer services within the next three years, possibly elevated by recent well-publicized satellite service announcements. Optimism for satellite services continues for new radio NTN (NR-NTN). 41% of operators expect to offer 5G NR-NTN services based on 3GPP specifications for fixed and / or mobile terminals in "4–6 years," and an eager cohort (36%) expects "1–3 years." Direct-to-cell satellite service may help create a market for longer-term NR-NTN solutions.

- Enhanced IoT coverage (42%), closely followed by 5G services to smartphones (41%) and public safety and disaster response (37%), have the highest priority within operators' NTN application strategies. Coverage extensions and low data rate IoT services are ideal primary applications, many with lower usage and capacity demands. Residential fixed access is the least dominant application, possibly reflecting existing well-established mobile fixed wireless access (FWA) or proprietary satellite solutions.

- Operators recognize that 5G NTN will present technical challenges. Terrestrial network (TN) integration (38%) is the lead group, followed by inter-satellite handover (26%), Doppler shift delay (20%), and "adapting to differing orbits for LEO, MEO, GEO systems" (17%). Considerable split on technical challenges underlines the importance of standardization and ecosystem development.

Mobile satellite services are experiencing a spike in interest. The perpetual growth of connected devices and the need for limitless coverage present new challenges to terrestrial mobile networks and opportunities for collaboration with the satellite ecosystem. According to satellite provider Iridium (January 2023), "approximately 85% of the world surface [is] without cellular coverage."

Operators worldwide are commencing partnerships and trials with satellite connectivity companies. Two solutions are emerging: direct satellite-to-device services and standardized NTN (3GPP Release 17 onward) focusing on 5G NR and IoT terrestrial to NTNs (e.g., satellite, high altitude platforms [HAPS], air-to-ground networks, etc.). Both offer great potential.
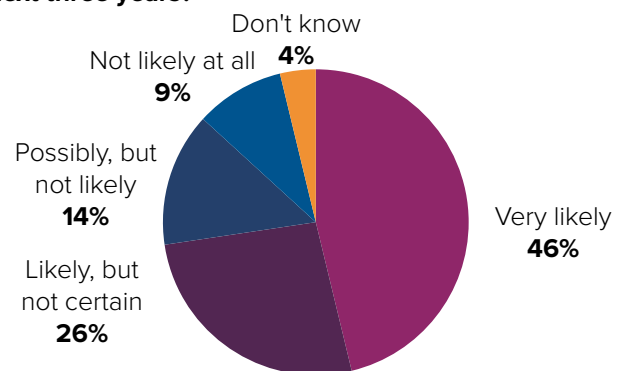
Mobile operators have significant opportunities to incorporate NTN with TNs but must consider the best options for architecture and spectrum, as well as how to overcome technical challenges such as delay, satellite handover, spectrum choices, etc. NTN offers substantial benefits, so planning which sectors and applications can offer the most value is vital. This section explores mobile operator thoughts and strategies for NTN.

The first question **(Figure 31)** in this section asks operators how likely they are to offer a direct-to-cell satellite service in the next three years. The leading response, "very likely" (46%), is significantly higher than expected.

Figure 31: How likely is your company to offer a "direct-to-cell" satellite service in the next three years?

Don't know **4%**
Not likely at all **9%**
Possibly, but not likely **14%**
Likely, but not certain **26%**
Very likely **46%**

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Figure 32: When will your company offer a 5G NR-NTN service based on 3GPP specifications for fixed and / or mobile terminals?

- Don't know **8%**
- Beyond 8 years **2%**
- 1–3 years **36%**
- 5–8 years **14%**
- 4–6 years **41%**
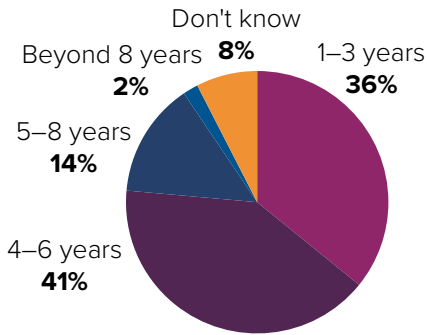
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Activity around direct-to-cell services is increasing, possibly amplified by recent well-publicized announcements, such as Starlink's direct-to-cell satellite launch for unmodified LTE devices.

Other operators are less certain about offering direct-to-cell services, with "likely, but not certain" (26%), "possibly, but not likely" (14%), "not likely at all" (9%), and "don't know" (4%) representing a combined total of over half (53%) of all votes. The mixed views indicate that while enthusiasm is high, operators are deciding strategies. Direct-to-cell satellite service may also

help create a market for longer-term NR-NTN solutions.

3GPP Release 17 introduces the initial integration of TNs to NTNs, with earlier satellite solutions often supported on proprietary technology. **Figure 32** shows operators' expectations for offering a 5G NR-NTN service based on 3GPP specifications for fixed and / or mobile terminals.

The leading group of 41% of respondents expects an offering in "4-6 years," stressing that operators are willing to wait for ecosystem maturity or additional enhancements. For example, 3GPP Release 18 onward looks to add network location, mobility enhancements, service continuity, etc.

Over a third (36%) of respondents are eager to offer 5G NR-NTN in "1–3 years," highlighting optimism for future solutions. Alternatively, this result might indicate that respondents have also considered narrowband IoT (NB-IoT) satellite service markets when deciding the timeline.

A combined total of 24% of operators make up the final groupings of "5–8 years" (14%), "beyond 8 years" (2%), and "don't know" (8%). These results

indicate that 5G NR-NTN services are undecided or longer term.

5G NTN offers the flexibility and ability to support multiple services, coverage, and capacity extensions for TNs. **Figure 33** considers which applications will have the highest priority for 5G NTN strategies.

Enhanced IoT coverage (42%), closely followed by 5G services to smartphones (41%) and public safety and disaster response (37%), have the highest priority within operators' NTN application strategies. Coverage extensions and low data rate IoT services are ideal primary applications, many with low usage or capacity demand.

Close scoring across enterprise fixed access (22%), mobile and nomadic access to vehicles (22%), and cell backhaul (21%) suggests operators are still determining their strategies. Residential fixed access (17%) has the lowest priority for 5G NTN application strategy, possibly reflecting existing mobile FWA or proprietary satellite solutions. Isolating respondents by geographical region reveals some differing opinions. The rest of the world group evaluates FWA via 5G NTN for residential access (21%) as a higher priority compared to

Figure 33: Which applications have the highest priority in your company's 5G NTN strategy? (Select top two)

- Enhanced coverage IoT (e.g., in remote areas or international connectivity) **42%**
- 5G services to smartphones (NTN direct - to - cell) **41%**
- Public safety and disaster response **37%**
- Enterprise fixed access **22%**
- Mobile and nomadic access to vehicles (e.g., ships, trucks, etc.) **22%**
- Cell backhaul **21%**
- Residential fixed access **17%**
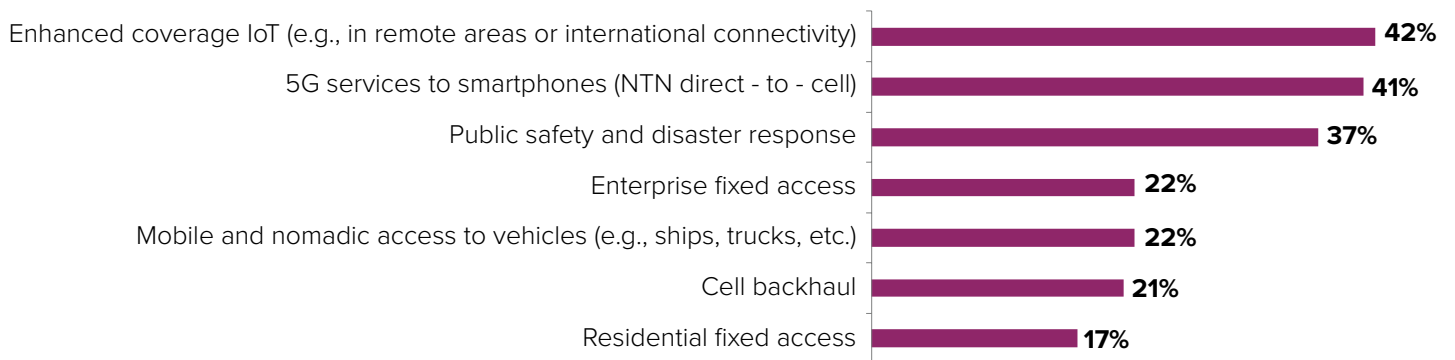
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US respondents, who rate residential access lower (12%).

Release 17 and 18 only introduce five frequency bands), and integration issues with TNs can all affect performance.

Figure 34 seeks to understand 5G NTN performance concerns. Operators believe network quality (60%) is the biggest performance concern, underlining the multiple technical challenges that could impact the reliability and stability of service. These include the speed and mobility of satellite and user devices, latency, spectral attenuation, etc.

Almost a third of operators (32%) consider "integration with terrestrial networks" the second biggest performance concern in operating 5G NTN, followed by "system capacity" (8%). These results and the multiple performance concerns emphasize the current immaturity of 5G NTN. Operators may look to build 5G NTN technical skills and validation strategies to assist with the performance complexities.

Implementing 5G NTN comes with multiple challenges, many driven by the vast distances compared to conventional TNs (e.g., doppler shift and delay, inter-satellite handovers, and adapting

to differing orbits). TN integration also presents problems such as signal interference, latency, security, etc.

Figure 35 indicates operators' expectations of the biggest technical challenge for 5G NTN, with views highly distributed. The lead challenge is "integration with terrestrial networks" (38%), followed by "handover from satellite to satellite" (25%), "Doppler shift and delay" (20%), and "adapting to differing orbits for LEO, MEO, GEO systems" (17%). Considerable technical challenges underline the importance of standardization and ecosystem development.

Figure 34: What is your company's biggest performance concern in operating 5G NTN?
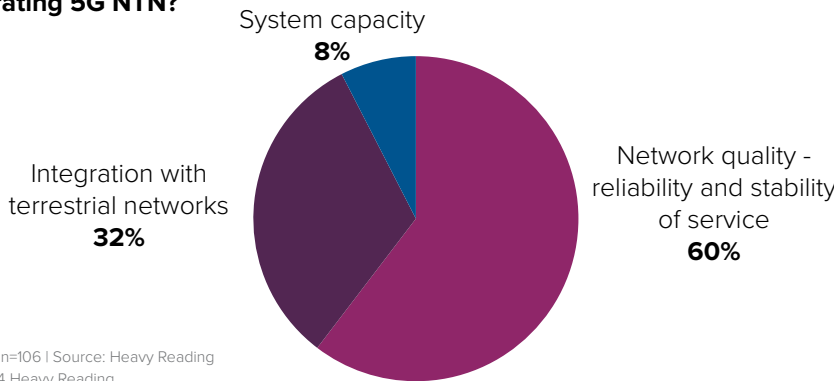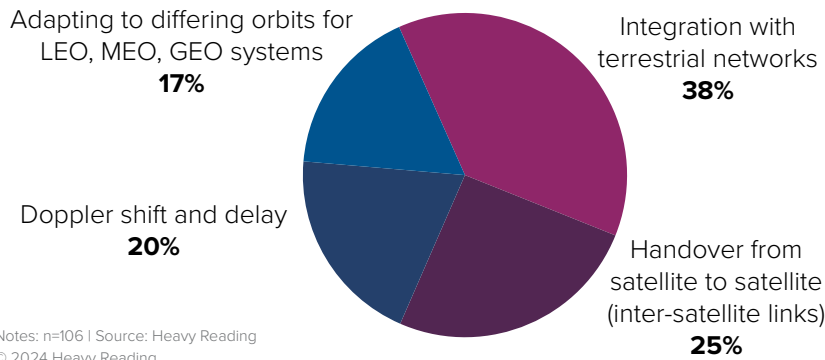
- System capacity **8%**
- Integration with terrestrial networks **32%**
- Network quality - reliability and stability of service **60%**

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Figure 35: What is the biggest technical challenge for 5G NTN?

- Adapting to differing orbits for LEO, MEO, GEO systems **17%**
- Doppler shift and delay **20%**
- Integration with terrestrial networks **38%**
- Handover from satellite to satellite (inter-satellite links) **25%**

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