6G: The Network for the Future of AI and Immersive Connectivity

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Executive Summary

The AI decade needs 6G to enable intelligence everywhere.

6G will bring the wireless connectivity capabilities and AI-native architecture required to merge the physical and virtual worlds, building on the many advances that 5G has delivered. Today, wireless connectivity enables near-instant communication on a planetary scale—and the commercial launch of 5G in 2019 represented the most significant step change in its evolution so far. BCG's research in collaboration with Qualcomm estimates that 5G-enabled applications have already generated over $1 trillion in global economic impact, and we project that their cumulative value will clear $6 trillion by 2030. 5G has also enabled an explosive increase in data consumption: people in the US alone used a record 132 trillion megabytes (MB) of data in 2024, up from 100 trillion MB in 2023, marking the largest year-over-year jump in US history. Adoption is broad and accelerating, as nearly 3 billion people now use 5G services.

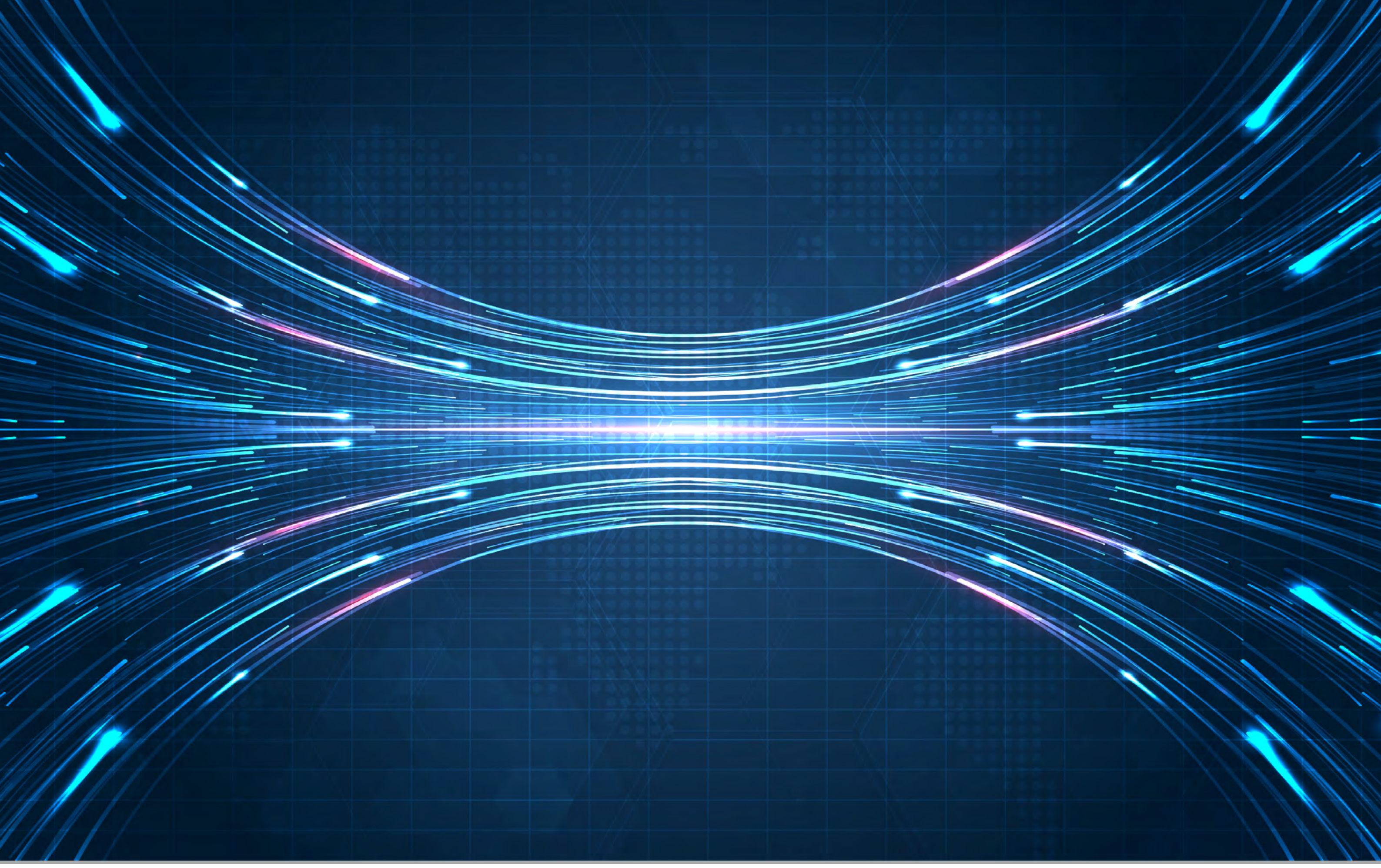
Crucially, 5G-enabled improvements include higher speeds, lower latency, reduced congestion, and highly scalable architectures. Collectively, these breakthroughs have transformed networks from communication systems into platforms for data-intensive applications, the Internet of Things (IoT), edge computing, and artificial intelligence (AI) services. These capabilities—together with the global experience gained through 5G policy, deployment, and monetization—form the foundation for the next generation of wireless connectivity, 6G.

Simultaneously, AI is testing the limits of existing networks. AI is shifting from cloud-isolated tools to persistent, multimodal agents that operate across phones, vehicles, wearables, and augmented reality (AR) and extended reality (XR) devices. These systems generate continuous uplink-heavy, latency-sensitive, context-dependent traffic, and they increasingly rely on a hybrid computing fabric that spans device, edge, and cloud. Connectivity thus becomes a key determinant of AI performance—a powerful enabler when available, and a bottleneck when not.

6G is being engineered to support AI-native, real-time, spatially aware systems at scale, complementing next-generation fiber infrastructures. It targets substantially higher sustained uplink capacity, predictable low latency, integrated sensing, and multilayer coverage that blends terrestrial and nonterrestrial networks, creating the foundation for context-aware agentic intelligence everywhere. By extending connectivity beyond communication to include sensing, orchestration, and predictable performance, 6G will enable continuous edge collection of real-world data and deployment of physical AI (drones, robots, connected vehicles) that can generate new streams of data from the physical world. That data will be critical to training and refining models, and will increasingly underpin AI performance, differentiation, and competitiveness. At the same time, it will enable new enterprise business models, immersive applications, and large-scale AI systems that operate in physical environments, unlocking new sources of economic and societal value in the 2030s and beyond.

Realizing this vision depends on governments and industry adopting a coherent approach across four policy levers: open, merit-based global standards; sustained R&D investment supported by reliable intellectual property frameworks; deep technical talent pipelines; and timely access to wide-channel spectrum. Spectrum allocation is particularly urgent, as device design cycles and infrastructure planning require multiyear planning.

5G significantly boosted capacity, scaling seamless connectivity across verticals with all-you-can-eat smartphone plans, fixed wireless access, connected vehicles, and IoT devices. Now, AI is intensifying the need for intelligent, hybrid connectivity—and decisions made during this decade will determine the pace and scale at which societies capture the many benefits of 6G and 6G-enabled AI.



Connectivity: The Invisible Engine of Human Progress

Wireless connectivity is the indispensable connective tissue of modern society.

More than 95% of the world's people are covered by mobile broadband, and over 5 billion people rely on portable, always-on wireless devices for communication, commerce, education, and entertainment.[1] Individuals no longer "go online"; they are always online. This shift has unleashed unprecedented gains in creativity, productivity, and access to opportunity—from digital payments and logistics to the creator and gig economies. In the arc of human history, few technologies have reshaped daily life as quickly or as decisively.

Nearly 9 billion mobile subscriptions depend on high-quality, reliable wireless networks for connectivity.[2] These networks form the access layer to the wider infrastructure behind them, including terrestrial and submarine fiber networks and cloud resources. This paper focuses on the wireless access layer: the critical point at which users, devices, and applications connect to the broader digital ecosystem.

1. GSMA Intelligence, *The Mobile Economy 2024* (February 2024).
2. Ericsson, *Ericsson Mobility Report* (November 2025).

Laying the Groundwork for Continuing Progress

Wireless connectivity generates significant economic and social value. Mobile money brought financial services to more than 2 billion previously unbanked people.[3] Mobile health programs have improved vaccination and maternal care rates by over 20% in developing regions.[4] Emergency response organizations rely on wireless networks for life-saving real-time coordination. And mobile devices are now the world's primary publishing and information channel: over 85% of people in the US receive news digitally, and creators reach global audiences through mobile-first platforms such as Instagram and Facebook.[5]

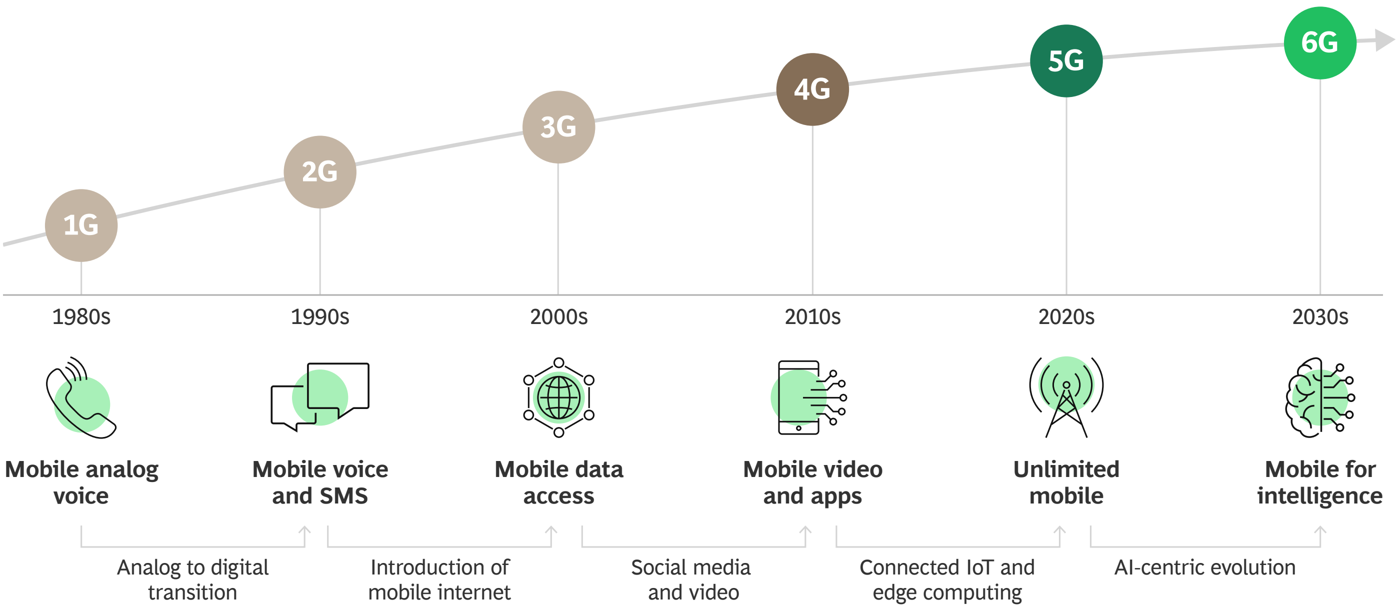
Each generation of wireless technology has delivered new capabilities and fundamentally transformed the ways in which people use their electronic devices. (See **Exhibit 1**.) The analog voice service of 1G gave way to 2G's digital messaging; 3G put the internet in billions of pockets; and 4G enabled mobile video and cloud apps. Today, 5G delivers high speeds and has expanded connectivity beyond smartphones to power IoT devices, industrial equipment, and connected vehicles, while also solving critical capacity challenges in dense urban environments.

This sustained progress reflects the strength of the global wireless ecosystem. Decades of private R&D investment, cutting-edge manufacturing, academic research, contributions from thousands of engineers, and open, consensus-based technology and standards have promoted interoperability, competition, and global scale. These advances also reflect the pivotal role of US companies in helping shape the mobile era and in continuing to influence the next generation of connectivity.

Global, open, industry-driven standards will continue to be an essential mechanism for turning innovation into reality at scale. A shared, standards-based framework allows devices and networks to interoperate globally, reduces deployment risk, accelerates product cycles, and ensures that advances in areas such as sensing, satellite integration, and security can reach scale. Preserving the openness, transparency, and competitiveness of the standards ecosystem is critical as the world prepares for 6G—an era that will merge connectivity, sensing, computing, and intelligence.

EXHIBIT 1

Successive Wireless Generations Have Advanced from Voice to Messaging to Mobile Internet to Computing to Intelligence



Source: BCG analysis.
Note: G = generation; IoT = Internet of Things; SMS = short message service.

3. GSMA, *The State of the Industry Report on Mobile Money 2025* (2025).
4. Mahamadou Kante & Mats Målqvist, "Effectiveness of SMS-based interventions in enhancing antenatal care in developing countries: a systematic review," *British Medical Journal* (February 2025).
5. Pew Research Center, *News Platform Fact Sheet* (September 2025).

The Strategic Imperative of Connectivity Leadership

Wireless connectivity is now a central pillar of economic competitiveness and national resilience. Intelligent manufacturing, digital health, autonomous mobility, and advanced robotics increasingly rely on robust wireless technology for real-time data exchange and AI-driven decision making. The rise of AI-native applications has further amplified the importance of mobile communication. As computing extends across device, edge, and cloud, reliable, wide-area mobile coverage makes it possible to distribute intelligence at scale and communicate between connected endpoints. In other words, the network is no longer a passive medium; it is an active and essential enabler of intelligent systems.

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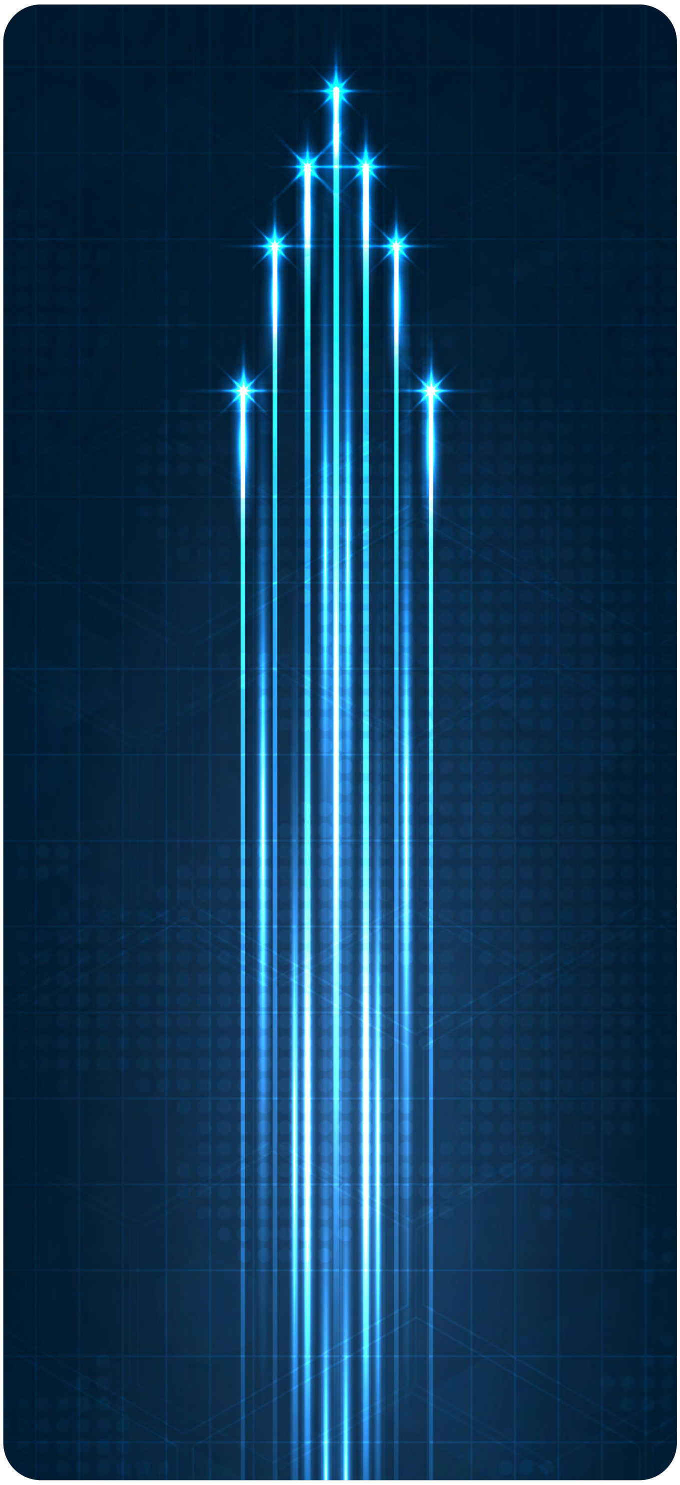
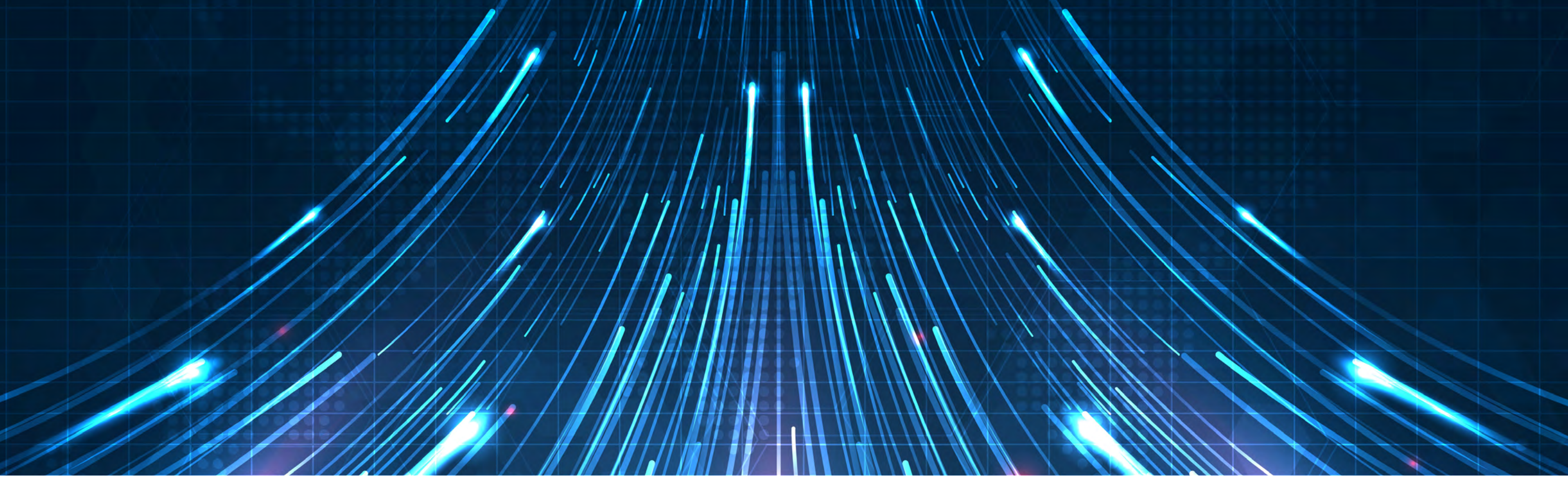


These shifts in functionality have elevated the strategic importance of leadership in developing 6G. Around the globe, nations are racing to advance capabilities, shape standards, invest in R&D, secure talent pipelines, and allocate spectrum. The reason for their attention is clear: leadership in advanced wireless communication influences economic productivity, technological innovation, and global competitiveness.

The story of wireless connectivity is far from complete. As the impact of 5G grows, and as 6G looms on the horizon, the next chapter will determine how intelligence is distributed, how industries evolve, and how fully societies harness the potential of emerging technologies. The US has the opportunity to shape this future, but doing so will require sustained investment and coordinated, forward-looking policy frameworks that continue to fuel innovation while supporting a competitive, secure, and interoperable global ecosystem.



5G: An Evolutionary Leap

In the evolution of connectivity, 5G represents one of the largest step changes in wireless technology—unlocking new capabilities, reshaping digital behavior, and enabling or accelerating new sectors and business models such as the gig economy and the creator economy.

As its advanced features continue to scale globally, 5G will drive value for the next decade and will help build the infrastructure, network, computing, and manufacturing on which 6G will be realized.

A Step Change in Wireless Capabilities

The technical leap from 4G to 5G has been significant across numerous dimensions. Most notably, 5G introduced several features that materially expand what consumers, enterprises, and public institutions can do with wireless connectivity:

- **Faster Speeds and Increased Capacity.** Specifications include peak data rates of up to 10 to 20 Gbps (although typically less than 1 Gbps in practice), up to 20 times faster than 4G.[6] This enhanced level of speed enables near-instant downloads, 4K/8K streaming, fixed wireless access (FWA), and emerging technologies such as augmented reality and virtual reality experiences.
- **Reduced Delay (Latency).** 5G delivers access network response times as low as 10 milliseconds or even less (typically 20 to 40 milliseconds in practice).[7] This enables smooth, glitch-free video streaming for consumers, and real-time applications such as autonomous vehicles, real-time conferencing, cloud gaming, and industrial automation.
- **Ability to Connect Massive Number of Devices.** 5G can support up to 1 million devices per square kilometer simultaneously, a roughly tenfold improvement over 4G.[8] This capability reduces network congestion in areas of dense usage and enables IoT ecosystems, smart cities, and connected industries.
- **Network Slicing.** One network is divisible into multiple virtual networks on the same physical infrastructure, each optimized for a specific need (for example, one slice for emergency services and another for gaming). This makes 5G dramatically more flexible and secure than previous generations of connectivity.
- **Enhanced Spectrum Use.** 5G operates across low-, mid-, and high-band (mmWave) frequencies, enabling operators to balance coverage, capacity, and speed.

6. International Telecommunication Union, *Recommendation ITU-R M.2150* (2017) and *Recommendation ITU-R M.2160: Framework and overall objectives of the future development of IMT for 2030 and beyond* (2023).
7. Ibid.
8. Ibid.

Although faster speeds were largely available at launch, more advanced features such as reduced latency, massive IoT, and network slicing are scaling more slowly. Early deployments relied on existing 4G cores (non-standalone) and lacked uniform mid-band availability and deployment, limiting the performance gains that 5G could achieve at scale. As operators deploy 5G standalone core architectures and continue rolling out 5G Advanced (for example, Release 18), we expect to see greater availability and use of these advanced capabilities. As of 2025, 173 operators across 70 countries had deployed or committed to 5G standalone, laying the groundwork to scale 5G's full capabilities and ultimately transition to 6G.[9]

Reimagining Digital Experiences on a Global Scale

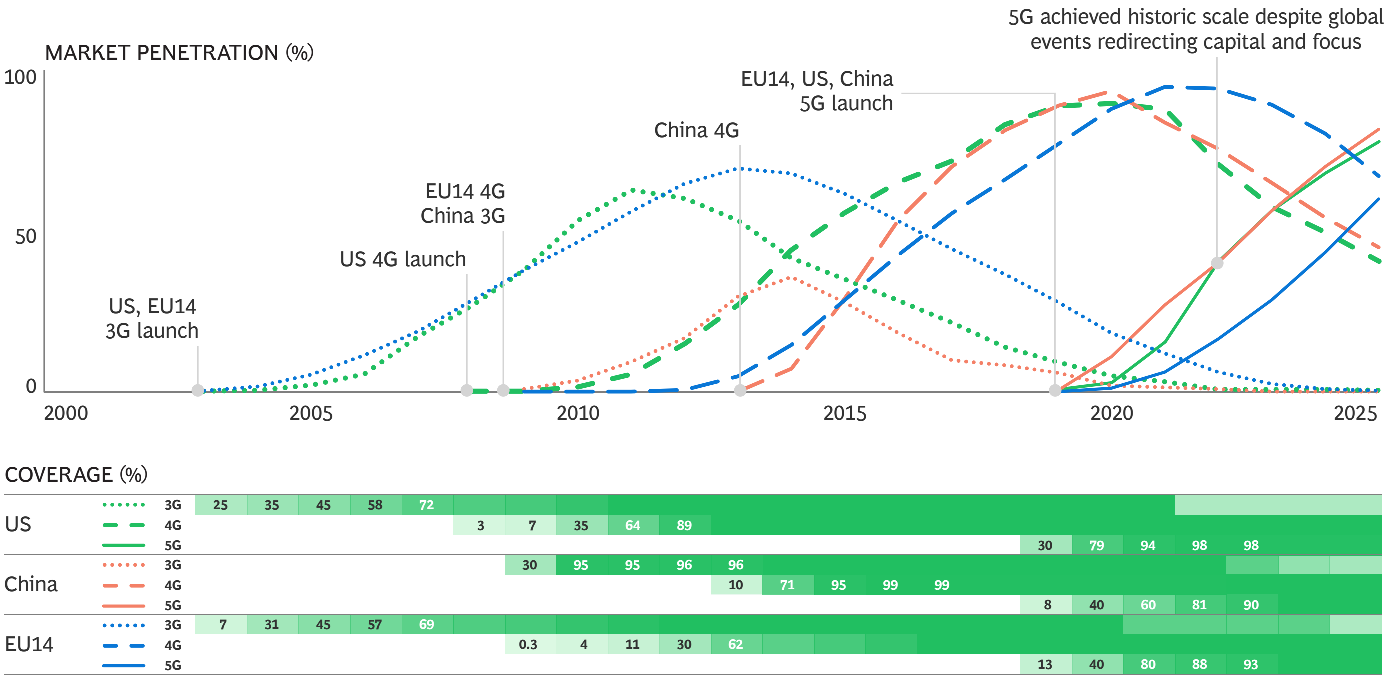
Since its introduction, 5G has rapidly expanded global wireless connectivity and further integrated wireless connectivity into people's everyday lives:

- The total number of global 5G connections is approaching 3 billion in 2025, growing over two times as fast as 4G at the same stage of its rollout.[10] (See **Exhibit 2**.)
- Global average mobile data consumption now exceeds 20 GB per person per month, driven by video consumption, which now accounts for over 75% of wireless traffic.[11] (See **Exhibit 3**.)
- US users consumed a record 132 trillion MB of wireless data in 2024, a 32 trillion MB increase from 2023, marking the largest year-over-year jump in history.[12]
- YouTube alone now serves over 1 billion hours of content every day, with 60% to 70% of views occurring on mobile devices. For their part, Instagram and Facebook Reels register over 200 billion daily views.[13]

EXHIBIT 2

5G Has Unlocked Adoption and Democratized Wireless Connectivity, Providing the Platform and Infrastructure for Future Generations

3G through 5G market penetration and population coverage aligned for the US, China, and the EU



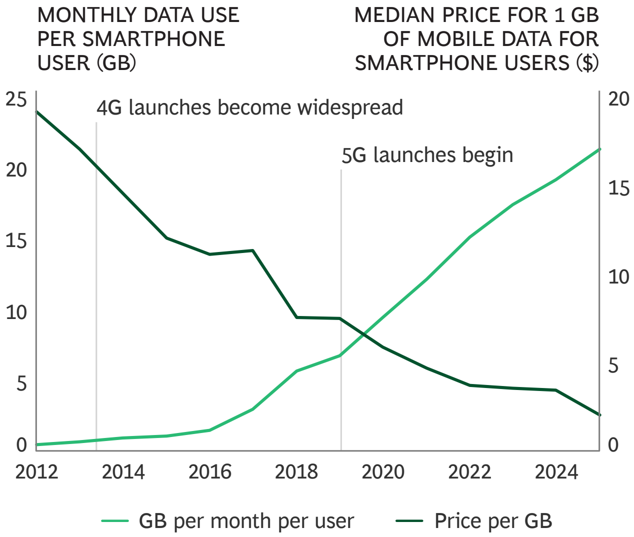
Sources: Omdia Subscriptions & Penetration report; GSMA; BCG analysis.
Note: EU14 represents the members of the European Union in 2000 sans UK. Penetration is the ratio of connections to population. Coverage is the percentage of the population living within range of a cellular signal. G = generation.

9. Global Mobile Suppliers Association, *5G Standalone Report* (August 2025).
10. GSMA Intelligence, *Data Platform* (2025).
11. Ericsson, *Ericsson Mobility Visualizer* (2025).
12. CTIA, *CTIA Annual Survey* (2024).
13. OBERLO, *10 YouTube Statistics Every Marketer Should Know* (2025); Naveen Kumar, "How Many Reels Are There on Instagram." DemandSage (2026).

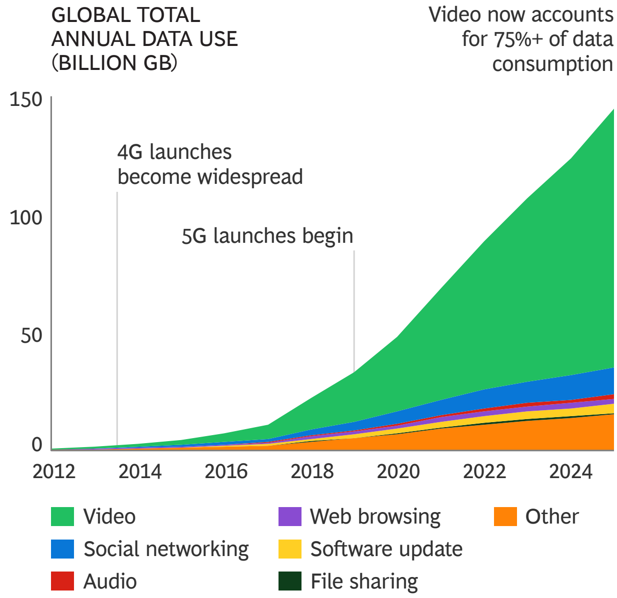
EXHIBIT 3

5G Has Further Integrated Wireless Technology into Everyday Life, Altering the Way Users Engage with Content and Devices

5G has supported continued proliferation of data and further reduced cost of data…



…shifting the way users interact with their devices and with the mobile internet



Sources: Omdia subscriptions; GSMA; Statista subscriptions; ITU; Ericsson Mobility Visualizer; industry reports; press articles.
Note: G = generation; GB = gigabytes.

Meanwhile, the unit price of wireless data has plummeted. US consumers now pay roughly $0.002 per MB, a drop in unit price of more than 90% from a decade ago and a decrease of approximately 60% since 2020—a deflationary trend made possible by 5G.[14]

In other words, 5G has not simply increased connection speeds. It has rewired global digital behavior, fueling new industries, reshaping media, and making always-on high-bandwidth mobile experiences accessible at scale.

> Meanwhile, the unit price of wireless data has plummeted. US consumers now pay roughly $0.002 per MB, a drop in unit price of more than 90% from a decade ago and a decrease of approximately 60% since 2020—a deflationary trend made possible by 5G.

14. CTIA, *CTIA Annual Survey* (2025).

How 5G Is Rewiring the Global Economy

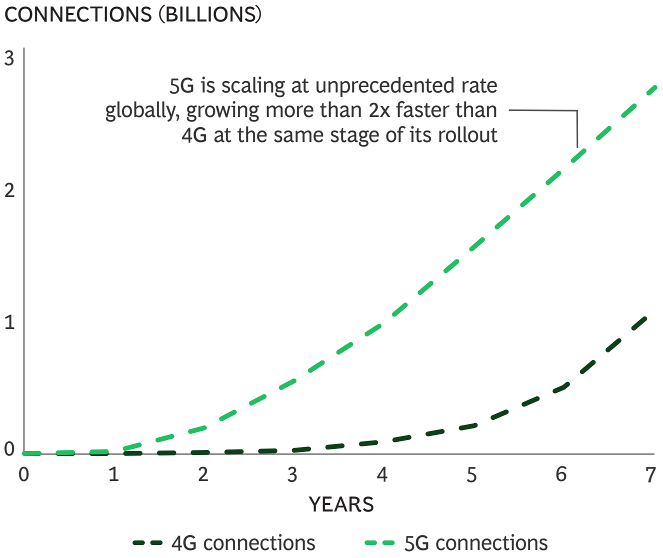
5G's direct economic impact extends across two key dimensions: value unlocked by 5G, which comprises entirely new use cases or industries born out of 5G such as Private 5G for use in industrial applications; and value accelerated by 5G, which includes existing use cases or industries increasing at faster rates due to 5G such as FWA. Our in-depth analysis assessed the impact of 5G's core features on 21 industry-tailored use cases across 27 industries to estimate the value attributable to 5G.

Our analysis suggests that 5G has already delivered over $1 trillion in economic impact globally, including over $400 billion in the US alone. It is important to consider that 5G is still in its early days and that its capabilities are continuing to scale. As adoption expands and enterprise deployments mature, we project that 5G's cumulative global economic contribution will reach approximately $6.1 trillion in 2030 and approximately $18.2 trillion by 2035. (See **Exhibit 4**.) The rapid adoption of AI has had an additive effect on the value of 5G services and will continue to drive significant economic benefit with 5G. Although 6G is set for precommercial launch in 2028 and commercial launch in 2029, we expect that most of the economic impact modeled for the period from 2030 to 2035 will be attributable to 5G, as countries continue to deploy and use its capabilities during the early stages of 6G deployment.

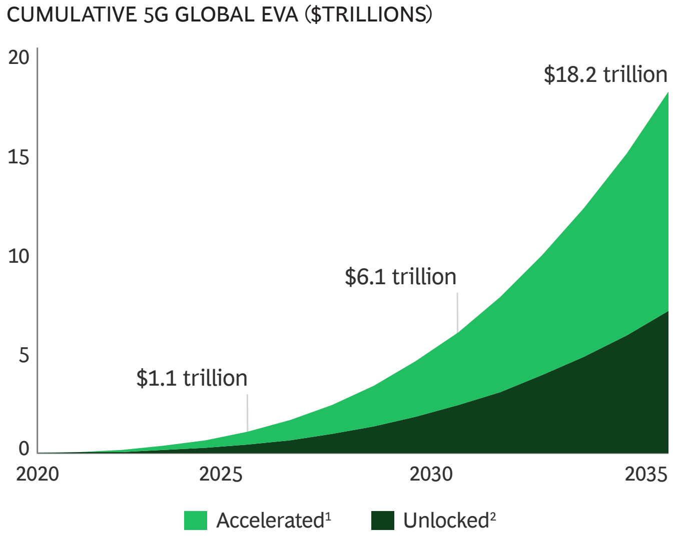
EXHIBIT 4

5G's Adoption Level and Economic Value Added

5G vs. 4G connections globally



Cumulative global upper-limit 5G EVA (accelerated and unlocked)



Source: BCG analysis.
Note: EVA = economic value added; FWA = fixed wireless access; G = generation; IoT = Internet of Things.
[1]Use cases that are further enhanced by 5G (e.g., IoT within manufacturing).
[2]Novel use cases, enabled by 5G (e.g., FWA).

These direct economic effects represent only part of 5G's significance. (See **Exhibit 5**.) Its broader impact is visible in the reshaping of industrial operations, the emergence of new business models, the expansion of digital inclusion, and improvements in public safety and society:

- **Reindustrialization.** 5G is reshaping the industrial landscape in the US and abroad, as 87% of industrial users have reported measurable returns on investment within 12 months of deploying private 5G.[15] A 2025 report published by Nokia estimates that adoption of private 5G in the US will grow eightfold over the next three to five years, driven by the pursuit of greater automation and operational resilience.[16]

- **New Business Sectors and Models.** 5G's higher speeds and enlarged capacity have prompted shifts in consumer behavior (such as video-first) and the growth of new sectors. For example, Lowes Creator estimates the market size of the global creator economy at approximately $250 billion and projects that it will grow to over $1 trillion in the early 2030s, as always-on wireless connectivity continues to expand both content creation and content consumption.[17] Mobile has become a core platform for productivity and commerce, too: it now accounts for about 40% of videoconferencing activity and drives $2.1 trillion in e-commerce sales.[18]

- **Digital Inclusion and Access.** 5G is expanding access to connectivity and helping to close the digital divide. In more than 30 global markets, consumers can now access 100GB+ 5G plans for less than 2% of their monthly income, with prices per GB for 5G service already lower than prices per GB for 4G in almost all markets.[19] In the US, FWA provides high-speed broadband access to over 13 million users, and a study by MoffettNathanson Research anticipates further growth, with FWA connecting approximately 12% of locations eligible for the Broadband Equity, Access, and Deployment program (BEAD).[20] BEAD is designed to extend broadband to remote and underserved areas where fiber buildouts may be too costly or impractical but where FWA can cost-effectively expand coverage. (See **Exhibit 6**.)

15. Nokia, *Industrial Digitization Report* (September 2025).
16. Manufacturers Alliance & Verizon Business, *Connectivity—A Critical Differentiator for Digital Transformation* (2024).
17. Lowes Creator, "How the Creator Economy Is Reshaping Modern Marketing—And Why Brands Are Paying Attention," *Forbes* (2025).
18. Appscrip, *Video Conferencing Market Trends: Opportunities and Challenges* (October 2025); Capital One Shopping Research, *Mobile eCommerce Statistics* (September 2025).
19. GSMA Intelligence, *The State of 5G 2024* (2024).
20. MoffettNathanson Research, *U.S. Wireless and U.S. Broadband: Is the FWA Market Big Enough for Three? A Proprietary Deep Dive* (October 2025); Connected Nation, *BEAD Tracker* (2025).

EXHIBIT 5

Examples of 5G's Impact

Direct

$1.1 trillion
Economic value unlocked or accelerated by 5G

>$120 billion
Auction revenue for 5G spectrum in the US alone

Reindustrialization

87%
Industrial enterprises that achieved measurable ROI within 12 months of deploying private 5G

8x
Expected growth in private 5G deployments in US in the next 3 to 5 years

New business sectors and models

$250 billion
Global creator economy, supported by increased video data consumption

$2.1 trillion
Mobile e-commerce sales

40%
Video conferencing done on mobile

Digital inclusion

<2%
Monthly income that 100GB+ 5G plans cost in over 30 markets

Health and public safety

350
5G-enabled ambulances in the UAE

7.5+ million
FirstNet connections in the US

Societal well-being

~1 million
Visually impaired people who have gained greater independence through 5G-enabled tech

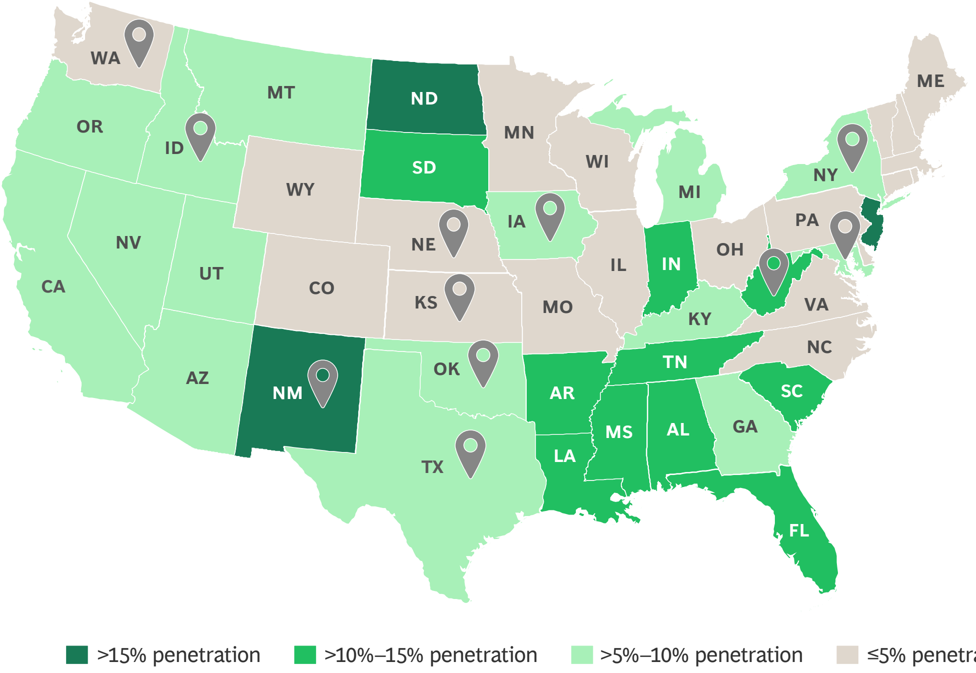
Sources: Nokia; Ericsson; GSMA; ITU; Statista subscriptions; industry reports; press articles; BCG analysis.
Note: G = generation; GB = gigabytes; ROI = return on investment; UAE = United Arab Emirates.

- **Health and Public Safety.** 5G saves lives by enabling remote diagnostics, faster emergency response times, and seamless coordination for first responders and public safety agencies. For example, the UAE deploys 350 5G-enabled ambulances; and in the US, more than 7.5 million 5G FirstNet connections serve the first responder community with high-priority secure connections.[21]
- **Societal Well-Being and Accessibility.** Globally, 5G is helping some 1 million visually impaired people regain independence through assistive technologies (for example, smart glasses) from companies such as Envision, Be My Eyes, and Aira.[22]

21. Ashwani Kumar, "First-ever 5G-powered ambulances to boost emergency care, save lives," *Khaleej Times* (October 2023); Scott Agnew, "Public safety continues to drive FirstNet innovation," FirstNet (2024).
22. Envision, Be My Eyes, and Aira company websites and articles.

EXHIBIT 6

5G Accelerated FWA's Impact on Monetizing 5G and Bringing Underserved and Unserved Consumers into the Digital Age



Key takeaways:

5G FWA has delivered nearly $25 billion in revenue since 2020, and it now serves more than 10 million consumers and nearly 3 million enterprises

Adoption across rural areas is likely to accelerate through BEAD:

- ~**12%** of BEAD locations served were awarded FWA, vs. 7% nationwide consumer penetration in 2025
- **10 states**—most with large rural populations—plan to serve more than 20% of locations with FWA
- **BEAD** de-risks rural deployment costs, so FWA can expand faster than fiber and provide deeper coverage

Sources: S&P Capital IQ; Omdia; NTIA; Connected Nation; OpenSignal; ITU DataHub; MoffettNathanson; Bloomberg; press articles.
Note: BEAD = Broadband Equity, Access, and Deployment; FWA = fixed wireless access; G = generation.

A Roadmap for Future Innovation

The industry's experience with 5G provides a roadmap for designing more effective next-generation networks:

- **Monetization matters.** Despite major capex investments, operators have struggled to monetize many of 5G's advanced capabilities. In designing future networks, planners must consider operators' monetization strategies (such as tiered pricing schemes and differentiated services) and profitability.

- **Spectrum availability, cost, and incentives are critical.** Operators and regions that secured mid-band spectrum, whether through auctions or through coordinated national strategies, saw the fastest early deployment of infrastructure in these frequencies. Early, coordinated spectrum policy, particularly for mid-band spectrum ranges, is critical to successful deployments.

- **Standalone architecture is essential.** Early-stage reliance on non-standalone 4G cores limited functionality and shaped initial perceptions of 5G as just a faster version of 4G. Deploying standalone architecture from the outset is vital to unlocking 6G's full set of capabilities, including native AI, advanced slicing for differentiated services, and integrated sensing and communications.

5G has set the preconditions for the future of connectivity: a world in which connectivity is intelligent, AI native, secure, globally scalable, and capable of orchestrating billions of devices and sensors. In short, 5G is the essential precursor for further entrenching AI in everyday life and for completing the foundation on which 6G will be built.

Connectivity for the AI Era

Early internet platforms required years to reach 100 million users. In contrast, the leading generative AI (GenAI) systems reached that threshold within months, enabled in large part by global connectivity and wireless access.

This acceleration signals a broader shift. AI is becoming a pervasive, general-purpose capability embedded across daily life, industry, and public services from AI copilots on mobile devices to smart infrastructure such as AI-driven traffic coordination. As AI increasingly plays a foundational role in mobile-based interactions (such as mobile-based personalized agents) and evolves from individual, standalone applications into continuous, multimodal agents, wireless connectivity will be an essential determinant of performance.

Two structural transitions are reshaping requirements. First, digital experiences are moving from app-centric interfaces to agent-centric systems that coordinate tasks across tools, channels, and environments. These agents will rely on stable, low-latency connectivity to maintain context and orchestrate optimal workflows in real time. Second, intelligence is shifting from device-centric computing to human-centric ecosystems in which phones, AR and XR wearables, vehicles, laptops, ambient sensors, and supporting networks operate as a single, persistent, interconnected environment. Tasks may begin on one device and conclude on another, requiring seamless mobility and consistent performance across indoor and wide-area networks.

On-device computing and connectivity have been working together in real time. Today, AI-native devices such as smart glasses, inference-optimized laptops, and personal agents operate untethered and in diverse physical settings. (See **Exhibit 7**.) Users now expect their networking experiences to be continuous, coherent, and instantaneous. But for these emerging technologies to achieve mainstream acceptance, network quality of service, latency, and throughput must materially improve.

EXHIBIT 7

Innovation Is Accelerating in Uplink-Heavy and Emerging GenAI-Driven Use Cases

AI is moving from app centric to agent centric and from device centric to human centric

Not exhaustive

Consumer

On-demand AI agents
Highly personalized on-demand AI agents that can communicate and exchange information; designed for specific tasks (e.g., banking, planning)

Always-on AI agents
Highly personalized AI agents that maintain pervasive presence, observe interactions, and overlay information in AR

XR
Extended reality—including AR and VR—covering experiences that range from real-world augmentation to fully immersive virtual environments

Enterprise/business

Massive IoT
Massively numerous devices and sensors with embedded edge AI capabilities to monitor environments, feed industrial or city digital twins, etc.

Autonomous robots
Autonomous vehicles, robots, drones, etc., that continuously collaborate and exchange sensor, video, radar, lidar, and other data to deconflict and operate safely in technology-dense environments

Cobots
Precision robots dynamically configured to work alongside humans or production systems, monitoring environments and exchanging data

These advances are increasing the need for flexible networks with greater versatility to provide untethered GenAI experiences and to perform in use cases that require purpose-built mobile connectivity that unites devices, edge, and cloud

Sources: Interviews with market participants; Ericsson Mobility Report.
Note: AR = augmented reality; GenAI = generative artificial intelligence; IoT = Internet of Things; VR = virtual reality; XR = extended reality.

How AI Is Reshaping Network Demand

AI-native experiences are reshaping not only the amount of traffic networks can carry but also the underlying demand characteristics of that traffic. Historically, wireless networks relied on downlink-heavy applications to bring data from the network to the device for uses such as video streaming and web browsing. The typical ratio was 90% downlink and 10% uplink, where *uplink* refers to sending data from the device to the network (for example, uploading a photo, sending an email message, or making a video call).[23]

The profile for AI applications is fundamentally different. Multimodal assistants, AR and XR devices, and AI-generated content involve traffic that is far more bidirectional and uplink (user-generated content) intensive. Early measurements indicate that common GenAI applications already shift the ratio toward approximately 74% downlink and 26% uplink, and emerging AI use cases are likely to shift this ratio even higher.[24] This represents a dramatic departure from legacy patterns, signaling a shift in network resources, especially spectrum utilization driven by AI and by supporting distributed sensor and UI technologies.

As a result, total mobile data per connection is on track to grow at an annual rate in the high teens through 2030. Composite analyses from Nokia, Ericsson, and ABI Research suggest that the ratio of uplink traffic will grow even faster, with projected annual growth in uplink demand reaching 20% to 35%.[25] These projections reflect the rapid rise of applications that continuously transmit images, video, and sensor data such as radar and lidar. AI agents, AR devices, and XR devices stream data in real time, contributing to estimates in common AI scenarios that uplink's share of total traffic will rise from about 10% today to more than 25%.[26] If personalized, on-demand AI assistants in AR devices reach 40% adoption, uplink traffic for that use case could increase by 100% to 150%.[27] If several such workloads scale concurrently, networks could reach uplink capacity before the end of the decade, resulting in congestion and inconsistent user experience.

Composite analyses from Nokia, Ericsson, and ABI Research suggest that the ratio of uplink traffic will grow even faster, with projected annual growth in uplink demand reaching 20% to 35%.

23. Ericsson, *Ericsson Mobility Report* (June 2025).
24. Ibid.
25. Ericsson, *Ericsson Mobility Report* (June 2025); Nokia, *Global network traffic report* (2025).
26. Ericsson, *Ericsson Mobility Report* (June 2025).
27. Ericsson, *Ericsson Mobility Report* (November 2025).

Distributed Intelligence Across Device, Edge, and Cloud

Increased use of AI and the complexity of AI functions will require increasingly voluminous computing resources. As computing demands intensify and mobile AI applications such as always-on AI agents evolve, networks will distribute the computing function across environments on the basis of task complexity. Workloads will move dynamically in response to latency, privacy, bandwidth, energy, and cost constraints. This distributed model will require network performance that is more symmetrical, predictable, and reliable than 5G can deliver at scale.

No single computing resource layer—whether device, edge, or cloud—can satisfy the needs of real-time, multimodal mobile AI at scale. Instead, mobile AI systems will operate across a balanced hybrid platform composed of three tightly integrated environments (see **Exhibit 8**):

- **On-device computing** supports sensing, inference, and user interaction that require near-zero latency. This environment keeps sensitive data local and reduces the amount of information traversing the network.

- **Telco edge computing** handles workloads that exceed device capabilities but cannot tolerate latencies beyond the telco edge. Examples include AR and XR rendering, perception workload for XR, and AI workloads such as real-time image and video processing and conversational AI assistants capable of interacting with minimal delay. This resource layer reduces backhaul to core by processing data close to the source.

- **Cloud computing** provides hyperscale capacity for model training, global model hosting, orchestration, and heavy workloads (such as GenAI), ensuring consistency across large application populations.

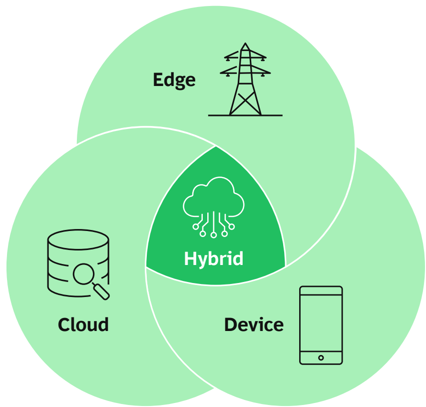
As computing capabilities and use case demands evolve over time, the distribution of computing tasks across device, edge, and cloud will shift dynamically as part of a hybrid computing environment optimized for performance, energy, and cost. Network quality and integration (wireless and fiber) will be crucial to enabling this distribution to work seamlessly at scale—maintaining context, directing data paths, and ensuring predictable performance across heterogeneous environments with dynamically varying radio and network congestion environments. Consistently delivering the necessary service requires wireless networks that are as reliable and stable as the fiber networks beneath them. The associated performance demands exceed the design parameters of 5G and underscore the need to engineer 6G networks for AI-native, distributed intelligence.

EXHIBIT 8

Computing That Balances Cloud, Edge, and Device Is Emerging as a Potential Way to Meet Evolving Needs

Not exhaustive

Device Executes real-time, mission-critical decisions that require low latency and low computing power	· Agentic personal AI assistants (e.g., local reasoning, object identification) · IoT sensors (e.g., anomaly detection) · Smartphone AI applications (e.g., summaries, image edits)
Edge Offers high-efficiency computing that has lower latency and doesn't overload the central network	· Autonomous vehicle coordination across fleets · Energy-demanding, time-sensitive AI models · AR/VR rendering offload (e.g., spatial content for Meta Quest) · Smart-grid control (e.g., distributed monitoring and optimization of energy loads)
Cloud Provides highest-efficiency computing suitable for large tasks with less critical latency needs	· Model training, hosting, and updates · Execution of the most energy-demanding large language models · Large-scale video generation and rendering



Future use cases will require a balanced mix across the three types, given bandwidth, latency, security, efficiency, and scalability needs

Source: BCG analysis.
Note: AR = augmented reality; IoT = Internet of Things; VR = virtual reality.

Five Connectivity Imperatives for the AI Era

6G is the first wireless network infrastructure that will fully enable AI-native workloads at scale—uplink intensive, latency sensitive, mobility dependent (for example, on-the-move use cases without access to Wi-Fi such as AR and XR or autonomous vehicles), and spatially aware. These workloads will increasingly be driven by agentic AI that can perceive context and act in real time. 6G will extend 5G's advances with improved performance, integrated sensing, and hybrid AI architectures, allowing AI systems to operate continuously and autonomously. In parallel, it will enable the edge to continuously collect real-world data for physical AI—drones, robots, and connected vehicles—that will generate large volumes of additional real-world data. This data will be used to train and refine AI models and will be a key driver of AI success and competitiveness.

To support ubiquitous, agent-based AI, networks must evolve into intelligent and adaptive platforms that can coordinate computing and dynamically manage variable workloads in erratic radio and network congestion environments:

- **Uplink Bandwidth.** AI agents, AR or XR devices, and sensor-rich environments create sustained uplink demand when in use. Most of today's time division duplex networks (in which both uplink and downlink traffic use a single frequency band) operate with fixed downlink–uplink ratios that favor downlink and are largely driven by video. As a result, today's wireless network capacity is biased toward downlink, limiting upstream capacity. Scaling AI workloads will require not only additional spectrum, but also networks that are designed for much higher uplink and downlink.

- **Latency and Jitter.** Interactive AI, synchronized industrial robotics, unmanned aerial vehicles, and immersive experiences increasingly demand predictable and consistent responsiveness (deterministic latency). The current typical mobile latency of 20 to 40 milliseconds is insufficient; many AI-native workloads require latency of less than 10 milliseconds, and some require less than 5 milliseconds with tight jitter control.

- **Coverage and Density.** AI experiences must function across a wide range of environments. Consumer applications (for example, on-demand AI assistants) will move between locations such as homes, workplaces, and public spaces and across multiple personal devices such as glasses, wearables (for instance, AI necklaces and smart bracelets), and smartphones, while industrial AI applications may operate across factories, warehouses, and transportation corridors. Achieving the necessary coverage will require denser deployments, improved indoor penetration, multidevice collaboration and greater integration of nonterrestrial networks to create continuous multidevice coverage wherever needed.

- **Security and Privacy.** Developments in AI inevitably offer malicious actors a set of advanced tools for attacking infrastructure such as wireless networks. To mitigate future vulnerabilities, future networks will need adaptive, AI-driven defenses, zero-trust architectures, and post-quantum cryptography to safeguard data, models, devices, and workloads in an increasingly dynamic threat environment.

- **Native Intelligence.** As billions of intelligent devices and AI applications drive increasingly dynamic network traffic, current approaches to network management will not be viable. Networks must continuously learn, predict demand, and optimize resources in real time to maintain consistent performance, provide differentiated services, and efficiently use network and device resources, including energy.

> 6G will enable the edge to continuously collect real-world data for physical AI—drones, robots, and connected vehicles—that will generate large volumes of additional real-world data.

Without the allocation of additional licensed mobile spectrum and advances in hardware and software, networks will face congestion, inconsistent AI performance, and a degraded user experience, limiting the adoption and economic impact of next-generation AI systems. In the AI era, connectivity is the substrate of intelligence. The networks built during this decade will determine not only the level of AI performs, but also the pace and scope of innovation that AI will enable.

The Foundation and Future of 6G

The shift described in the previous section of this paper reveals a structural mismatch between AI-native workloads and current wireless network architectures and design.

Networks built for downlink-dominant broadband cannot support sustained and concurrent uplink traffic (that is, many users at the same time), real-time multimodal perception, or coordinated interaction across devices, edge nodes, and cloud regions. 5G Advanced can address early versions of these needs for a small number of users, but the full model of continuous, agent-based intelligence requires an architecture designed for predictable performance and integrated computing. This transition sets the stage for 6G. (See **Exhibit 9**.) 6G's advanced connectivity promises multiple breakthroughs:

- **AI is exposing gaps in today's networks, and 6G is the fix.** 5G was built for downlink, but AI applications need sustained uplink and predictable performance, which 6G is being designed for.
- **6G will enable a real-world data engine for AI.** 6G will support continuous collection of real-world data from the edge at scale, which can be used to advance AI models further.
- **6G will be the underlying fabric for scaling physical AI.** New networks with 6G will provide the always-on connectivity, coordination and hybrid AI architectures that drones, robots, and connected vehicles require to deliver enhanced capabilities.
- **Public safety demands 6G's resilient connectivity.** Secure control, precise location, reliable communications, and wireless sensing matter most during disasters.

Breaking Through Connectivity Bottlenecks

With an expected commercial launch in late 2029 or early 2030, 6G targets major improvements across five dimensions that correspond directly to the bottlenecks we discussed earlier:

- **Uplink at Scale.** 6G will increase spectral efficiency by about 50% over 5G and will double uplink cell-edge throughputs in the same spectrum band.[28] Access to additional upper mid-band spectrum combined with advanced antennas could increase spectral efficiency four- or fivefold by modifying network (for example, radio) design and scheduling to support increased upstream data needs. This change supports multimodal perception and telemetry without exceeding network capacity or degrading other users' experience, assuming sufficient network density and proper deployment of network resources.

28. Tingfang Ji, *6G Foundry: The next air interface for a more capable, connected future*, Qualcomm (August 2025).

EXHIBIT 9

6G Will Remove Multiple Connectivity Bottlenecks and Offer Significantly Enhanced Capabilities

Breaking through connectivity bottlenecks

Uplink at Scale. AI in the real world must continuously send large amounts of sensor and video data

Native Intelligence. AI-scale complexity requires real-time, intelligent control of traffic, computing, and performance

Ubiquitous Coverage. AR/XR and autonomous systems need reliable performance while moving

Lower Latency and Predictable Jitter. Reliable timing is essential for safe autonomy and natural human-AI interaction

Increase Security and Resilience. Zero-trust continuous authentication and resilience are essential as AI moves into real-world systems

6G is being built to address each of these bottlenecks

New and improved capabilities

Integrated Sensing. Native sensing and precise positioning enable context-aware AI and safer autonomy

Distributed Intelligence. 6G orchestrates end-to-end computing, making AI to be faster, more reliable, and scalable in real time

Context-Aware Multidevice Collaboration. 6G enables devices and machines to coordinate actions instantly, unlocking systems of AI, not just apps

Differentiated Services at Scale. 6G moves beyond best-effort connectivity, delivering the right latency, reliability, and security for each use case

Layered and Resilient Network Architecture. 6G unifies terrestrial and nonterrestrial layers so AI services remain available across geographies and conditions

6G will bring new monetizable capabilities to the market

Sources: BCG analysis.
Note: AR = augmented reality; XR = extended reality.

- **Lower Latency and Predictable Jitter.** 5G improved average wireless access latency, but current wireless networks cannot guarantee consistent performance under load. 6G targets predictable radio access latency in the single-digit millisecond range with tight jitter bounds. This is essential for natural AR interactions, coordinated robotics, real-time digital twins, and closed-loop control in energy, health, and industrial systems. Deterministic latency, rather than peak performance, ensures that the system will satisfy its service-level guarantees, assuming the correct engineering of the rest of the network.

- **Ubiquitous Coverage.** 6G integrates terrestrial and satellite layers to provide wide-scale deployment of seamless connections across rural regions, mobility corridors, and indoor environments. Nonterrestrial networks (for example, satellites) complement higher-band access to ensure global reach, enabling wide-area, continuous connectivity across all geographies. Collaborative communications will also allow multiple devices to aggregate network resources to improve throughput at the edge of coverage, while reducing power consumption on form-factor-limited devices such as AR glasses.

- **Increased Security and Resilience.** 6G incorporates post-quantum cryptography, zero-trust architectures, and AI-native threat detection. These capabilities offer further protection to systems such as network traffic and applications even as the threat landscape evolves and the number of connected devices proliferates.

- **Native Intelligence.** 6G embeds intelligence across the wireless network technology stack (including hardware, software, and protocols), supporting real-time orchestration of device, edge, and cloud computing. Networks will continuously learn, adapt, and optimize diverse resources. Innovations include application of advanced beamforming for higher spectral efficiency, adaptive routing for lower latency and greater resilience, and strategic workload placement to maximize overall service capacity in response to context and user needs. Increasingly intelligent devices will support this network intelligence, providing flexibility to adapt behavior on the basis of application requirements, user context, and network conditions.

From Enhanced Connectivity to New and Improved Capabilities

6G's performance gains are critical for meeting increasing traffic demands and for enabling new network functions:

- **Integrated Sensing.** 6G introduces wide-area sensing into the communication layer. Higher-frequency bands, large antenna arrays, and reconfigurable intelligent surfaces (programmable surfaces such as a window containing small elements that intelligently reflect, refract, or absorb radio waves) allow networks to detect motion, positioning, and environmental conditions. These capabilities strengthen autonomous vehicle safety, enhance AR and robotics, improve infrastructure monitoring, and provide richer context for AI models.

- **Distributed Intelligence in the Radio Access Network (RAN).** Traffic patterns are becoming more complex and variable. 6G radio access networks will rely on AI-native controls and edge inference to manage thousands of tunable parameters per radio. Next-generation RAN intelligent controllers and user devices will work together to optimize resources and coordinate spectrum bands of operation, handovers, beamforming, and quality-of-experience policies in real time within the single unit and across the cell. This will enable networks to support shifting loads generated by AI agents, industrial systems, and immersive applications.

- **Context-Aware and Multidevice Collaboration.** Consumers will carry multiple, increasingly intelligent cellular connected devices—such as smart glasses, AI wearables, pucks, and phones—that will work seamlessly together with the network to deliver a superior user experience. In addition, networks and devices will collaborate closely and dynamically to adapt to changing user contexts, device capabilities, and traffic conditions in real time.

- **Differentiated Services at Scale.** 6G will enable differentiated services at scale by dynamically aligning network behavior with the specific requirements of each traffic flow. AI-native capabilities will allow the network to continuously tune radio and scheduling parameters—balancing uplink, latency, coverage, and other variables—so that diverse applications, from AI agents to immersive communications, receive the specific connectivity profile they require in real time.

- **Layered and Resilient Network Architectures.** By combining terrestrial and satellite assets, 6G can improve system resilience. Critical services such as emergency response and logistics coordination can continue even when individual components are impaired, albeit at varying levels of performance; direct-to-device, for example, will likely have lower performance. This resilience increases national infrastructure's reliability and reduces its vulnerability to climate events or geopolitical disruptions.

These capabilities enable 6G networks to support untethered devices such as AI assistants, industrial robots, autonomous vehicles, and AR wearables without hitting limits in uplink, responsiveness, mobility, or reliability.

Transformative Use Cases for 6G

Although many AI applications can operate on 5G Advanced, 6G will be necessary for categories where uplink, responsiveness, and spatial precision are essential. (See **Exhibit 10**.) Five use cases are especially likely to benefit from 6G:

- **Industrial Automation and Reindustrialization.** Real-time digital twins for industrial automation and smart maintenance, industrial sensor networks for safe production, and cooperating mobile robots for flexible manufacturing require capabilities such as ultralow latency and jitter, integrated sensing and positioning, high-density device support, and robust uplink.

- **Public Safety.** Autonomous rescue drones, first responder systems, real-time situational awareness (of wildfires, for instance), and manned-unmanned teaming in hazardous environments require capabilities such as secure control channels, precise localization, wide-area coverage in settings such as mountains or at sea, resilience (including self-healing) during partial network failures, and predictable and consistent latency and jitter for autonomous vehicles and other mission-critical use cases.

- **Immersive and Interactive Experiences.** High-resolution AR overlays, holographic interaction, and multisensory events for entertainment and education (such as immersive training) require bidirectional uplink and downlink throughput at scale and predictable and consistent latency and jitter to enhance realism and avoid motion sickness.

- **Smart Cities and Infrastructure.** City-scale digital twins for traffic optimization or resource allocation, autonomous transportation, and dense environmental sensing for air quality or other environmental hazards depend on capabilities such as high device density, integrated sensing, wide-area coverage, and predictable and consistent latency and jitter for connected transportation.

- **E-Health and Assisted Care.** Continuous biometric monitoring, remote diagnostics with high-resolution sensor data, robotic assistance in home and clinical settings, and advanced remote procedures rely on capabilities such as predictable and consistent sub-10-millisecond access latency (for robotics), strong uplink, and uninterrupted coverage across homes, clinics, and mobile environments.

Three Key Enablers of 6G

Delivering these capabilities will require coordinated progress in three areas:

- **Spectrum.** 6G will demand a huge increase in capacity. New wide-channel (up to 400 MHz) mid-band allocations will expand capacity and enable capabilities such as high-resolution sensing. AI-optimized scheduling will reduce cost per bit and improve spectrum utilization. Early clarity on spectrum allocations is essential for long-term planning and will impact radio engineering and semiconductor design.

- **Software.** AI-native architectures, including intelligent routing and granular slicing, will determine where data processing occurs, how workloads move across devices, edge, and cloud, and how multiple devices collaborate with the network to produce seamless experiences. Self-healing capabilities will reduce downtime and improve energy efficiency, allowing the radio access network to function as an effective and reliable part of the overall network.

- **Hardware.** Advances in antennas, radios, and components—including advanced semiconductors for modems and massive MIMO evolution—will enable multilayer, multiband operation and intelligence at the network edge, with improved reliability and coverage.

These enablers must advance together. The regions and industries that shape 6G spectrum plans, reference architectures, and standards will influence the performance of future AI systems and the distribution of economic value.

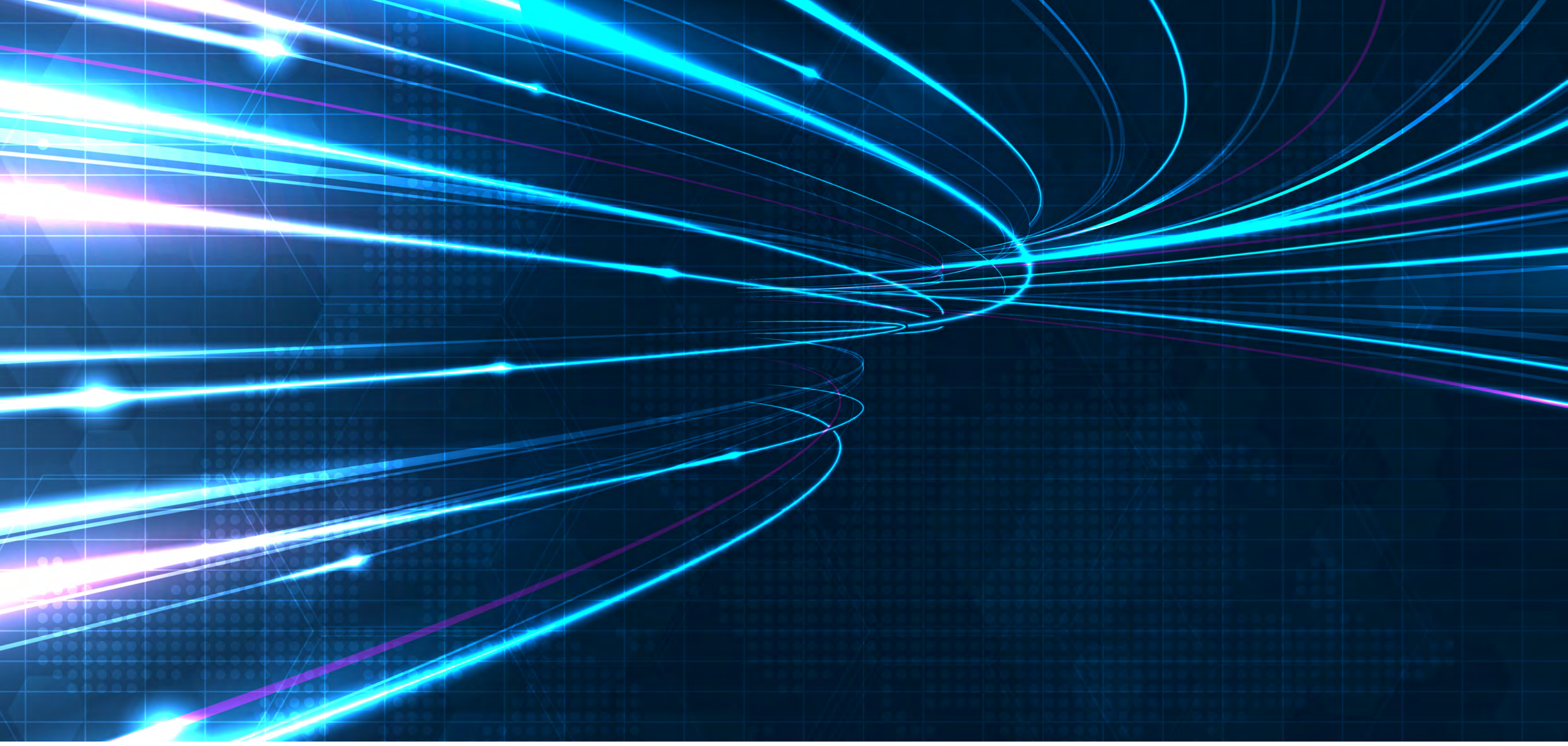
EXHIBIT 10

6G Will Powerfully Enhance Existing Use Cases and Enable New Ones Beyond GenAI at Scale

Not exhaustive

Category	Use cases	Expected benefits	Requirements
Industrial automation and reindustrialization	· Real-time digital twins for industrial automation and smart maintenance · Industrial sensor networks for safe production · Cooperating mobile robots for flexible manufacturing	· Cost reduction · Efficiency improvements · Increased production volume · Improved workplace safety	· Ultralow latency and jitter · High reliability · Integrated sensing and positioning · High-density device support · Robust uplink
Public safety	· Autonomous rescue drones · First responder systems (e.g., for wildfires) · Real-time situational awareness · Manned-unmanned teaming in hazardous environments	· Faster response times · Safer operations · Improved mission success in degraded/dangerous conditions	· Secure control channels · Precise localization · Wide area coverage (e.g., in mountains, at sea) · Resilience during partial network failures (e.g., self-healing)
Immersive and interactive experiences	· High-resolution AR overlays · Multisensory events for entertainment and education (e.g., immersive training) · Holographic interaction	· More natural remote interaction · Improved training · New creative/entertainment formats	· Bidirectional throughput (uplink and downlink) · Predictable and consistent latency and jitter to enhance realism and avoid motion sickness
Smart cities and infrastructure	· Autonomous transportation · Dense environmental sensing for air quality or other environmental hazards · City-scale digital twins for traffic optimization or resource allocation	· Reduced congestion · Lower emissions · Improved public services · Resilient infrastructure management	· High device and IoT sensor density · Integrated positioning and sensing · Uniform coverage over large areas · Predictable and consistent latency and jitter for connected transportation
E-health and assisted care	· Continuous biometric monitoring · Remote diagnostics with high-resolution sensor data · Robotic assistance in home and clinical settings	· Earlier intervention (i.e., more lives saved) · Expanded access to specialists and services	· Strong uplink for sensor-rich data streams · Predictable and consistent sub-10-ms access latency and jitter (for robotics) · High reliability and wide area coverage

Sources: Interviews with market participants; BCG analysis.
Note: AR = augmented reality; G = generation; GenAI = generative artificial intelligence; Internet of Things; ms = millisecond.



Policy Implications for Next-Generation Connectivity

The progress from 5G to 6G reflects connectivity's continuing evolution as the linchpin of economic value creation, global competitiveness, and technological resilience.

As networks become AI-native, distributed intelligence platforms, innovation will increasingly depend on a consistent and coherent policy frameworks that align public and private priorities.

Four Policy Levers for the 6G Era

Policymakers will play a decisive role in shaping this future, particularly in ensuring access to the spectrum resources needed to scale next-generation systems; fostering open, industry-led standardization processes; incentivizing critical R&D; and cultivating talent.

Spectrum: Ensure Access to the Core Input of Wireless Innovation

Spectrum is the basic raw material of wireless connectivity. Allocating additional spectrum resources has always been essential to enabling mobile services to serve an ever-expanding market of users and applications economically. Early mobile telephone service in the US operated in a small number of channels over an entire city, which limited service to a few dozen concurrent users. The cellular mobile telephone service introduced in the 1980s changed that situation by reusing the same frequencies across many low-power cells, and later generations increased capacity further by developing advanced modulation approaches to allow more bits to be sent per Hertz of spectrum. The result was a step-change increase in the number of people and devices that mobile services could support.

Nevertheless, spectrum remained a constraint, and opening new radio channels—typically at higher frequencies—was the only effective and economical way to accommodate the billions of users that use mobile services today. As consumers and advanced use cases demand higher speeds, always-on connectivity, and improved reliability, networks needed access to more spectrum. 6G will be no different: it will require additional spectrum and wider channels to support increasing data demands and advanced capabilities for AI, XR, and ballooning mobile video and gaming needs.

Many countries already allocate mid-band spectrum for 6G deployments and piloting testbeds. Examples include Europe's RSPG 6G strategic vision and various Asia-Pacific spectrum roadmaps.

To ensure adequate 6G spectrum resources, policymakers should consider three key actions:

- **Develop a national spectrum roadmap for 6G.** This roadmap should include specific bands and timelines for late-2029 or early-2030 deployments.

- **Ensure transparent, efficient allocation mechanisms.** The goal here is to provide industry with long-term certainty about infrastructure and equipment investments.

- **Prioritize allocations of exclusively licensed mobile spectrum for operator deployments.** Planners should continue to explore coexistence and sharing approaches, supported by AI-driven tools, but at the same time they must ensure guaranteed spectrum access to wireless network operators.

Timely spectrum decisions are essential. Delays will reduce a region's attractiveness for early 6G deployments, slow network buildouts, and hinder innovation and economic growth.

Standards: Shape the Rulebook for the Next Decade

Standards shape the technical, economic, and geopolitical foundations of wireless ecosystems. Historically, nations and companies that led in standards development have also led in value capture. For over 30 years, Western companies have driven the development and standardization of the technologies that powered 2G through 5G.

Each generation builds on the foundations of its predecessor. The Third Generation Partnership Project (3GPP) has already confirmed that many core technologies developed for 5G—including channel coding and beamform modulation—will carry forward into 6G. Thanks to this continuity, companies at the forefront of 5G innovation are likely to lead in 6G as well.

Nevertheless, the competitive landscape is shifting. Companies from regions such as China have expanded their role in standards development, and countries such as South Korea and India have articulated ambitious targets to secure significant shares of 6G standard-related patents. In short, competition for leadership in the development of global standards has intensified.

Nations that want their companies to lead must adopt a comprehensive strategy that fosters cutting-edge R&D, cultivates talent, and ensures active participation in international standards bodies.

A key lesson from the 5G era is that leadership in wireless connectivity has often been mischaracterized, with commentary conflating two distinct concepts: leadership in standards development, which involves shaping the technical direction of global standards and developing foundational technologies; and leadership in deployment, which affects how quickly and widely implementation of those standards occurs domestically.

Standards leadership determines who defines the technologies embedded in future networks, while deployment leadership determines who captures the earliest economic and societal benefits. A country may excel in one while lagging in the other. Optimal competitiveness requires strength in both.

For policymakers worldwide, three priorities related to the standard development process are critical:

- **Preserve open, rules-based standards bodies.** Such bodies promote merit-driven technical evaluation, which guards against dominance by any single nation or bloc. This approach fosters global trust, encourages broad participation, and allows companies to compete on the basis of technical merit.

- **Encourage full participation by domestic technology leaders.** Participants should include research institutions, network companies, device manufacturers, and semiconductor firms to ensure that local innovation directly influences next-generation specifications.

- **Support long-term investment in foundational technologies.** The greatest influence on standards comes from impactful technological contributions, not number of chair positions, contribution counts, or patent filing submissions. Sustainable R&D investment ensures that resources flow to the innovations that matter and strengthens the technical foundations for future global standards.

As integrated sensing, AI-native networking, multidevice collaboration, and distributed computing become central to 6G architectures, standards decisions made over the next five years will shape global technology ecosystems and long-term value distribution.

R&D: Support Innovation and Protect Intellectual Property

6G will not emerge from incremental improvements. It requires fundamental advances in radio technologies, device–edge–cloud computing fabrics, wide-channel spectrum operations, and AI-driven network intelligence. These breakthroughs demand long-horizon R&D. Companies that focus on core wireless technologies continue to invest a large share of their revenues (about 20%) in R&D. That percentage exceeds the number in most other industries and is in line with other R&D-intensive industries such as pharmaceuticals. It also far surpasses the percentages committed by large tech companies such as Apple (approximately 8%), Amazon (approximately 14%), and Google (approximately 15%).

To support this innovation, policymakers can take the following actions:

- **Ensure robust and predictable global protection and enforcement systems for intellectual property (IP) and patents.** Doing so will enable innovators to reap returns on successful R&D and reinvest in the innovation cycle. For decades, Western leaders in wireless communication have relied on licensing to sustain ongoing investments in R&D. When IP enforcement becomes uncertain, it deprives creative companies of the revenue that fuels investments in R&D, undermining their ability to innovate and to compete for standard leadership.

- **Support long-horizon R&D.** Such support can take the form of targeted and consistent incentives and investments, tax measures, and competitive research programs that align with national technology roadmaps.

- **Implement investment tax credits for advanced technology design expenditures.** Investment tax credits reflect the rising cost and complexity of designing fundamental technologies that will underpin next-generation networks.

- **Encourage collaborative models of innovation linking universities, firms, and research labs.** Collaborative models are especially valuable in the areas of AI-native architectures, advanced semiconductor design, and novel radio systems.

Regions that underinvest in R&D may find that they have limited influence over standard development, must depend on foreign technology baselines, and ultimately incur higher long-term costs to achieve integration and compliance.

Talent: Build the Workforce for AI-Native Connectivity

Global competition for advanced wireless and AI talent is increasing. Several regions have launched national initiatives to expand their technical capacity, such as Europe’s Deep Tech Talent Initiative and various research partnerships linking academia and industry. Similarly, China has introduced coordinated national talent programs and high-skill recruitment pathways such as K-Visa to strengthen its 6G workforce and deepen global collaboration across universities, research institutes, and industries, as with IMT-2030.

Talent policy frameworks guarantee sustained focus on two horizons: near term priorities and longer term opportunities.

In the area of near-term priorities, several measures are useful:

- **Expand opportunities for advanced technical education and applied research.** This includes sponsoring or encouraging fellowships, research programs, and cross-sector partnerships.

- **Incentivize investment in wireless research centers at leading universities.** The goal here is to expand the available talent pool through hands-on experience.

- **Prioritize early STEM education.** States can integrate engineering and computer science into core middle-school curricula to begin developing pipelines of technically proficient workers. In tandem with this initiative, prioritize affordable access to industry-aligned hardware, software, and tools that can help prepare students for high-skilled technical jobs.

With regard to longer-term opportunities, two steps are especially noteworthy:

- **Promote skills- and experience-based hiring in AI and machine learning (ML), software-defined networking, cybersecurity, and distributed systems.** At the same time, planners should recognize that some specialized roles will still require deep formal engineering training.

- **Develop programs that build expertise in wireless engineering, AI and ML, radio frequency systems, semiconductors, and security.** These skills are essential for developing and deploying next-generation networks.

Regions and nations that build and maintain strong talent pipelines will gain resilience, agility, and deeper participation in shaping 6G ecosystems.

A Rapidly Shifting Global Landscape

Technology leaders worldwide are moving quickly across standards, R&D investment, talent development, and spectrum planning. National programs increasingly integrate their efforts across these dimensions, supported by public–private partnerships and targeted industrial strategies. In parallel, global AI competitiveness is tightening. Multiple countries are closing the Top-Ranked AI Nations innovation gap through increased computing investment, new model development, and reforms that improve data accessibility.

As architectures converge around AI-driven networks, regions that most effectively align connectivity, computing, and intelligence will shape global ecosystems and the economic platforms built on top of them.

A Pivotal Moment for Global Connectivity

Policy choices made during this formative period will determine whether 6G's next-generation connectivity becomes a driver of economic dynamism, industrial modernization, and secure digital infrastructure, or a source of technological dependency. By coordinating committed and sustained action across standards, R&D, talent, and spectrum, policymakers can help establish open, innovative, and resilient 6G ecosystems that will deliver long-term societal and economic benefits.

The connectivity systems built during this decade will define the future global architecture of intelligence. Policymakers who act cohesively and decisively will play a central role in shaping how tomorrow's networks support growth, innovation, and opportunity.

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