The Mobile Economy
North America
2022

GSMA Intelligence

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Executive summary

Connectivity set to power post-pandemic economic recovery

> Mobile networks are vital to economic recovery and the realisation of green and digital transformation across North America.

Mobile technology has been at the core of digital transformation across society. During the pandemic, mobile acted as a critical lifeline for consumers and it is set to play a crucial role in defining the 'new normal'. Throughout the pandemic and the ongoing conflict in Ukraine and supply-chain disruptions, the mobile industry has continued to bring connectivity to people. It also continues to invest in network coverage and capacity expansion to help people interact with the communities and environment around them.

Mobile networks are vital to economic recovery and the realisation of green and digital transformation across North America. In 2021, the US Congress passed an infrastructure bill, which allocates about $65 billion in federal funding toward expanding broadband access and 5G connectivity nationwide. In Canada, the government has recently established the Universal Broadband Fund, a CAD2.75 billion ($2.1 billion) investment to support high-speed internet projects across the country, including mobile internet projects in underserved areas. These developments highlight the opportunity for operators to partner with governments to improve connectivity across society and drive post-pandemic economic recovery.

5G momentum continues to build

The US and Canada are among the global leaders in terms of 5G adoption, reflecting the ambitious 5G deployment plans of operators and a rapidly expanding device and content ecosystem. 5G will account for almost all mobile capex in the period to 2025 as operators step up deployments of mid-band spectrum, taking overall population coverage to 92% in Canada and 100% in the US by 2025. At that time, 5G will account for almost two thirds of total mobile connections across North America, which is equivalent to nearly 280 million connections.

The rise of 5G means that 4G is declining rapidly and will fall behind 5G in terms of adoption for the first time in 2023. However, this trend is not uniform; 4G adoption will continue to rise across the Caribbean for the foreseeable future. In many of these markets, 5G is a medium-to-long-term prospect, as operators look to maximise existing 4G capacity. By 2025, 4G will account for a third of mobile connections across North America, down from around three quarters at the start of 2022.

Mobile adoption slows, but smartphone adoption still has headroom to grow

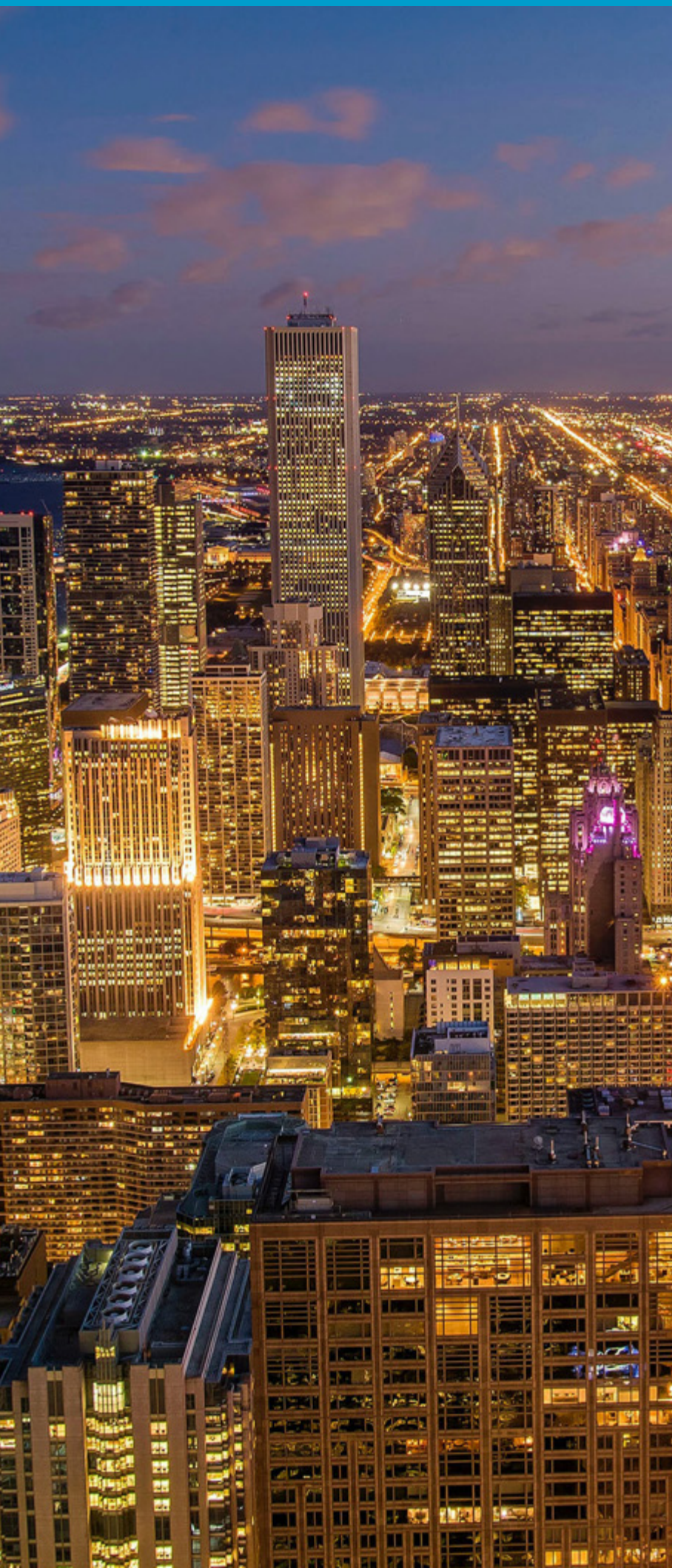
In 2021, 329 million people in North America (84% of the population) subscribed to mobile services. The total addressable market for the region's operators is approaching saturation point, with the US accounting for the majority of new unique subscribers. Three quarters of the 12 million new subscribers expected in the region in the period to 2025 will come from the US. The majority of new unique subscribers will be young consumers and visitors, such as tourists, given the high penetration rates among the adult population in most markets in the region.

Smartphone adoption, however, still has some headroom to grow; by the end of 2021, smartphones accounted for 83% of mobile connections in North America. The transition from legacy networks (2G and 3G) will sustain smartphone uptake in the coming years, with 30 million new smartphone connections expected by 2025. Rising smartphone adoption will be key to mobile data traffic growth in North America, which is forecast to more than triple over the period to 2027.

Mobile continues to contribute to the economy and social wellbeing

In 2021, mobile technologies and services generated 4.2% of GDP in North America, a contribution that amounted to more than $1 trillion of economic value added. The mobile ecosystem also supported more than 2.2 million jobs (directly and indirectly) and made a substantial contribution to the funding of the public sector, with $110 billion raised through taxation. Over the period to 2030, 5G technologies will drive further contributions to the region's economy, impacting key industries such as manufacturing and public administration.

Beyond economic impacts, operators are making significant contributions to the welfare of society more broadly, including efforts to keep vulnerable people connected. For example, US operators have contributed to relief efforts to help keep vulnerable people connected during the humanitarian crisis in Ukraine. Also, the mobile industry in North America continues to make progress on its contribution to the realisation of the UN Sustainable Development Goals (SDGs), with significant improvement recorded during 2021 across SDG 3: Good Health and Well-Being, SDG 8: Decent Work and Economic Growth and SDG 13: Climate Action.



Policies to sustain the impact of mobile on the digital economy

As North America emerges from the uncertain environment of the pandemic, mobile will continue to play a role in connecting to a brighter future. As such, stakeholders need to take the right steps on pertinent issues to sustain the impact of mobile services on the digital economy. Two areas that have received attention recently are illegal robocalls and spectrum.

Stopping illegal robocalls is a top policy priority for the US and Canada as consumers continue to receive scam robocalls. In May 2022, the Federal Communications Commission (FCC) approved two new orders addressing robocalls that originate outside their borders. Following a new registration deadline, US providers (intermediate and terminating) will be prohibited from accepting traffic from foreign voice service providers (VSPs) using US numbering resources if they are not registered in the FCC's Robocall Mitigation Database (RMD).

Meanwhile, 5G connectivity is already proving to be a powerful driver of GDP growth, with 5G's contribution to GDP in North America expected to reach $122 billion in 2030. The success of 5G rollouts depends heavily on operators' 5G spectrum holdings across low, mid- and high bands to deliver both speed and geographical coverage. Additional spectrum can boost the provision of cost-efficient investment and enhance network quality in North America, which can become a central pillar of the region's economic development strategies.

The Mobile Economy North America

Unique mobile subscribers

2021 **329m**
2025 **341m**

84% 2021
85% 2025
Penetration rate
Percentage of population

CAGR 2021-2025 **0.8%**

Mobile internet users

2021 **303m**
2025 **322m**

77% 2021
80% 2025
Penetration rate
Percentage of population

CAGR 2021-2025 **1.6%**

SIM connections

(excluding licensed cellular IoT)

2021 **413m**
2025 **431m**

Penetration rate
Percentage of population
105% 2021
107% 2025

CAGR 2021-2025 **1.0%**

4G

Percentage of connections *(excluding licensed cellular IoT)*

2021 **79%** → 2025 **33%**

5G

Percentage of connections *(excluding licensed cellular IoT)*

2021 **14%** → 2025 **64%**

Smartphones

Percentage of connections *(excluding licensed cellular IoT)*

2021 **83%**

2025 **86%**

Licensed cellular IoT connections

2021 **185m**

2025 **400m**

Operator revenues and investment

2021 **$294bn**

2025 **$333bn**

Total revenues

Operator capex

$204bn

2022 – 2025

99% on 5G

Mobile industry contribution to GDP

2021 **$1.0tn**

2025 **$1.1tn**

4.2% of GDP

Public funding

2021 **$110bn**

Mobile ecosystem contribution to public funding (before regulatory and spectrum fees)

Employment

870,000 jobs

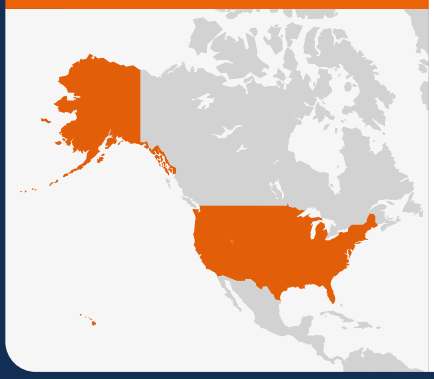
Directly supported by the mobile ecosystem in 2021

Plus an additional

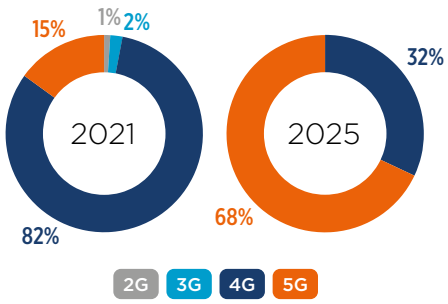
1.4 million jobs supported indirectly

Subscriber and technology trends

US



TECHNOLOGY MIX*



SUBSCRIBER PENETRATION

2021 → 2025

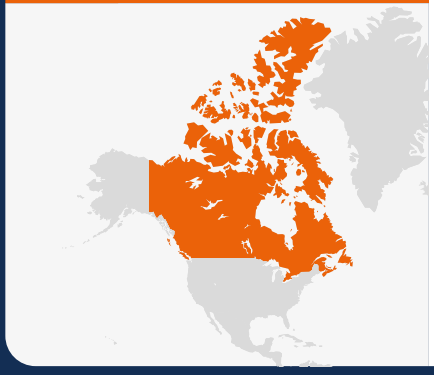
85% → 86%

SMARTPHONE ADOPTION

2021 → 2025

83% → 85%

Canada



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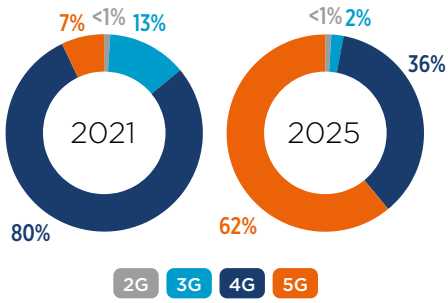


SUBSCRIBER PENETRATION

2021 → 2025

79% → 81%

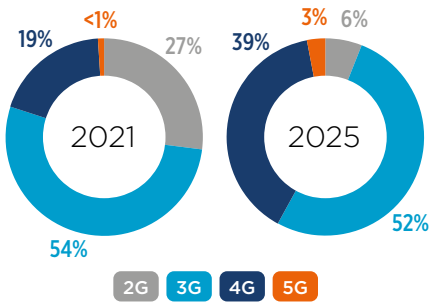
SMARTPHONE ADOPTION

2021 → 2025

89% → 92%

The Caribbean

TECHNOLOGY MIX*



SUBSCRIBER PENETRATION

2021 → 2025

67% → 70%

SMARTPHONE ADOPTION

2021 → 2025

77% → 86%

Defining North America

We define North America in this report as the US, Canada and the Caribbean (for Mexico, please see The Mobile Economy Latin America report).

The Caribbean includes the following countries or territories: Anguilla; Antigua and Barbuda; Aruba; Bahamas; Barbados; Bermuda; Cayman Islands; Curacao; Dominica; Grenada; Guadeloupe; Haiti; Jamaica; Martinique; Montserrat; Puerto Rico; Saint Kitts and Nevis; Saint Lucia; Saint Pierre and Miquelon; Saint Vincent and the Grenadines; Trinidad and Tobago; Turks and Caicos Islands; British Virgin Islands; and the US Virgin Islands.

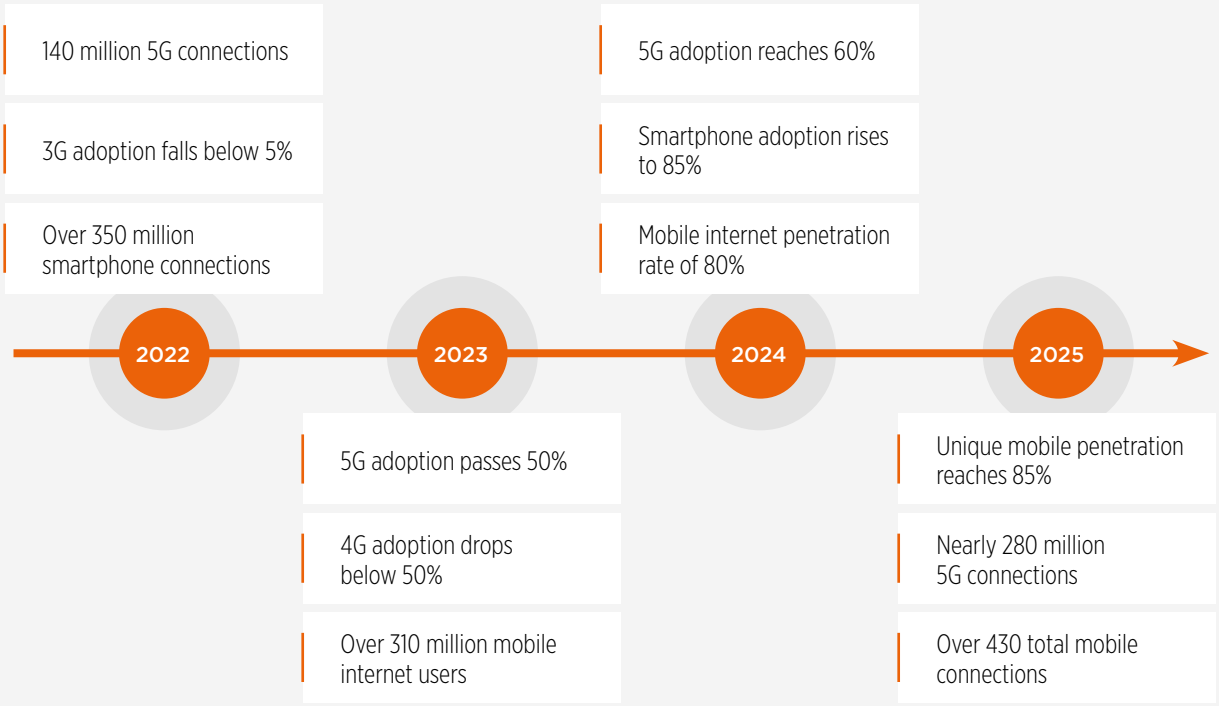
** Percentage of total mobile connections (excluding licensed cellular IoT)*
Note: Totals may not add up due to rounding

01
The mobile market in numbers

1.1 Mobile market nears saturation

Figure 1

Key milestones for the mobile industry in North America to 2025

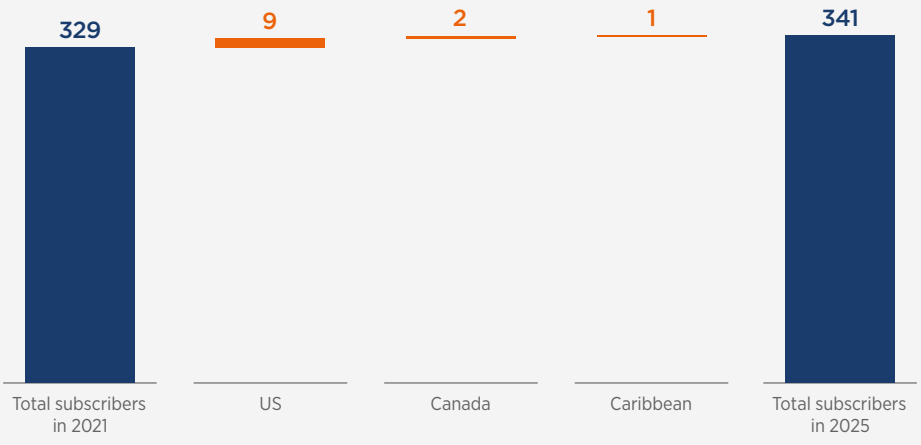


Source: GSMA Intelligence

Figure 2

Mobile subscribers to grow by nearly 12 million in North America by 2025; the US will account for three quarters of new subscribers

New mobile subscribers (million)



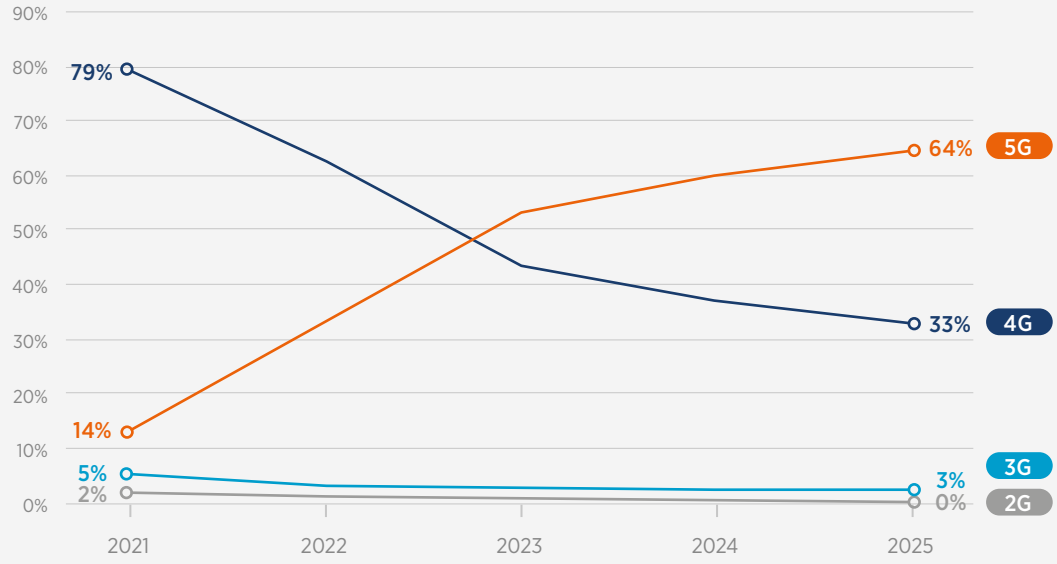
Source: GSMA Intelligence

1.2 5G adoption continues to accelerate

Figure 3

5G set to overtake 4G in 2023 to become the dominant mobile technology in North America

Percentage of connections (excluding licensed cellular IoT)



Source: GSMA Intelligence

North America's progress with network sunsets

Operators are increasingly looking to optimise their network operations and costs while being conscious of the spectral efficiency multiple to be gained if 4G and 5G were deployed in existing legacy technology bands. They are therefore taking the opportunity presented by licence renewals and re-auctions to retire legacy networks and refarm spectrum to 4G and 5G.[1]

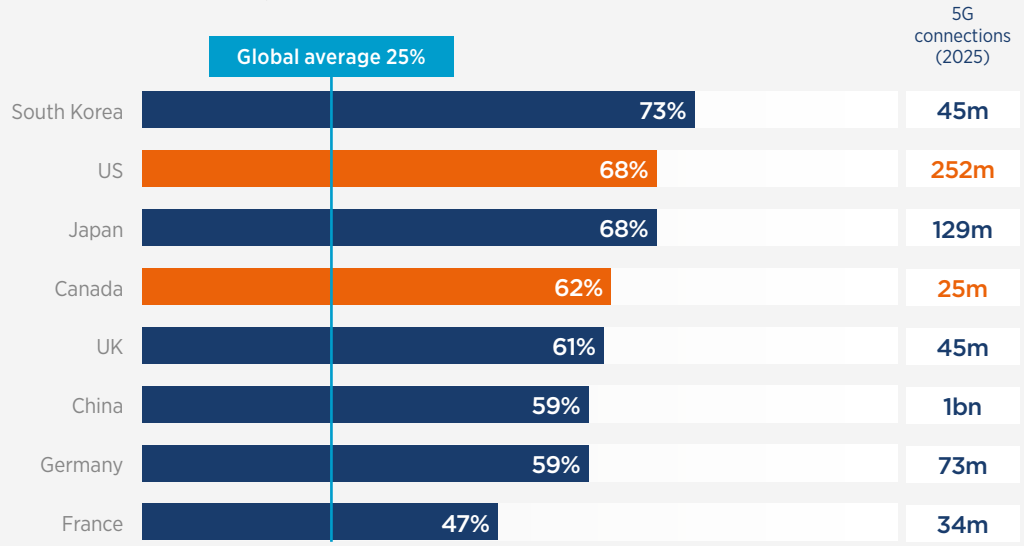
AT&T and Verizon closed their 2G networks in 2017 and 2019 respectively. AT&T shut its 3G network in February 2022, while Verizon plans to do the same by the end of the year. T-Mobile retired its 3G network in June 2022, but it has opted to leave its 2G network intact to support IoT devices. To ensure a successful network switch-off, operators used a variety of channels to inform customers of the proposed changes while offering customers incentives (e.g. discounts on 4G and 5G devices and service plans) to accelerate migration.

1. Mobile network sunset: trends, regional variations and implications for IoT, GSMA Intelligence, June 2022

Figure 4

The US and Canada are among the global leaders in terms of 5G adoption

5G adoption in 2025 (percentage of total connections)



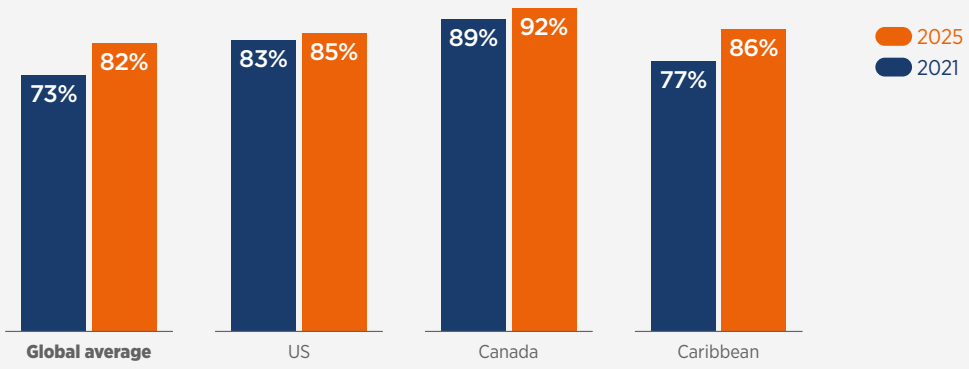
Source: GSMA Intelligence

1.3 Smartphone adoption and data traffic on the rise

Figure 5

By 2025, smartphones will account for nearly nine in 10 connections on average in North America

Smartphones as a percentage of total connections (excluding licensed cellular IoT)



Smartphone connections in North America (2025)

US
317 million

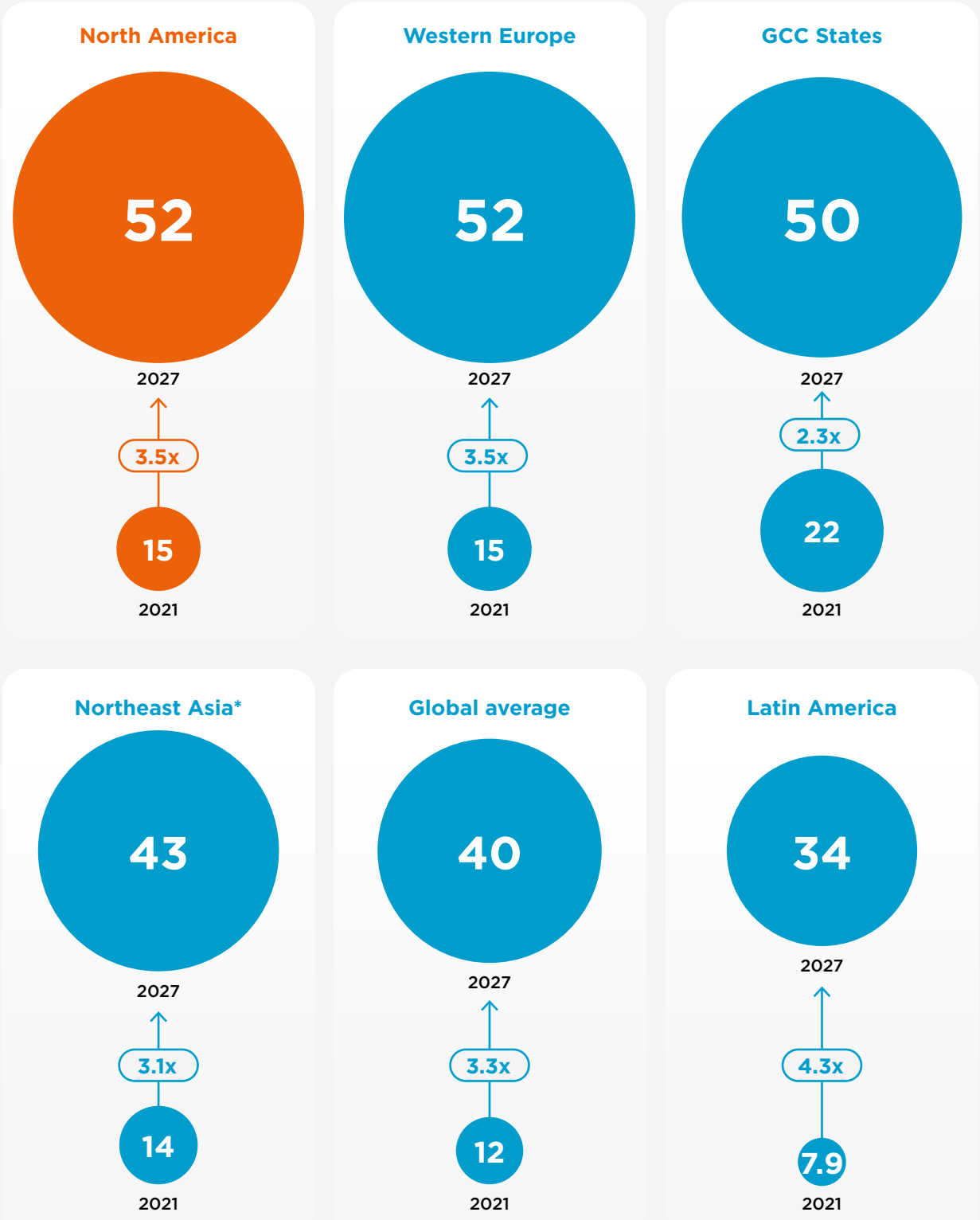
Canada
37 million

Caribbean
17 million

Figure 6

North America is home to some of the world's biggest consumers of mobile data

Mobile data traffic per smartphone (GB per month)



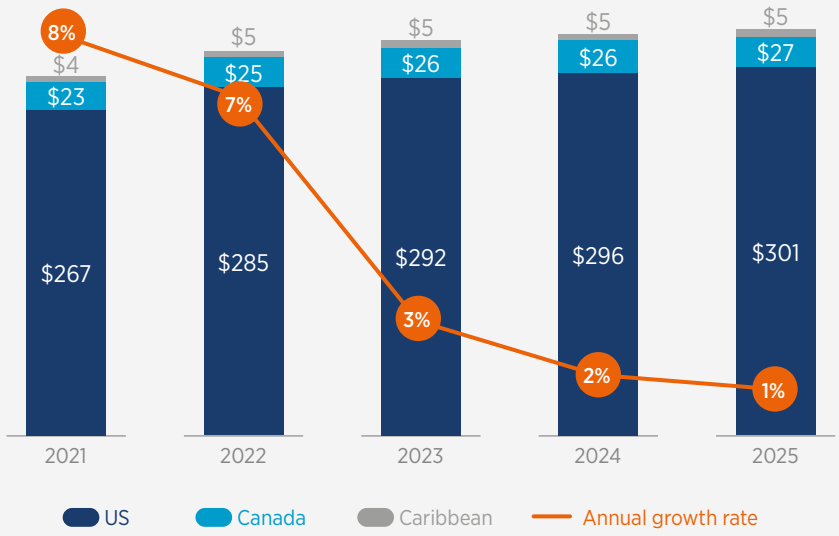
Source: Ericsson
* Includes China

1.4 Macroeconomic pressures weigh on revenue growth

Figure 7

After a swift recovery from the impact of the pandemic, mobile revenue is facing renewed pressure from macroeconomic challenges, notably inflation

Mobile revenue (billion)

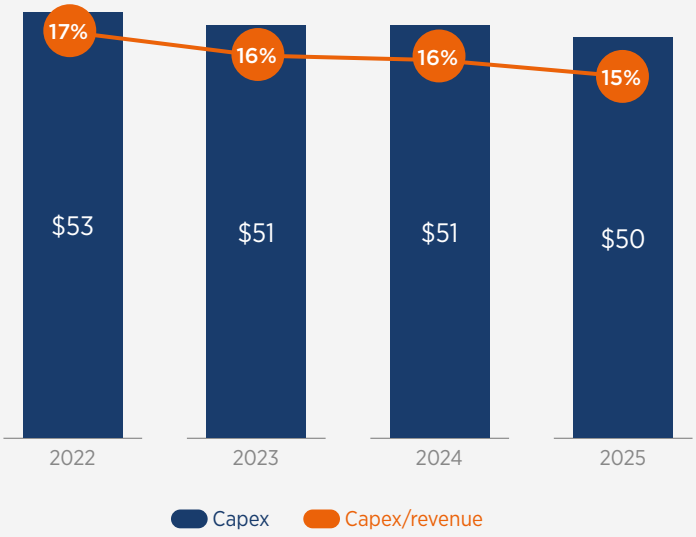


Source: GSMA Intelligence

Figure 8

Capex will decline in the coming years following initial investments in the rollout of 5G networks

Operator capex (billion)



Source: GSMA Intelligence

02

Key industry trends shaping the mobile industry

2.1 5G: becoming mainstream

At the end of June 2022, 208 mobile operators in 79 markets worldwide had launched commercial 5G services. 5G is becoming mainstream in pioneer markets such as the US, where 5G now accounts for around one in four mobile connections. Momentum has been boosted by a number of factors, including economic recovery from the pandemic, rising 5G handset sales and overall marketing efforts.

The continued deployment of C-band spectrum will help to sustain momentum over the next few years, enabling users to access faster 5G speeds and higher-capacity networks in more locations. Verizon intends to cover more than 175 million people with its C-band service (5G Ultra Wideband) by the end of 2022, a year earlier than initially announced. Moreover, AT&T aims to reach more than 200 million people with C-band services by the end of 2023, supporting its existing 5G footprint, which covers more than 255 million people.

C-band rollouts are also getting underway in Canada. Bell, Rogers and Telus all introduced 5G services using 3.5 GHz spectrum in June 2022. Rollouts are initially in urban centres such as Calgary, Edmonton, Montreal, Toronto and Vancouver. However, the spectrum will also be used to support those living in rural communities, highlighting the C-band as a valuable middle ground between capacity and coverage for 5G networks.

Realising the 5G FWA opportunity

Consumer intent to upgrade to 5G is growing and existing 5G users are increasingly interested in adding content and services (video streaming, music, gaming, live sports, cloud storage etc.) to their 5G plans.[2] Furthermore, interest is growing in immersive reality applications and entertainment experiences (e.g. sport activities and venues), which leverage the high-bandwidth capabilities of 5G networks.[3]

There is also strong demand for 5G home broadband. While fixed wireless access (FWA) networks have been around for more than a decade globally, FWA market adoption had been slow, with its share of total fixed broadband connections in the low-to-mid-single digits. 5G is now making FWA a more competitive solution, for example by providing speeds of more than 10× greater than 4G FWA, significantly reducing the deficit compared to fibre and cable. 5G is also improving FWA network capacity, especially with spectrum in the millimetre wave (mmWave) bands.

In the US, operators are using 5G FWA to gain market share from cable providers, which have previously dominated the fixed broadband market.

While FWA networks have been around for more than a decade globally, FWA market adoption had been slow. 5G is now making FWA a more competitive solution.

2. Analysing the behaviour of early 5G users: 10 things to know when planning consumer 5G strategies, GSMA Intelligence, December 2021
3. See for example https://www.gsma.com/5GHub/stadiums

Notable developments include the following:

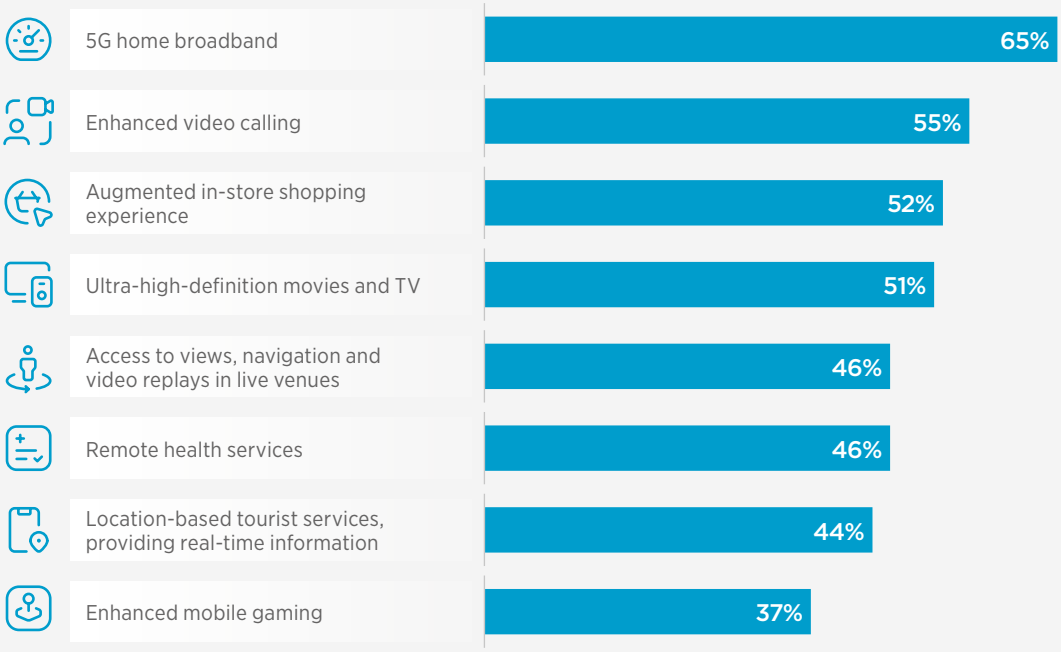
- **T-Mobile:** T-Mobile launched its 5G FWA service in April 2021, covering 40 million households a year later. As of Q1 2022, T-Mobile had 984,000 FWA subscribers – the largest FWA subscriber base in the US. The operator aims to increase this to 7–8 million subscribers by 2025. Most of T-Mobile's 5G FWA subscribers are from suburban or urban areas, while 40% of its new FWA customers are coming from cable.
- **Verizon:** As of Q1 2022, Verizon's FWA footprint covered more than 30 million homes and more than 2 million businesses, with roughly an equal number of customers in each segment – 216,000 and 217,000 respectively. Verizon is aiming to reach around 50 million households (40% of total US households) and 14 million businesses by 2025, with 4–5 million FWA subscribers in total, suggesting a penetration rate of around 7%.
- **UScellular:** UScellular, in collaboration with Qualcomm and Inseego, launched its 5G mmWave high-speed internet service in parts of 10 US cities. The operator's Home Internet+ solution delivers speeds of up to 300 Mbps, an increase of 10-15× compared to its 4G LTE home internet offering. It plans to expand the service to dozens more cities throughout 2022.

Operators in Canada are also exploring 5G FWA opportunities, with a focus on targeting rural households. For example, Bell recently added 5G to its Wireless Home Internet service, allowing it to offer faster speeds and higher data allowances than in the past with 4G. Meanwhile, Telus recently announced it is using its Smart Hub technology and 5G network to bring faster fixed wireless internet speeds to nearly 60 rural communities across British Columbia and Alberta by the end of 2022.

Figure 9

5G is driving renewed interest in FWA

Percentage of US smartphone users who find the following 5G use cases or 5G-enhanced services 'very' or 'extremely' appealing (aggregate)



Source: GSMA Intelligence Consumers in Focus Survey 2021

New capabilities key to 5G enterprise success

While the consumer market has been the focus of early 5G deployments, the enterprise segment is the largest incremental opportunity in the 5G era. To fully exploit this opportunity, operators in North America are building new capabilities and partnerships in a range of areas. Private networks in particular are garnering significant attention as enterprise digitisation drives the need for secure, low-latency connectivity. Below are examples of recent private networks announcements:

- **AT&T** is working with Microsoft on a private 5G solution, which integrates AT&T's 5G network with Azure's private edge capabilities. Still in its proof of concept stage, the solution will focus on providing a simple, integrated offering to help businesses set up and run private networks more quickly.
- **Verizon** has announced the launch of On Site 5G, the operator's first commercially available private 5G network solution in the US. Verizon has previously built custom 5G solutions for Corning, Marine Corps Air Station and WeWork, among others.
- **Google** unveiled its private 5G network solution in June 2022, following similar moves from Microsoft and AWS. Google's solution offers "turn-key" private 5G with the option to run network management, control and user plane functions in the cloud. It noted that enterprises in the US can use the unlicensed 3.5 GHz Citizens Broadband Radio Service (CBRS) spectrum band for their private networking operations.
- **Utility companies**, such as Southern California Edison, Sempra Energy and Alabama Power, acquired priority access licences (PALs) in the CBRS auction. This opens up opportunities to build private networks for smart grid applications or for staff requiring remote assistance when performing service upgrades.

Edge computing is also expected to become a significant part of the 5G enterprise message over the next few years as operators build out new capabilities. For example, Verizon's investment arm has inked a $40 million deal to acquire a 10% stake in Casa Systems, which supplies cloud-native and physical network equipment for fixed and mobile network providers. Under the commercial agreement, Casa Systems will supply its 5G core network functions system to Verizon for its public edge computing service. This builds on previous moves made by Verizon towards the use of edge computing infrastructure, including for broadcast of ultra-high-definition content and in its private enterprise offerings.

The full power of edge computing, though, will not be unleashed until 5G standalone (SA) networks are more widely deployed. Unlike non-standalone (NSA), SA networks can deliver on the ultra-low-latency requirements of many industrial clients, which a guaranteed quality of service through a private networks reinforces.

SA networks are still in the minority, both globally and in North America, but momentum is building. In Canada, Rogers announced it had completed the country's first national 5G SA rollout, in partnership with Ericsson. Meanwhile, T-Mobile recently launched commercial voice over new radio (VoNR) services for customers in limited areas of Portland and Salt Lake City, representing another technology milestone for its 5G SA service.

Progress towards network slicing commercialisation continues

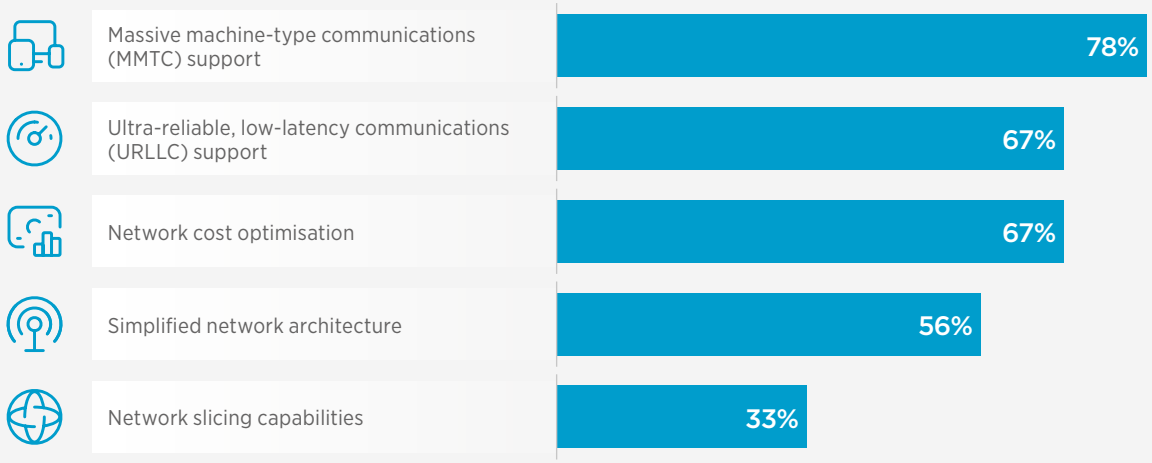
With the rollout of 5G SA networks, interest is growing in the customised network capabilities that network slicing can create. While slicing has use cases in the consumer segment (e.g. gaming), it is the enterprise market (e.g. IoT applications across vertical sectors) that is attracting more attention.[4]

Progress on network slicing continues in North America. For example, Telus and Ericsson successfully conducted the first multi-vendor network slicing proof of concept in a lab environment based on 3GPP Release 16 and the Internet Engineering Task Force (IETF) Layer 3 NW Yang Model (L3NM). That the industry is still conducting network slicing trials indicates there is work to be done to execute on its commercialisation, but those trials are critical to ensure that dedicated on-demand slicing solutions can deliver on their promise.

Figure 10

Top benefits of SA: support for enterprise aspirations resonates with operators

Percentage of operators in North America (top three choices selected)



Source: GSMA Intelligence Operators in Focus: Network Transformation Survey 2021

4. Network slicing: assessing the gap between enterprise expectations and operator deployments, GSMA Intelligence, May 2022

Operators can use drones to showcase 5G and edge capabilities

US operators and enterprises are showing high levels of interest in solutions using drones. AT&T is looking to improve its network performance by using a drone to carry a lightweight signal generator to test high-gain outdoor antennas in spectrum up to 40 GHz. T-Mobile recently announced it had become the exclusive provider of IoT connectivity for Lucid Drone Technologies, which operates a growing fleet of industrial spraying drones that provide commercial cleaning services. Drones also provide an avenue for operators to capture new revenues beyond connectivity by providing hardware, support services and platforms.

While there is clear momentum, operators and enterprises still face hurdles in scaling the use of drones. In particular, there is more work to be done on defining the regulatory framework for beyond-visual-line-of-sight (BVLOS) flights.

2.2 The telco of the future: sustainability moves to the top of the agenda

Sustainability in telco operations is expanding across North America, with US and Canadian operators at the forefront of green transformation. In 2021, the US re-joined the Paris Agreement and set a course to tackle the climate crisis at home and abroad and to become a net-zero emissions economy by 2050. Canada has a similar plan; the Canadian Net-Zero Emissions Accountability Act enshrines in legislation Canada's commitment to achieve net-zero emissions by 2050.

Mobile operators in the US have committed to even more ambitious net-zero targets, taking several steps to reduce carbon emissions within their operations and across their entire supply chain. This includes the following recent developments:

- **T-Mobile** met its target to source 100% of its total electricity usage from renewable sources by the end of 2021. To achieve this, the operator developed a renewable energy strategy that includes eight virtual power purchase agreements, 19 retail agreements, one Green Direct programme and unbundled renewable energy certificates that support projects across the country. The nine large wind and solar farm projects (which include the virtual power purchase agreements and Green Direct programme) alone are contracted to provide T-Mobile with approximately 3.4 million MWh of clean energy annually.
- **AT&T** has committed to net-zero greenhouse gas emissions across its global operations by 2035. To support this ambitious goal, AT&T plans to source more renewable energy through solar power purchase agreements from Vitol, making it one of the largest corporate buyers of renewable energy in the US. These new deals with Vitol bring the company's total portfolio to more than 1.7 GW of capacity.
- **Verizon** issued its Green Bond Impact Report in February 2022, outlining the full allocation of the nearly $1 billion of net proceeds from its third green bond. The bond was issued in September 2021 under its updated Green Financing Framework that included new underwriter selection criteria focused on diversity and the UN SDGs. In February 2019, Verizon became the first US telecoms company to issue a green bond and it remains a leader in the industry with the allocation of three green bonds.

Sustainability in telco operations is expanding across North America, with US and Canadian operators at the forefront of green transformation.

Figure 11

Climate targets by North American operators

Network operators	Science-based targets	Carbon-neutral target	Race to Zero target	CDP disclosure
AT&T	Targets set: 1.5°C	2035		Disclosed
BCE	Committed	2025		Disclosed
Optimum	Committed		2050	
Telus	Targets set: 1.5°C	2030	2050	Disclosed
T-Mobile US	Targets set: 1.5°C			Disclosed
Verizon	Targets set: 1.5°C	2035	2040	Disclosed

DEFINITIONS
Science-based targets (SBTs): Defined by the Science-Based Targets Initiative (SBTi) to set carbon-reduction targets in line with limiting global warming to below 2°C. See gsma.com/betterfuture/setting-climate-targets
Carbon-neutral target: Refers to reducing and offsetting carbon emissions from a company's own operations (Scope 1 and 2 emissions). For operators, the largest sources of Scope 1 and 2 emissions are electricity use for networks and diesel fuel used for transport and generators.
Race To Zero target: Committing to achieving net-zero carbon emissions by 2050 at the latest, as part of the UN-led Race to Zero campaign with businesses, cities, regions, investors and financial and educational institutions. See unfccc.int/climate-action/race-to-zero-campaign
CDP disclosure: CDP operates the global disclosure system for investors, companies, cities, states and regions to manage their environmental impacts. Operators can disclose their climate impact every year and contribute to the world's most comprehensive dataset.

Source: SBTI, UNGC and operator websites

Leveraging partnerships to achieve climate ambitions

In 2021, AT&T announced the AT&T Gigaton Goal to deliver connectivity solutions that enable business customers to cumulatively save a gigatonne (1 billion metric tons) of greenhouse gas (GHG) emissions. A gigatonne is equal to approximately 19% of US GHG emissions in 2020. AT&T-enabled customer GHG emissions reductions measured between 2018 and 2021 totalled 110.3 million metric tons of CO_2 equivalent (CO_2e) – approximately 11% toward their final goal.

To achieve this ambitious goal, cross-industry partnerships are essential. Through its Connected Climate Initiative, AT&T convenes the leading technology companies, AT&T Business customers, universities and nonprofits to identify best practices, develop innovative new products and use cases, and scale the innovations of startup partners building 5G- and other broadband-enabled climate solutions.

AT&T is currently working with businesses (e.g. Microsoft, Equinix and Duke Energy), research universities (e.g. Texas A&M University and the University of Missouri) and a range of other organisations to make an impact on a global scale. Building partnerships is essential for operators to improve their energy efficiency and to reduce operator emissions while enabling the transition to a net-zero economy.

2.3 The metaverse ecosystem grows in North America

The Covid-19 pandemic has spurred new ways of working and living, accelerating the shift to digitalisation, including virtual experiences. Unsurprisingly then, the concept of the metaverse, a parallel virtual world populated with avatars, has gained significant attention. In essence, the metaverse allows individuals to consume media content, purchase items, generate tokens or participate in recreational activities without the geographical restrictions, safety concerns and other physical limitations associated with real-life experiences.

The metaverse (which continues to lack a universally agreed-upon definition) is still nascent. However, the significant levels of investment in metaverse initiatives and market-size estimates reflect the opportunities possible from the rapid advancement of the metaverse over the coming years. In the first five months of 2022, more than $120 billion was invested in building out metaverse technology and infrastructure, more than double the $57 billion invested in all of 2021.[5]

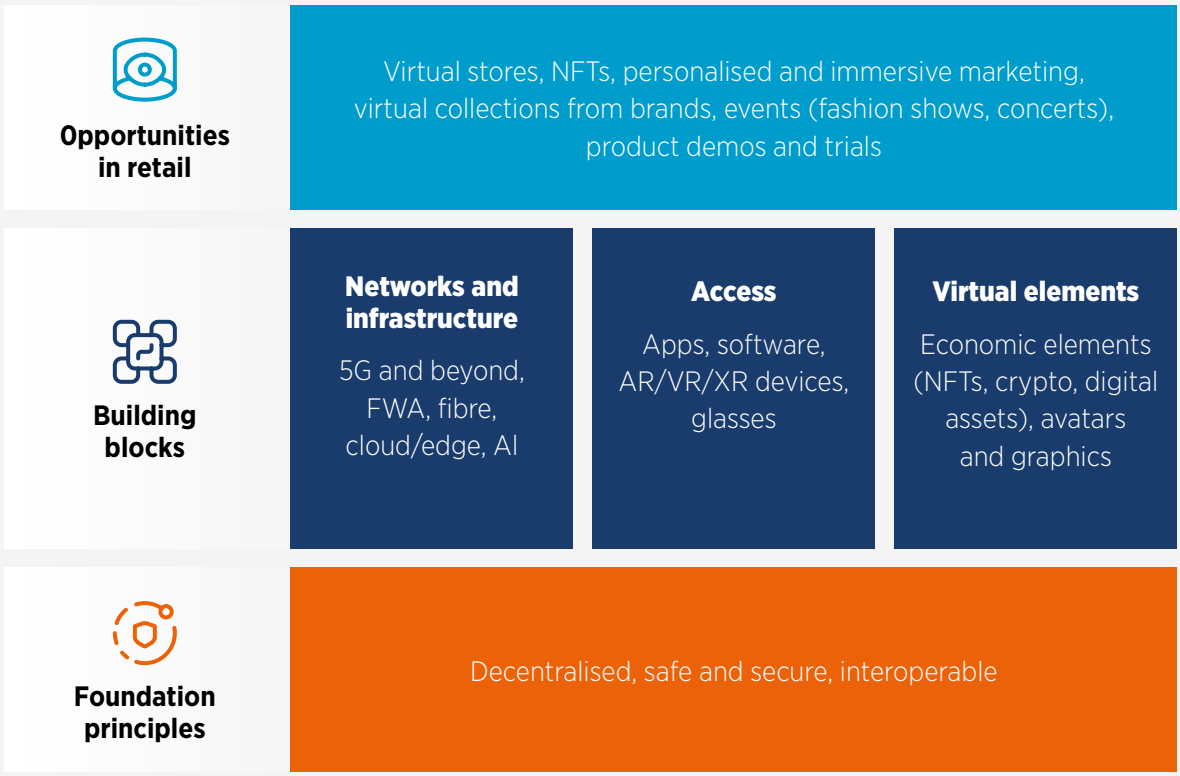
The metaverse ecosystem is growing in many countries around the world, including in North America. In the US and Canada, public and private institutions are increasingly establishing a presence in the metaverse and actively utilising the platform in their engagement with customers and other stakeholders. For example, the US military relies on a series of metaverse or metaverse-adjacent virtual reality programs for a variety of applications, from training to healthcare; KPMG's US and Canadian member firms jointly launched a metaverse collaboration hub to support employee and client journeys into Web 3.0; and Barbados has signed an agreement with Decentraland to outline the baseline development elements for its metaverse embassy.

The early stages of the metaverse can already be seen in gaming, but other industry verticals are using gaming and other platforms to test use cases in the metaverse. The fashion retail sector in particular sees significant opportunities. Brands around the world have taken notice of the metaverse because they believe it will usher in the next age of consumerism. Well-recognised brands, such as Balenciaga, Gucci, Louis Vuitton and Nike, have already began collaborating with platforms similar to the metaverse in order to reach a broader audience. The Metaverse Fashion Week hosted on Decentraland in March 2022 speaks to the potential for different use cases across retail.

5. McKinsey

Figure 12

The building blocks of the metaverse and opportunities in retail



Source: GSMA Intelligence

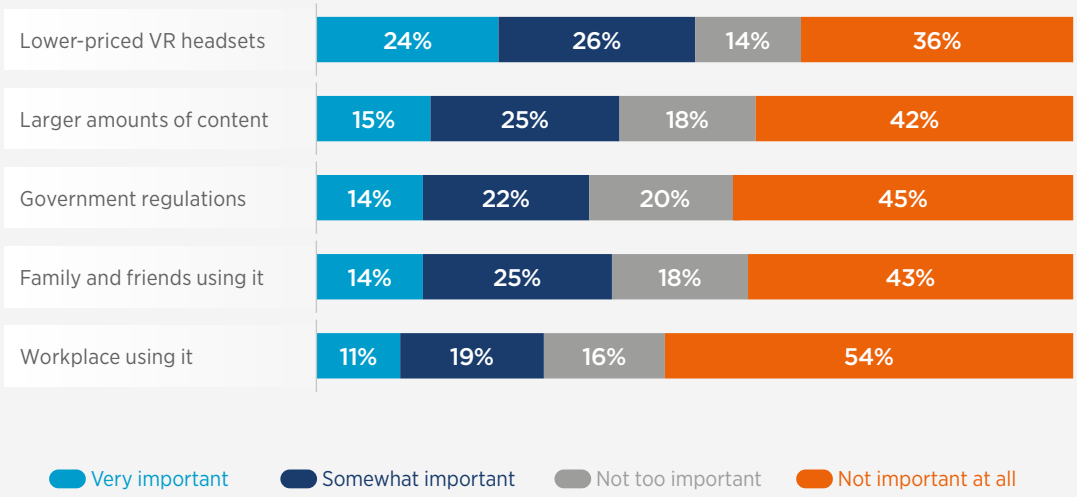
The growing interest in the metaverse among large institutions from different verticals will be crucial to the development of the broader metaverse ecosystem, including device production, content creation and network provision. Large technology companies, including Meta, Microsoft, Nvidia and Alphabet, among others, are taking deliberate actions toward shaping the metaverse, with a range of products and solutions, including the following:

- **Meta** offers the Oculus Quest 2, which has become one of the most accessible and affordable VR headsets, currently available at under $400.
- **Nvidia** is expanding the range of developer frameworks, tools, apps and plugins for Nvidia Omniverse, its platform for building and connecting metaverse worlds based on Universal Scene Description (USD).
- **Microsoft** plans to purchase game maker Activision Blizzard for $69 billion, a move that would further enhance its footprint and capability in the virtual gaming world.
- **Google** is reported to be building its own operating system for metaverse headsets as part of its Project Iris. Early prototypes are already under development, with Google likely to introduce the devices sometime by 2024.

Figure 13

Lower-priced VR headsets are an important factor for consumers when deciding whether to try using the metaverse

Top factors for trying the metaverse (percentage of US internet users), March 2022



Source: Statista

As the metaverse concept becomes more mainstream, the question of how operators can participate, beyond providing the underlying connectivity, has gone up the agenda:

- **AT&T** and Quintar, a sports entertainment AR business, have announced a partnership to create and deliver highly engaging in-game AR experiences to sports fans in stadia and venues by using the capabilities of AT&T 5G.
- **T-Mobile** is teaming up with Disney Studios' StudioLAB to help develop new mixed reality and immersive experiences, leveraging the operator's 5G infrastructure.
- **Verizon** and Meta have formed a strategic partnership to explore a range of metaverse opportunities, including how Verizon's MEC infrastructure can deliver intensive XR cloud rendering and low-latency streaming.

These examples highlight the opportunity for operators to capture additional value elsewhere in the value chain, particularly in developing platforms, content and services in the metaverse. Leveraging new and existing relationships to create partnerships within the telecoms industry and beyond will be necessary to capitalise on the potential of the metaverse.

03
Mobile contributing to economic growth and social progress

3.1 Mobile's contribution to economic growth

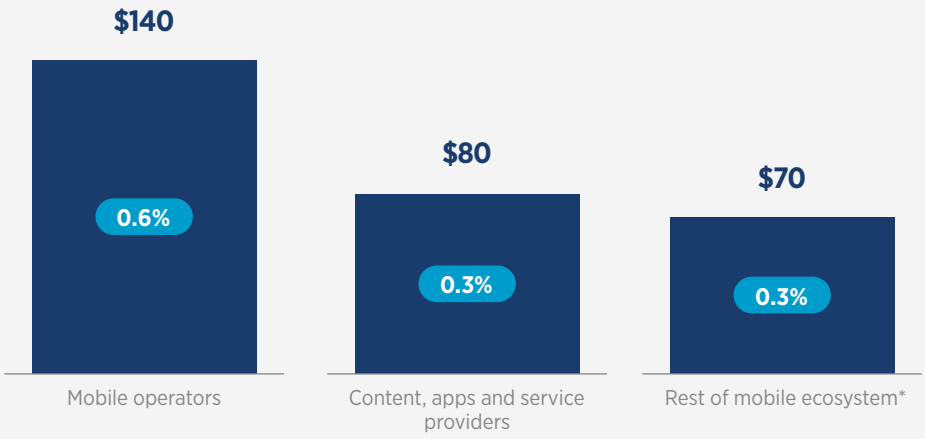
In 2021, mobile technologies and services generated 4.2% of GDP in North America, a contribution that amounted to more than $1 trillion of economic value added. The mobile ecosystem also supported more than 2.2 million jobs (directly and indirectly) and made a substantial contribution to the funding of the public sector, with around $110 billion raised through taxes on the sector.

By 2025, mobile's contribution will grow by $100 billion (reaching $1.1 trillion), as the countries in the region increasingly benefit from the improvements in productivity and efficiency brought about by the increased take-up of mobile services.

Figure 14

The North America mobile ecosystem directly generated around $300 billion of economic value in 2021, with mobile operators accounting for the majority

Billion, percentage of GDP

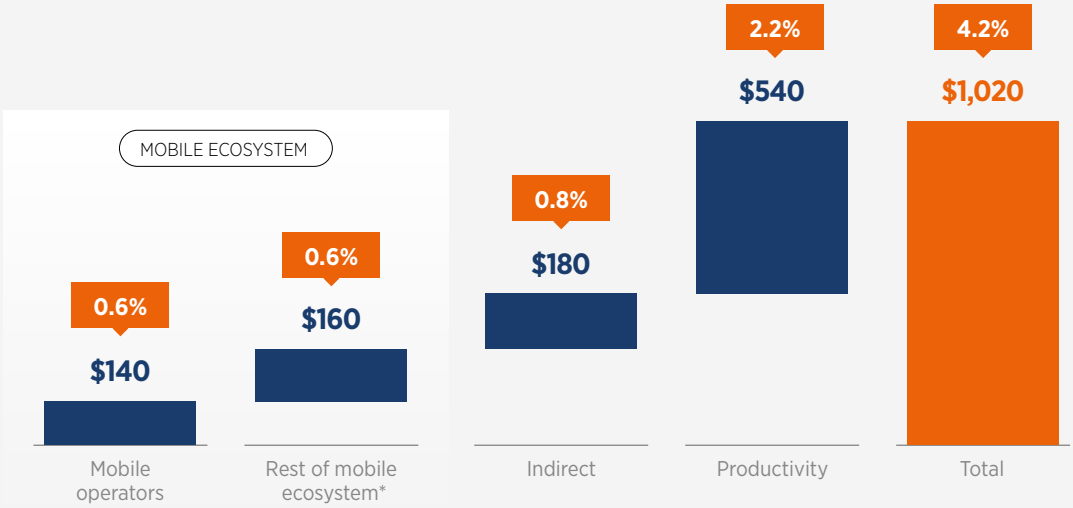


Source: GSMA Intelligence
* Rest of mobile ecosystem category includes infrastructure providers, device manufacturers, and distributors and retailers
Note: Totals may not add up due to rounding

Figure 15

Additional indirect and productivity benefits brought the total contribution of the mobile industry to the regional economy to more than $1 trillion in 2021

Billion, percentage of GDP

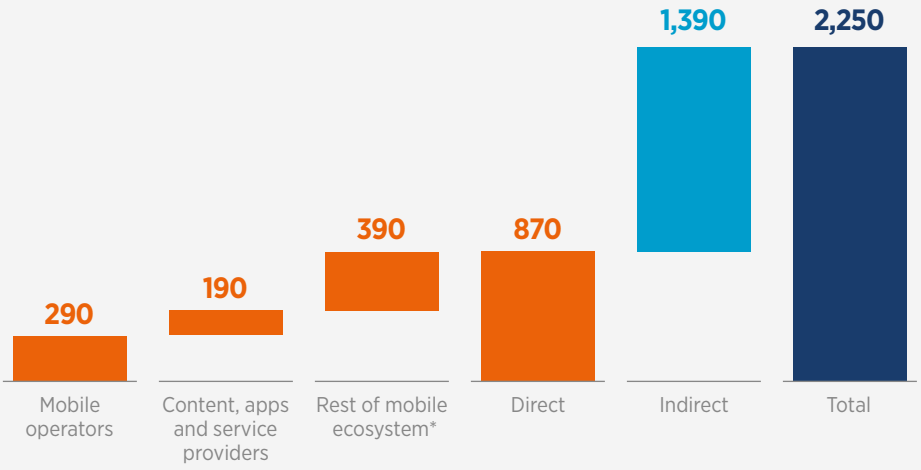


Source: GSMA Intelligence
Note: Totals may not add up due to rounding.
* Rest of mobile ecosystem category includes infrastructure providers, device manufacturers, distributors and retailers, and content, apps and service providers.

Figure 16

In 2021, the mobile ecosystem directly employed more than 850,000 people in North America and supported another 1.4 million jobs indirectly

Jobs (thousands)

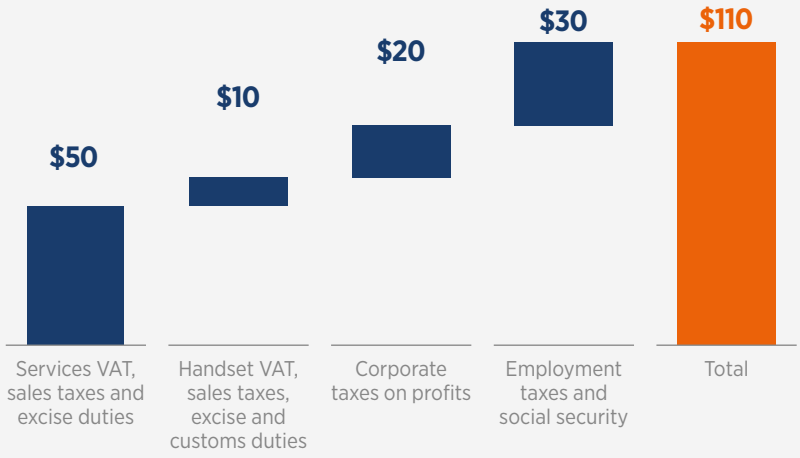


Source: GSMA Intelligence
* Rest of mobile ecosystem includes infrastructure providers, device manufacturers, and distributors and retailers.
Note: Totals may not add up due to rounding.

Figure 17

In 2021, the mobile ecosystem contributed almost $110 billion to the funding of the public sector through consumer and operator taxes

Billion

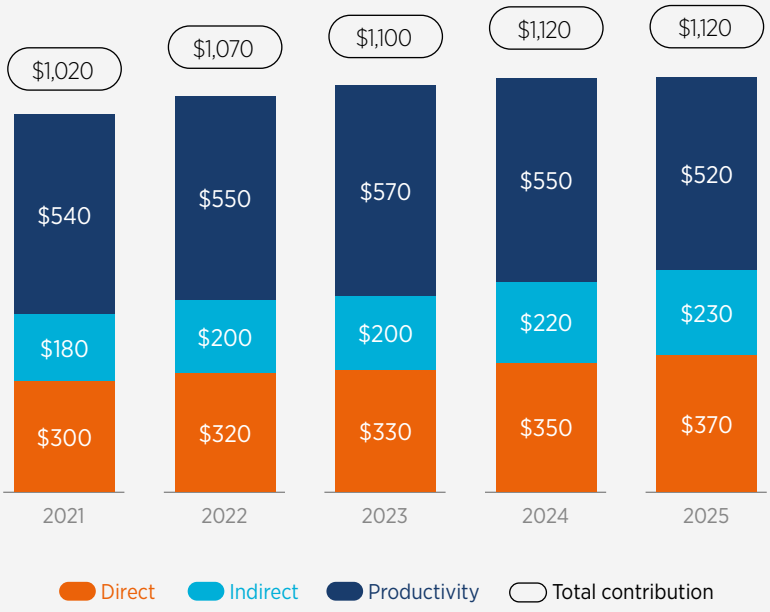


Source: GSMA Intelligence
Note: Totals may not add up due to rounding.

Figure 18

Driven mostly by the continued expansion of the mobile ecosystem, the economic contribution of mobile in North America will increase by $100 billion by 2025

Billion



Source: GSMA Intelligence
Note: Totals may not add up due to rounding.

3.2 Supporting the SDGs and bridging the digital divide

As the first industry to have committed fully to the UN SDGs, the mobile industry continues to have substantial positive effects on lives and livelihoods. In 2021, the industry increased its impact on all the SDGs, with the average year-on-year increase accelerating compared with 2020. The average SDG impact score across the 17 SDGs reached 53, up from 49 in 2020 and 32 in 2015, meaning the mobile industry is achieving 53% of what it could potentially contribute to the SDGs.[6]

In North America, the mobile industry recorded a significant improvement in 2021 to its contribution to the following SDGs:

- **SDG 3: Good Health and Well-Being:** The Covid-19 pandemic has highlighted the pressing need to strengthen health systems, with digital solutions likely to play a crucial role in addressing systemic challenges. Telus Health is a leader in Canada in digital health technology. In 2021, it completed 551 million digital health transactions and added 1.1 million new virtual care members, meaning nearly 3 million members now use its virtual care solutions.
- **SDG 8: Decent Work and Economic Growth:** Operators continue to support enterprises with their digital transformation projects. This is contributing to economic growth by enabling enterprises to make productivity gains through automation, analytics, redistribution of labour, cost savings and future-proofing operating models as more purchasing activity moves online and processing power to the cloud.
- **SDG 13: Climate Action:** The mobile industry is making continued progress on disclosing climate impact data and setting targets for emissions reductions. Network and supply-chain innovations and the rapid substitution of renewable energy in place of fossil fuels are key enablers of this.

Extending connectivity to underserved areas

Mobile operators continue to innovate in addressing the digital divide, driving the industry's contribution to multiple SDGs, including SDG 9: Industry, Innovation and Infrastructure and SDG 10: Reduced Inequalities. Operators' investments to improve network infrastructure in rural areas have been an important part of this contribution. For example, T-Mobile's 5G High-Speed Internet provides affordable, reliable home broadband to 30 million US homes, with millions of those in rural areas.

Aerial technologies, such as satellites, could also play a role in improving rural connectivity, particularly when providing backhaul solutions in remote areas where microwave or fibre are not viable. There has been a recent wave of partnerships between operators and satellite companies to support this. For instance, Verizon is collaborating with Amazon's Project Kuiper to deliver backhaul solutions across remote communities in the US, while AT&T is working with OneWeb to improve connectivity for AT&T business customers in remote areas.

Mobile operators also continue to participate in initiatives to provide affordable connectivity to underserved segments, enabling more people to access vital services, such as digital health and education tools. For example, Telus is aiming to provide a free smartphone and/or subsidised data plans to 30,000 marginalised Canadians by 2025. So far, it has reached over 13,000 people through this initiative, including 5,600 low-income elderly people. Rogers recently extended its donation programme to provide thousands of phones and plans to more than 325 shelters and transition houses across Canada. These devices help women and their children to safely escape violence and abuse while also connecting young people to mentors.

Bridging the digital divide also means developing inclusive products and services that meet the

6. 2022 Mobile Industry Impact Report: Sustainable Development Goals, GSMA, 2022

diverse needs of people with disabilities, who typically have lower levels of mobile ownership than people without disabilities.[7] Operators and their partners are taking many steps to support people with disabilities. For instance, Bell Mobility customers with disabilities are eligible to receive a $20/month discount on any current Bell Mobility Connect Everything or Unlimited smartphone data plan. Furthermore, customers with disabilities receive exclusive pricing on apps built specifically for accessibility needs, including MobiHelper, Seeing AI and BlindSquare.

Building digital skills

SDG Target 4.4 aims to substantially increase the number of people who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship by 2030. However, training to get these skills can be expensive and some teachers may have limited knowledge of these areas.

In response to this challenge, operators have promoted digital skills and education across all parts of society. For example, T-Mobile's Project 10Million is an initiative aimed at delivering internet connectivity to millions of underserved student households. The programme offers free internet and mobile hotspots, as well as access to low-cost laptops and tablets.

As part of its $2 billion digital divide commitment, AT&T introduced Connected Learning, a multi-year initiative investing in digital inclusion, literacy and education to help connect today's learners with skills, resources and opportunities for success – in and out of the classroom. This includes opening Connected Learning Centers, which provide students and families access to education, mentoring and tutoring resources, as well as high-speed internet and computers.

Meanwhile, Verizon is working to foster digital inclusion through an initiative called Verizon Innovative Learning. In 2021, it launched the Verizon Innovative Learning HQ, a free online portal that makes next-generation learning tools and resources available to all. It includes a curated library of AR and VR educational experiences made in partnership with leading ed-tech innovators and educators. The platform also offers professional development resources to help teachers learn new skills and feel more comfortable and confident bringing technology into the classroom.

These initiatives are helping to deliver improved outcomes for learners across the country, supporting the industry's contribution to SDG 4: Quality Education. Examples of key achievements include the following:

- **T-Mobile** has brought free or subsidised connectivity to nearly 1,500 school districts and connected around 3.2 million students nationwide.
- **AT&T** will have launched more than 20 AT&T Connected Learning Centers in under-resourced neighbourhoods facing barriers to connectivity by the end of 2022.
- **Verizon**, through its Verizon Innovative Learning initiative, has reached more than 1.5 million students and invested over $1 billion in market value to support STEM education, with the operator aiming to equip 10 million people with digital skills training by 2030.

7. The Mobile Disability Gap Report 2021, GSMA, 2021

04

Policies to sustain the impact of mobile on the digital economy

The 4G era sparked significant productivity gains through the 2010s, helping people around the world to manage their lives more efficiently at home and at work. Today these benefits are at the core of the North American economy. As the region emerges from the uncertain environment of the pandemic, mobile will continue to play a role in connecting to a brighter future. This comes at a time when 5G is gaining momentum and is set to drive the next phase of digital transformation across society. In this context, stakeholders need to take the right steps on pertinent issues to sustain the impact of mobile services, and 5G in particular, on the digital economy.

4.1 Fighting illegal robocalling and spam calls

Stopping illegal robocalls is a top policy priority for the US and Canada, as consumers continue to receive scam robocalls. As the ones closest to the victims of robocalling, terminating operators have been doing extensive work to abate robocalls for their consumers, which includes utilising blocking tools and caller-ID technologies and coordinating with federal and state enforcement agencies. Over the past several years, the FCC has been implementing new frameworks and rules to address illegal robocalls.

Illegal robocalling is an international issue, but it is not felt equally around the world. Outside the FCC's jurisdiction, bad actors abroad originate illegal robocalls, spoofing the number to appear local.

In May 2022, the FCC approved two new orders addressing robocalls that originate outside their borders. The first order requires gateway providers that transmit calls into the US to certify with the FCC's Robocall Mitigation Database (RMD) and implement STIR/SHAKEN to authenticate session initial protocol (SIP) calls. The FCC previously mandated STIR/SHAKEN adoption for operators on the IP portions of their network.

For the second order, following a new registration deadline, US providers (intermediate and terminating) will be prohibited from accepting traffic from foreign voice service providers (VSPs) using US numbering resources if they are not registered in the FCC's RMD.

4.2 Spectrum availability as a key driver of affordable 5G for all

North America is an early leader in 5G development. Strengthened by 3.5 GHz assignments, 5G connectivity is already proving to be a powerful driver of GDP growth, with 5G's contribution to GDP expected to reach $122 billion in 2030. The success of 5G rollouts depends heavily on operators' 5G spectrum holdings across low, mid- and high bands to deliver both speed and geographical coverage. Additional spectrum can boost the provision of cost-efficient investment and enhance network quality in North America, which can become a central pillar of the region's economic development strategies.

Low bands

Low-band spectrum is a driver of widespread and affordable connectivity, and is therefore a key building block for digital equality. Increased sub-1 GHz spectrum is essential to building coverage in thinly populated areas and providing indoor coverage in built-up and hard-to-reach urban areas. In addition, it would decrease the number of macro sites required, leading to lower energy consumption.

Rural connectivity continues to be a challenge in North America, particularly across difficult-to-connect rural regions. Adding 600 MHz to existing low bands is shown to raise download speeds by 30–50% in rural areas.[8] In the US and Canada, the 600 MHz band is already used for mobile (band n71) with 2x35 MHz. The amount of spectrum in band n71 was the result of an auction that matched the willingness of broadcasters to relinquish spectrum at prices mobile operators were prepared to pay. According to FCC documents for the 600 MHz auction, an auction outcome with 2x50 MHz would have been possible, extending the band further downwards.

Mid-bands

Mid-band 5G spectrum can play a central role in sustainable social and industrial development. According to a recent study by the GSMA,[9] mobile networks will need on average 2 GHz of mid-band spectrum per country by 2030. An average of 2 GHz of mid-band spectrum for mobile operators is required in the 2025–2030 time frame.

In North America, that goal leaves a shortfall of 0.93 GHz beyond today's assignments. While the region is starting to move closer to the 2 GHz figure, maximising existing harmonised bands is crucial, and the lack of 6 GHz licensed 5G in the region makes meeting mid-band capacity needs a challenge.

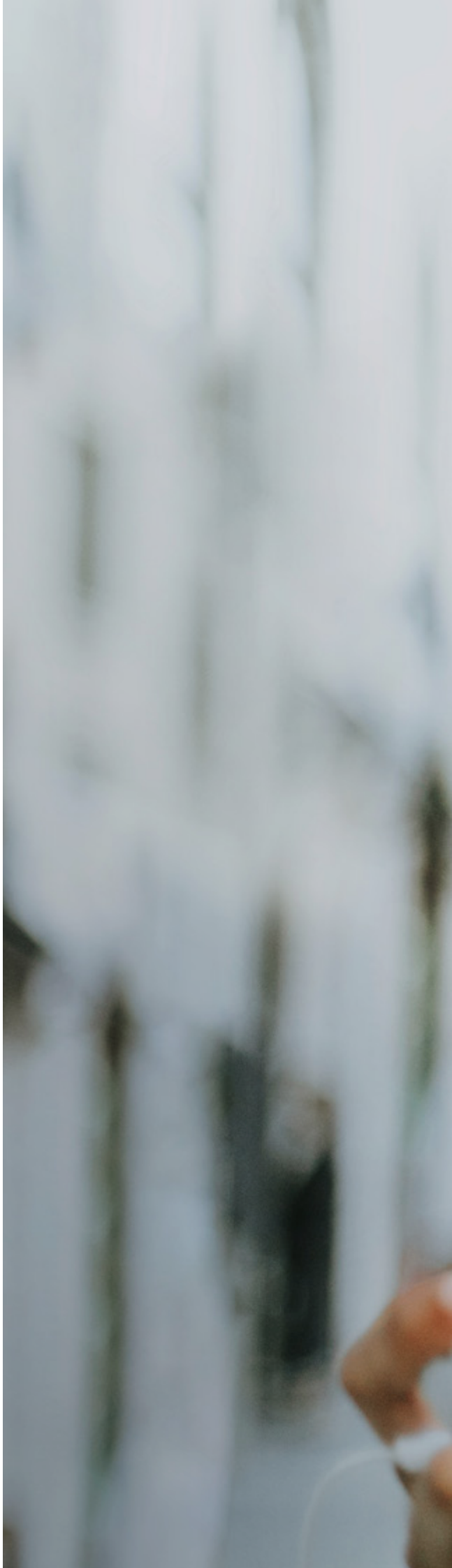
High bands

mmWave frequencies help realise the full potential of 5G by enabling lightning-fast download speeds, huge capacity and the lowest latencies. The North American region has been a pioneer on mmWave spectrum assignments and this leadership has paid off, expanding to other bands and unlocking additional possibilities.

mmWave spectrum is essential for peak performance. According to a recent report by the GSMA,[10] 5 GHz of mmWave spectrum is required per market for enhanced mobile broadband (eMBB), FWA and enterprise applications. Successful and effective mmWave spectrum assignments are therefore important to ensure 5G achieves its true potential in terms of performance and socioeconomic impact. Any spectrum capacity constraints should be addressed early by licensing adequate mmWave spectrum for IMT services.

8. Vision 2030: Low-Band Spectrum for 5G, GSMA, 2022
9. "GSMA Reveals 5G Spectrum Needs for 2030 Across Low, Mid, and High Bands", GSMA, June 2022
10. Vision 2030: mmWave Spectrum Needs, GSMA, 2022

gsma.com



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