

# ERICSSON MOBILITY REPORT (REVIEW. PART I)

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## ABSTRACT

Resilient networks are the foundation for continued digitalization of societies and industries. Continuous network modernization and coverage build-out has led to several hundred million people becoming new mobile broadband subscribers every year. 5G is scaling faster than any previous mobile generation and we expect 5G subscriptions to reach 1 billion by the end of 2022. In several regions, deployment of 5G standalone networks is also picking up pace, as communications service providers prepare for innovation to address the business opportunities beyond enhanced mobile broadband. A solid digital network infrastructure underpins enterprises' digital transformation plans, and their new capabilities can be turned into new customer services. As exemplified in this edition, service providers are looking to expand out of pure connectivity into service enablement platforms. Global mobile network data traffic has doubled in the last two years, driven by continuing growth in smartphone usage, mobile broadband and now the digitalization of societies and industries. But traffic is not the only thing that grows. The ongoing war in Europe, as well as increased geopolitical tension in the world, leads to a range of global threats - economic as well as social - that must be navigated. And in our field of networking, the threat landscape calls for constant diligence in keeping ahead with security. You can read more about security in this edition. Managing the continued strong traffic growth while reducing energy consumption is also a top priority. Older technologies are being replaced by continuous build-out of 4G and 5G networks, substantially improving network performance and energy efficiency with each generation. 5G technologies play a key role in modernization, providing multiples of capacity while becoming more energy efficient. Innovative network technologies enable service providers to introduce new services that in turn support societies and enterprises to reduce their carbon emission footprint. In this edition, we share some examples of how 4G and 5G technologies make it possible to unleash the power of IoT connectivity to enhance both enterprises' business performance and sustainability.

**KEYWORDS:** *5G technologies, digitalization, mobile subscriptions.*

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## INTRODUCTION

Taking a wide view, subscription and traffic trends are following the expected patterns in our forecasts – 5G and the associated new technologies are trending upwards, as older generations begin to slow or decline [1-3]. If we go down a layer, differences between the regions and countries become clear due to their unique circumstances. For example, while 5G dominates the stories in our forecasts, it's also notable that earlier-generation technologies still play an important role in closing the digital divide in many regions, by connecting the unconnected [4-7].

### 5G MOBILE SUBSCRIPTIONS TO SURPASS 1 BILLION IN 2022

*By the end of 2027, 5G subscriptions are expected to reach 4.4 billion.*

Service providers continue to switch on 5G and more than 210 have launched commercial 5G services globally. Deployment of 5G standalone (SA) networks is also increasing, with more than 20 commercial launches at the end of 2021. The most common 5G services that service providers have launched for consumers are enhanced mobile broadband (eMBB), fixed wireless access (FWA), gaming and AR/VR-based services. When it comes to 5G offerings for enterprises, the most common segments targeted are manufacturing (smart factories), transport, smart cities and ports.

A weaker global economy and the uncertainties caused by Russia's invasion of Ukraine have impacted our global estimate for 2022 by around 100 million, and the forecast has been adjusted accordingly.

#### Strong 5G subscription growth

5G subscriptions grew by 70 million during the first quarter to around 620 million, and that number is expected to surpass 1 billion by the end of this year. Currently, North America and North East Asia have the highest 5G subscription penetration, followed by the Gulf Cooperation Council countries and Western Europe. In 2027, it is projected that North America will have the highest 5G penetration at 90%.

By the end of 2027, we forecast 4.4 billion 5G subscriptions globally, accounting for 48% of all mobile subscriptions. 5G subscription uptake is faster than that of 4G following its launch in 2009, reaching 1 billion subscriptions 2 years sooner than 4G did. Key factors include the timely availability of devices from several vendors, with prices falling faster than for 4G, as well as China's large, early 5G deployments. 5G will become the dominant mobile access technology by subscriptions in 2027 (Fig. 1, 2).

Subscriptions for 4G continue to increase, growing by 70 million during the quarter to around 4.9 billion. The technology is now projected to peak at 5 billion this

year, then decline to around 3.5 billion by the end of 2027 as subscribers migrate to 5G.

3G subscriptions declined by 49 million, while GSM/EDGE-only subscriptions dropped by 59 million during the quarter and other technologies decreased by about 5 million.

During the quarter, China had the most net additions (+16 million), followed by the US (+4 million) and Bangladesh (+3 million).

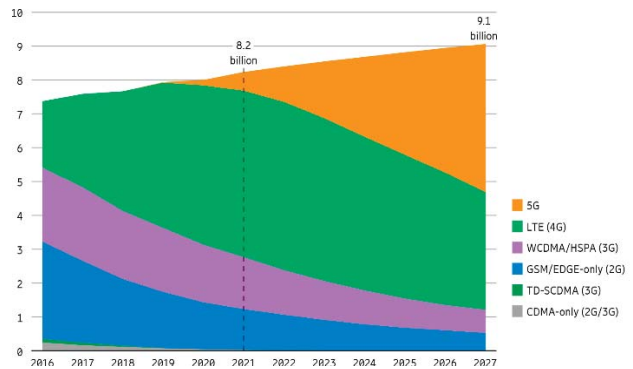


Figure 1. Mobile subscriptions by technology (billion)

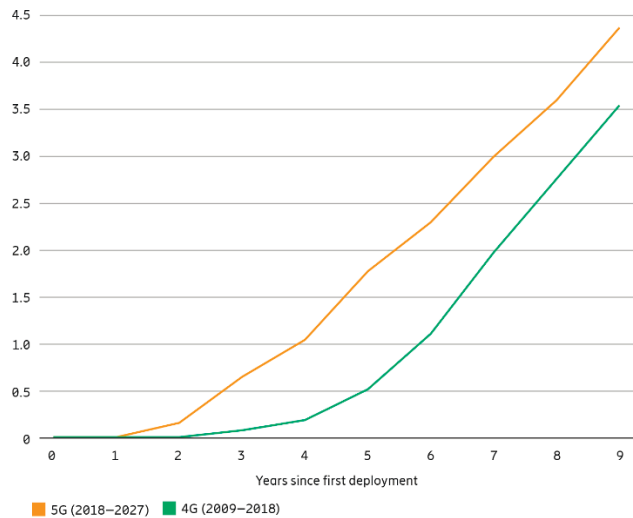


Figure 2. Comparison of 5G and 4G subscription uptake in the first years of deployment (billion)

#### Mobile broadband dominates mobile subscriptions

At the end of 2021, there were around 8.2 billion mobile subscriptions, and we project this figure will increase to around 9.1 billion by the end of 2027. During the same time, the share of mobile broadband subscriptions will increase from 84 to 93%. The number of unique mobile subscribers is projected to grow from 6.1 billion at the end of 2021 to 6.7 billion by the end of the forecast period.

Subscriptions associated with smartphones continue to rise. At the end of 2021 there were 6.3 billion, accounting for about 77% of all mobile phone subscriptions. This is forecast to reach 7.8 billion in 2027, accounting for around 87% of all mobile subscriptions at that time.

Subscriptions for fixed broadband are expected to grow around 4% annually through 2027. 4 FWA connections are anticipated to show strong growth of 17% annually through 2027. Subscriptions for mobile PCs and tablets are expected to show moderate growth, reaching around 540 million in 2027 (Figure 3).

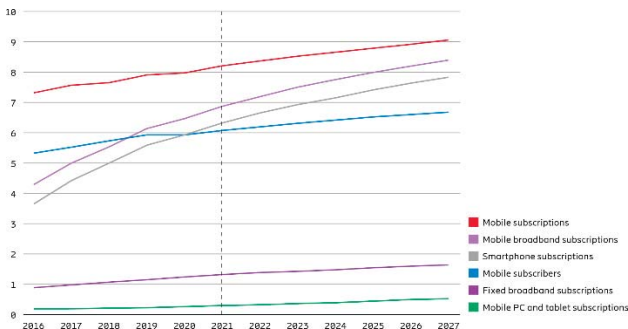


Figure 3. Subscriptions and subscribers (billion)

### NORTH AMERICA AND NORTH EAST ASIA REGIONS REACHED SIMILAR 5G SUBSCRIPTION PENETRATION IN 2021

#### Sub-Saharan Africa

Demand for mobile voice and data services continues to grow in the region. Investment in telecom infrastructure accelerated during 2020-2021 in the wake of COVID-19, including mobile coverage and fixed wireless access (FWA) build-out, enabling service providers to address additional subscriber segments with mobile broadband. In 2021, the number of 4G subscriptions grew by 26%, and strong growth is expected to continue during 2022. Migration towards 4G devices continues to be an important driver for 4G subscription uptake, which in turn drives the growth of mobile data traffic. 3G mobile data traffic is still increasing, but the majority of traffic growth is expected to be in 4G. Over the forecast period, total mobile broadband subscriptions are predicted to increase, reaching 78% of mobile subscriptions.

Regulatory initiatives are being taken to make more spectrum available in key markets across Africa. This will enable access to mobile services for a larger part of the population, especially in rural areas that have traditionally been underserved.

#### Middle East and North Africa

Mobile subscription growth in the region is predominantly driven by the uptake of 4G services in less mature markets. In 2021, 4G subscriptions increased by about 54 million, while 2G and 3G declined.

Digitalization is a high priority in some countries as a means for transforming economies and societies. Service providers are motivated to undertake extensive network modernization and expansion to improve network performance, which stimulates further subscription growth. 5G subscriptions grew to around 10 million in 2021, and the region is forecast to reach nearly 200 million 5G subscriptions in 2027.

#### Gulf Cooperation Council (GCC)

In the GCC countries that are major travel destinations, tourism has begun to return to pre-pandemic levels, giving rise to seasonal, mostly pre-paid mobile subscriptions. 5G saw strong growth in 2021, adding 5 million subscriptions, while 4G grew by less than 1 million subscriptions. From 2022 onwards, 5G will be the only growing subscription type. It is expected to reach over 65 million, representing 80% of total subscriptions in 2027. Monetization through growing both traditional and IoT mobile connections remains a key short-term priority for service providers (Figure 4).

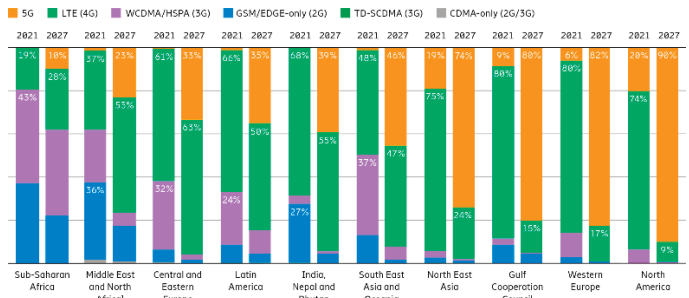


Figure 4. Mobile subscriptions by region and technology (percent)

Another focus is extracting value from network investments through partnerships with regulators, solution providers, and vendors. Service providers are also exploring new types of service offerings, for example at mega-events such as the 2022 international football tournament in Qatar.

GCC service providers are targeting a range of services beyond mobile broadband to monetize 5G, including IoT, financial services, video services and cloud gaming. All these have the potential to increase mobile subscriptions, data consumption and service revenues. As demand for high-speed connectivity increases, FWA will also drive growth in broadband subscriptions. Demand for dedicated networks is also expected to grow as 5G use cases emerge.

**Central and Eastern Europe Technology** adoption and subscription uptake are typically slower in this region than in Western Europe. This is due in part to slower spectrum allocation processes, as well as consumers being reluctant to upgrade to more expensive subscriptions. 4G is the dominant technology, accounting for 61% of all subscriptions at the end of 2021. Mobile subscription growth has flattened, and is expected to be virtually zero in the coming years. However, migration from 2G/3G to 4G continues to look strong up to 2024, from which time 5G is expected to add the most subscriptions. During the forecast period, there will continue to be a significant decline in 3G subscriptions, from 32% of mobile subscriptions to 3%.

#### Latin America

4G is currently the dominant radio access technology in the region, accounting for two-thirds of all subscriptions at the end of 2021. 4G subscription growth is strong, with more than 70 million added in 2021, and growth is

expected to continue during 2022. However, 3G subscriptions are steeply declining as users migrate to 4G and 5G. Many service providers will sunset 3G networks in the next two years to enable the reuse of valuable radio spectrum for 4G deployments.

Commercial 5G has been launched in seven countries, and trials are ongoing in six other countries. Service providers are accelerating 5G deployments in mid-band (3.5GHz) and low-band to stimulate 5G subscription uptake. There were around 5 million 5G subscriptions at the end of 2021, and more substantial uptake is expected from 2023 onwards. By the end of 2027, 5G will account for 35% of mobile subscriptions.

#### ***India, Nepal and Bhutan***

In India, mobile broadband is the foundation on which the government's "Digital India" initiative will be realized. Currently, 4G is the dominant subscription type driving connectivity growth.

Commercial launches of 5G networks are planned for the second half of 2022 in India, with enhanced mobile broadband expected to be the initial main use case.

With increasing availability and affordability of 5G smartphones, along with rapid adoption of smartphones in urban and rural areas, 5G subscriptions are expected to rapidly increase to reach around 50 million in the region by the end of 2023. 5G will represent around 39% of mobile subscriptions in the region at the end of 2027, with about 500 million subscriptions. As subscribers migrate to 5G, 4G subscriptions are forecast to decline annually to an estimated 700 million subscriptions in 2027.

#### ***South East Asia and Oceania***

4G is currently the dominant radio access technology in the region, making up 48% of all subscriptions at the end of 2021. In 2021, almost 100 million 4G subscriptions were added, and this strong growth is projected to continue in 2022. 5G subscriptions were around 15 million at the end of 2021 and are expected to more than double during 2022. As more network deployments take place over the next few years, 5G mobile subscriptions are expected to grow at an CAGR of 83% over the forecast period, reaching 570 million in 2027.

There are about 15 commercial 5G mobile networks in the region, including in Australia, Singapore, New Zealand, Thailand, Indonesia, Malaysia and the Philippines. Trials have also commenced in several countries including Cambodia, Sri Lanka and Vietnam, highlighting the strong 5G momentum in the region.

In addition to mobile services, service providers in Australia, Indonesia and the Philippines have also launched 5G FWA services. In Australia, all service providers have deployed 5G in a combination of low-, mid- and high-bands.

#### ***North East Asia***

Service providers continue to invest strongly in 5G deployments to further fuel 5G subscription growth. The current focus for service providers is to improve nationwide

coverage by adding more sites or introducing services on low-band.

In 2021, 5G grew strongly, adding around 275 million subscriptions, as migration from 4G to 5G subscriptions picked up pace. 5G is the only growing subscription type and is expected to reach 1 billion at the end of 2023. The rapid growth of 5G subscriptions, supported by the availability of more 5G device models, has positively impacted service providers' financial performance. Major service providers in leading 5G markets, such as China, Taiwan and South Korea, have reported a positive impact of 5G subscribers on service revenues and ARPU in 2021.

#### ***Western Europe***

4G is widely deployed and has the highest penetration of all regions.<sup>3</sup> Due to continued migration from 2G and 3G, 4G subscriptions grew by 7% to account for 80% of all mobile subscriptions at the end of 2021. 5G subscription growth was also strong, rising from 5 million in 2020 to 31 million in 2021.

4G is expected to decline in favor of substantially increased 5G subscription uptake from 2023 onwards. 5G subscriptions are expected to reach almost 150 million at the end of 2023, and penetration will reach 82% by the end of 2027. Many service providers will be sunsetting 3G networks in the next few years to enable the reuse of radio spectrum for 4G and 5G.

#### ***North America***

5G has entered the second wave of build-outs and user adoption. New mid-band spectrums (C-band and 3.45-3.55GHz) in multi-band 5G networks enhance the mobile user experience, stimulating subscription growth. In 2021, 5G grew strongly, adding around 64 million subscriptions, as migration from 4G to 5G subscriptions picked up pace significantly. 5G is the only growing subscription type and is expected to reach 250 million at the end of 2023. An increasing variety of broadband bundles offered by service providers across North America makes it easy for customers to find suitable 5G service offerings. FWA has gained traction as a fixed broadband option for consumers, as well as small and medium enterprises. By 2027, 400 million 5G subscriptions are anticipated, accounting for 90% of mobile subscriptions.

### **INDIA'S 5G FUTURE: A CLOSER LOOK**

India is among the world's fastest growing economies. It has a developed software industry with e-commerce, digital payments and educational technology standing out. Industrial enterprises are making unprecedented investments in digital transformation to modernize their processes – increasing demand for reliable network connectivity.

India's strong growth supports a dynamic mobile services market. Over the past five years, it has seen rapid adoption of smartphones and migration up to 4G. In the region as a whole (including India, Nepal, and Bhutan), the share of 4G has grown from 9% of mobile subscriptions in 2016 to 68% in 2021.

This has had a significant positive impact on India's consumers, economy and society. With a low penetration of fixed broadband, consumers have mostly relied on mobile broadband for remote working, education, healthcare services, shopping and other services during the COVID-19 pandemic.

### Challenges in the Indian market

While India presents significant opportunities for growth, it also holds challenges for service providers.

Indian service providers have recently been raising the price of data (the average price of 1GB of mobile data reached USD 0.68 in 2021) and mobile services revenue has continued to grow. Despite this, service provider ARPU remains low. Moreover, India has some of the highest prices for spectrum in the world, constraining service providers' ability to invest in infrastructure.

In the India region as a whole, mobile data traffic has grown by more than 15 times in the past 5 years (from 0.8EB per month to 13EB per month in 2021) and is expected to more than double in the next 3 years.

With the projected traffic increase, service providers would benefit significantly from the efficiency gains provided by 5G.

### The state of 5G

The Indian Department of Telecommunications (DoT) plans to auction 5G spectrum in June–July 2022. Even as the government continues to work on the process of auctioning 5G spectrum, India's leading service providers are testing 5G at multiple locations, focusing on use cases for both urban and rural consumers. These include FWA for rural broadband, mobile cloud gaming, cloud-connected robotics, and remote healthcare.

### 5G outlook

5G is projected to account for almost 40% of mobile subscriptions – 500 million – by the end of 2027. By then, smartphone users in the region are forecast to consume 50GB of data per month on average. Even though 5G has not been launched commercially, there is already a good foundation for 5G uptake in India. There is significant consumer interest in adopting 5G – as an Ericsson ConsumerLab study indicated, 40 million smartphone users could take up 5G in its first year of availability.

Additionally, 21% of respondents that are smartphone users indicated that they already have a 5G-ready device.

Indian consumers also claim to be willing to pay 50% more for 5G bundled plans. This presents a unique opportunity to grow revenue within a market that has historically had very low ARPU.<sup>2</sup>

### Looking into the future

According to an Ericsson-Arthur D Little study, 5G will enable Indian mobile service providers to generate USD 17 billion in incremental revenue from enterprises by 2030. Much of this is projected to be driven by the adoption of 5G in the manufacturing, energy and utilities, ICT and

retail industries. Indian enterprises consider 5G to be the most important technology for their digital strategies.

5G will also enable service providers to launch new services for consumers, including home broadband (5G FWA), enhanced video, multiplayer mobile gaming, and AR/VR services. Consumers anticipate that service providers will offer pricing plans with service bundling and data sharing.

5G can play an important role in achieving India's digital inclusion goals, especially in bringing broadband to rural and remote homes. Trials have proven the potential offered by 5G to bridge the digital divide by enabling access to high-speed broadband through FWA.

### OVER 100 MILLION FWA CONNECTIONS IN 2022

More than 75% of service providers surveyed in over 100 countries are offering fixed wireless access (FWA) services. Around 20% of these service providers apply differential pricing with speed-based tariff plans.

### Service providers with FWA offerings doubled in three years

An updated Ericsson study<sup>1</sup> of retail packages offered by service providers worldwide shows that, out of 311 service providers studied, 238 had an FWA offering, representing an average of 77% globally. Service providers' adoption of FWA offerings has more than doubled in the last three years.

### More service providers now offering 5G FWA

During the last 6 months, the number of service providers offering 5G FWA services has increased from 57 to 75, representing growth of around 30%. There is growth across all regions, with the strongest increase in North America, where 60% of all service providers surveyed now offer 5G FWA. During the last 6 months, the number of service providers offering 5G FWA services has grown by about 30% (Fig. 5, 6).

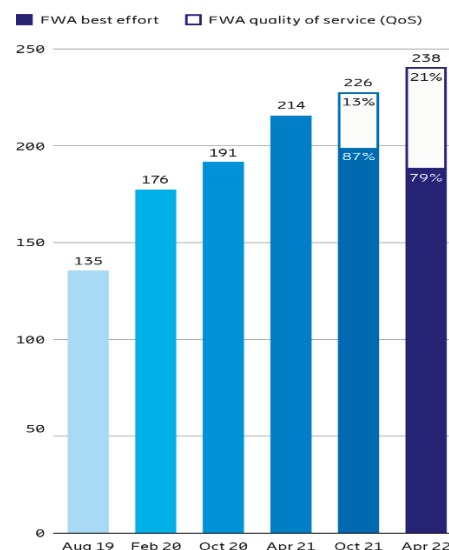
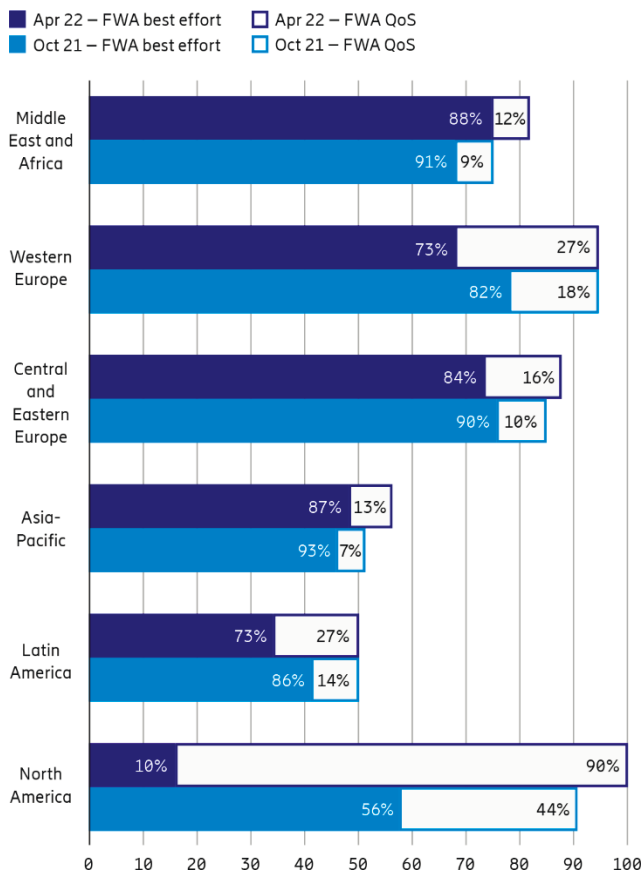


Figure 5. Global number of service providers offering FWA



**Figure 6.** Regional% age of service providers offering FWA

**Speed-based tariff plans on the rise**

The majority (79%) of FWA offerings are still best effort, with volume-based tariff plans (that is, buckets of GB per month). About 20% of service providers offer speed-based tariff plans (also referred to as QoS), a significant increase from 13% in October 2021.

Speed-based tariff plans are commonly offered for fixed broadband services such as those delivered over fiber or cable. These types of plans are well understood by consumers, enabling the service providers to fully monetize FWA as a broadband alternative. Around 20% of these speed-based offerings are basic, with average/typical speeds being advertised. Almost 80% are more advanced offerings, involving speed tiers, such as 100Mbps, 300Mbps and 500Mbps. Service providers with 5G FWA are more likely to have QoS FWA with speed-based offerings, with 26 out of 75 utilizing this approach (35%). Speed-based offerings are growing across all regions, with the North America region showing the highest adoption, with 90% of all offerings being speed based.

**High numbers of service providers in all regions offering FWA**

More than 80% of service providers in North America, Europe and the Middle East and Africa regions are offering FWA. In Latin America and Asia-Pacific, more than 50%

of service providers are offering FWA. All service providers in North America offer FWA services.

**FWA connections set to more than double by 2027**

Some service providers and regulatory bodies are starting to report FWA connections, but globally there is still limited reporting. Based on Ericsson’s own research, we estimate that there were close to 90 million FWA connections by the end of 2021, and during 2022 that figure will exceed 100 million. This number is forecast to more than double by 2027, reaching almost 230 million. This figure represents 15% of fixed broadband connections. Of these 230 million, the number of 5G FWA connections are expected to grow to around 110 million by 2027, representing almost half of the total FWA connections.

**FWA data traffic projected to grow by almost five times**

FWA data traffic represented almost 20% of global mobile network data traffic by the end of 2021, and is projected to grow almost 5 times to reach 86EB in 2027.

**MID-TIER SMARTPHONES TAKE 5G INTO THE MAINSTREAM**

**5G adoption continues**

- Over 650 5G smartphone models have been launched, accounting for 50% of all 5G devices by form factor.
- 5G device shipments more than doubled in 2021 over 2020 and surpassed 615 million units shipped.
- There is a greater focus on standalone (SA) enablement for smartphones including 3CC New Radio (NR) carrier aggregation.
- Global smartphone shipments rose 6% in 2021 compared with 2020. However, additional limitations are evident in 2022 due to geopolitics, continued supply chain constraints and the COVID-19 situation in China.
- There is an optimistic outlook for extended reality (XR) use cases over the intermediate term based on XR glasses, headsets or heads-up displays as peripherals connected to smartphones or other 5G smart devices.

**Devices in 2022**

In line with expectations, devices introduced so far in 2022 show improved capabilities, including carrier aggregation extended from two to three NR carriers for SA, NR dual connectivity for SA and improved uplink capabilities. The trend is clear, with more focus on SA. Apart from improved device capabilities, a wider range of 5G smartphone models are now available in the mid-tier price segment. This means that 5G smartphones are becoming increasingly affordable for more market segments.

This comes at a time when we see a price trend break at the lowest end of 5G devices. Impacted by supply, inflation and globalization challenges, there have been indications for some time of an emerging price floor of USD 120.

### 5G use cases for the future

The latest Mobile World Congress was awash with XR demos. Bounded – or committed maximum – latency, combined with network slicing, enables new device-powered use cases and will result in new innovations. As XR glasses will be connected through companion devices for the next few years, the smartphone will likely be part of that innovation for a longer time than generally anticipated. The first devices have started to enter the market, and more are expected throughout this year.

In 2024, the first reduced capability (RedCap) devices should be available, introducing relaxed requirements on the receiver in the device, allowing lower costs compared to standard NR. RedCap devices can facilitate the expansion of the NR device ecosystem to cater to the use cases that are not currently best served by NR specifications. This includes wearables, industrial wireless sensors and video surveillance (Figure 7).

5G SA networks increasingly deployed More than 20 service providers had launched public 5G SA networks on mid- and low-band by the end of 2021.

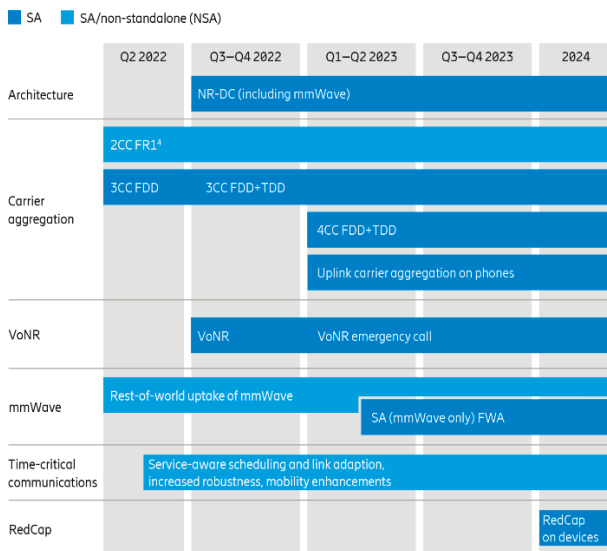


Figure 7. 5G technology market readiness

### MASSIVE IOT SHOWS STRONG GROWTH IN 2021

The Massive IoT technologies NB-IoT and Cat-M – primarily consisting of wide-area use cases involving large numbers of low-complexity, low-cost devices with long battery life and low throughput – continue to be rolled out around the world. The number of IoT devices connected via 2G and 3G has been in slow decline since 2019, and NB-IoT and Cat-M technologies are the natural successors. The number of devices connected by these Massive IoT technologies increased by almost 80% and reached close to 330 million in 2021.

The number of IoT devices connected by NB-IoT and Cat-M technologies is expected to overtake 2G/3G

connected IoT devices in 2023, and to overtake broadband IoT in 2027, making up 51% of all cellular IoT connections at that time. The growth of Massive IoT technologies is enhanced by a recently added network capability that enables Massive IoT co-existence with 4G and 5G in FDD bands, via spectrum sharing.

About 124 service providers have commercially launched NB-IoT networks and 55 have launched Cat-M. These technologies complement each other, and around 40 service providers have launched both technologies.

In 2021, broadband IoT (4G/5G) overtook 2G and 3G as the technology that connects the largest share of all cellular IoT connected devices, accounting for 44% of all connections. Broadband IoT mainly includes wide-area use cases that require high throughput, low latency and large data volumes.

By the end of 2027, 40% of cellular IoT connections will be broadband IoT, with 4G connecting the majority. As 5G New Radio (NR) is being introduced in old and new spectrum, throughput data rates will increase substantially for this segment.

North East Asia is the leading region in terms of the number of cellular IoT connections, and is forecast to reach 1.5 billion in 2022. The region is set to account for 60% of all cellular IoT connections in 2027 (Figure 8).

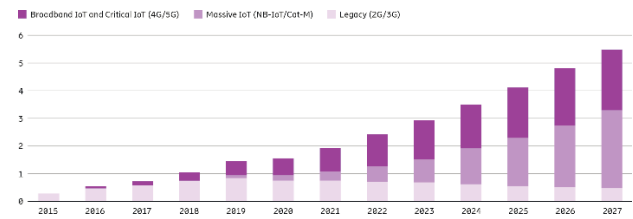


Figure 8. Cellular IoT connections by segment and technology (billion)

### ENHANCED COMMUNICATION SERVICES FROM VOLTE TO VONR

#### VoLTE continues to grow

Service providers continue to use the IP Multimedia Subsystem (IMS) to support mobile voice services for 4G and 5G smartphones and other smart devices.

Voice over LTE (VoLTE) has been activated in over 280 networks to date. Now, launches of Voice over New Radio (VoNR) – the voice application for 5G standalone (SA) networks – have commenced.

It is estimated that the number of subscriptions with voice service built on IMS will exceed 4.6 billion by the end of 2022 and is projected to reach nearly 7 billion by the end of 2027. This will account for around 90% of all combined 4G and 5G subscriptions at that time. This is partly driven by the growing obsolescence of Circuit-Switched Fallback (CSFB) which requires 2G or 3G.

#### First commercial VoNR services to be introduced

IMS is the standardized voice platform for 5G SA networks, which do not support CSFB. 5G voice services can

be deployed using a variety of applications in 5G networks: LTE New Radio (NR) dual connectivity, Evolved Packet System (EPS) fallback and VoNR. These are used in different phases of the 5G coverage build-out. Once nationwide 5G SA is in place, only VoNR will be used. The first EPS fallback voice-enabled networks have gone live in North America, Asia-Pacific and Europe. VoNR and 5G video calling has completed interoperability testing with network infrastructure and devices, and the first VoNR services are ready to be rolled out.

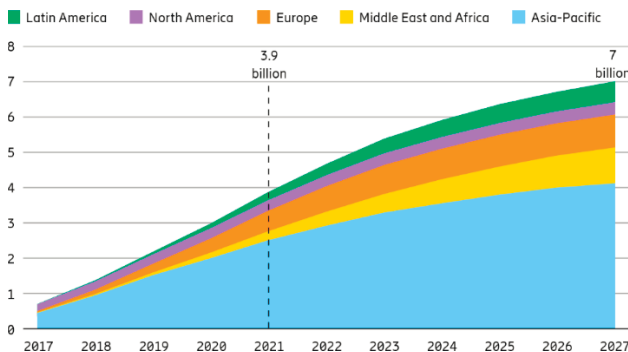
**Device availability and use case uptake** There are more than 650 voice-enabled 5G smartphone models available.

The majority of these smartphones support 5G non-standalone (NSA) networks and the remaining, and quickly growing, part supports 5G SA. Note that all 5G SA smartphones support IMS for voice. Other devices include indoor and outdoor customer premises equipment with fixed wireless access (FWA) capabilities.

New voice use cases leveraging IMS include multi-device network capabilities which tie several devices – such as phones, smartwatches, smart speakers and cars – to the same phone number. More than 100 networks support cellular smartwatches with a VoLTE one-number service.

**Europe following North America's trends** An application built on IMS enables mission-critical push-to-talk services for public safety organizations, utilities and local private 4G networks. This has started to be deployed widely in North America, and now the European market is following suit. Once mission-critical communications for 5G have been finalized in the 3GPP standards, additional use cases with low latency and high-capacity broadband can be enabled.

VoLTE subscriptions are predicted to exceed 4.6 billion by the end of 2022 (Figure 9).



**Figure 9.** VoLTE subscriptions by region (billion)

*Continued strong smartphone adoption and video consumption are driving up mobile data traffic, with 5G accounting for around 10% of the total in 2021.*

Total global mobile data traffic – excluding traffic generated by fixed wireless access (FWA) – reached around 67EB per month by the end of 2021 and is projected to grow by a factor of around 4.2 to reach 282EB per month in 2027. Including FWA, this takes the total mobile network traffic to around 84EB per month by the end of 2021,

and to 368EB per month by the end of 2027. The traffic growth up to 2027 includes an assumption that an initial uptake of XR-type services, including AR, VR and mixed reality (MR), will happen in the latter part of the forecast period. If adoption is stronger than expected, data traffic could increase even more than currently anticipated towards the end of the forecast period (particularly in the up-link). Currently, video traffic is estimated to account for 69% of all mobile data traffic, a share that is forecast to increase to 79% in 2027.

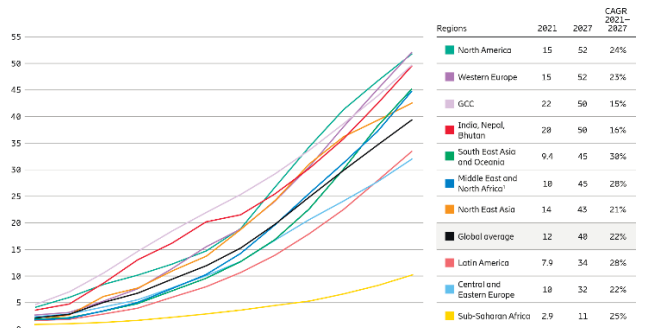
Populous markets that launch 5G early are likely to lead traffic growth over the forecast period. 5G's share of mobile data traffic was around 10% in 2021, and this share is forecast to grow to 60% in 2027.

Traffic growth varying across regions Traffic growth can be highly volatile between years and can vary significantly between countries, depending on local market dynamics. Globally, the growth in mobile data traffic per smartphone can be attributed to three main drivers: improved device capabilities, an increase in data-intensive content and growth in data consumption due to continued improvements in the performance of deployed networks.

Globally, the average monthly usage per smartphone is expected to surpass 15GB in 2022. These differences are reflected, for example, in the difference between the Sub-Saharan Africa region, where the average monthly mobile data usage per smartphone was 3GB, and the Gulf Cooperation Council countries where it was 22GB per smartphone in 2021. The global monthly average usage per smartphone was 12GB by the end of 2021 and is forecast to reach 40GB by the end of 2027.

### ***New services expected to drive data growth in North America***

In North America, the average monthly mobile data usage per smartphone is expected to reach 52GB in 2027. Unlimited data plans and improved 5G network coverage and capacity are increasingly attracting new 5G subscribers. The data traffic generated per minute of use will increase significantly in line with the expected uptake of new XR and video-based apps. This is due to higher video resolutions, increased uplink traffic, and more data from devices off-loaded to cloud compute resources. In 2027, 5G subscription penetration in North America is predicted to be the highest of all regions at 90% (Figure 10).



**Figure 10.** Mobile data traffic per smartphone (GB per month)



In **Western Europe**, service usage and traffic growth is expected to follow a similar pattern to that anticipated for North America. The more fragmented market situation has led to later mass-market adoption of 5G. But, by 2027, traffic usage per smartphone is projected to reach 52GB per month – similar to the usage in North America at that time.

The **North East Asia** share of total global mobile data traffic is expected to be around 30% in 2027. In the region, 5G subscribers currently use, on average, 2–3 times the amount of data than 4G subscribers. As more 4G subscribers migrate to 5G, average mobile data traffic per smartphone will increase. Video is the dominant traffic type. For example, in South Korea, video traffic share has increased 6% age points since the introduction of 5G services in 2019. Service providers expect additional traffic growth with the introduction of new video services, for example high-definition video and XR services.

In the **Middle East and North Africa region**, data traffic is expected to continue rising as the transition to 4G networks continues, coupled with the availability of more affordable 4G devices and data packages. The average data traffic per smartphone is expected to be around 45GB per month in 2027.

In the **Gulf Cooperation Council (GCC)** countries, smartphone data traffic will increasingly be lifted by 5G traffic due to the availability and relative affordability of 5G devices, especially in the higher ARPU markets. Operator monetization plans for 5G will also bring to bear a myriad of services relying on eMBB (enhanced Mobile Broadband), further stimulating data traffic growth. By the end of the forecast period, it is expected to reach an average of around 50GB per month.

Data traffic in **Sub-Saharan Africa** will maintain an upward trajectory, as mobile broadband-capable devices become more accessible. This is due to increasingly affordable price plans and service provider subsidies in some parts of the region. In markets such as South Africa and Kenya, recent spectrum allocations will enable service providers to extend their coverage and capacity of 3G/4G networks, leading to rising data traffic. 3G mobile data traffic is still increasing, but most of the traffic growth is expected to be in the 4G networks. The average data traffic per smartphone is expected to reach 11GB per month over the forecast period.

In **India, Nepal and Bhutan**, people have been dependent on mobile networks to stay connected during the successive lockdown waves, in both their personal and work lives. Mobile networks continue to play a pivotal role in driving social and economic inclusion, as service providers in India prepare to launch 5G this year.

Total mobile data traffic in the India region is estimated to grow by a factor of 4 between 2021 and 2027. This is driven by high growth in the number of smartphone users and an increase in average usage per smartphone. The average data traffic per smartphone in the India region is the second highest globally. It is projected to grow from 20GB per month in 2021 to around 50GB per month in 2027 – a CAGR of 16%.

In **South East Asia and Oceania**, mobile data traffic per smartphone continues to grow strongly and is expected to reach around 45GB per month in 2027 – a CAGR of 30%. Total mobile data traffic is expected to grow by a factor of around 6 between 2021 and 2027, driven by continued strong growth in 4G subscriptions and increasing 5G subscription uptake in several markets. Wider 5G adoption and new XR services are expected to drive traffic growth in the latter part of the forecast period up to 2027.

**Latin America** is expected to follow a similar trend as South East Asia and Oceania over the forecast period, while individual countries show very different growth rates for data traffic per smartphone. Traffic growth is driven by coverage build-out and continued strong adoption of 4G (and eventually 5G), linked to a rise in smartphone subscriptions and an increase in average data usage per smartphone. The average data traffic per smartphone is expected to reach 34GB per month in 2027.

In **Central and Eastern Europe**, growth is fueled by the migration of 2G and 3G subscribers to 4G, up to 2024, which is when 5G is expected to overtake previous generations as the technology contributing the most subscriptions. Over the forecast period, the monthly average data traffic per smartphone is expected to increase from 10GB to around 32GB per month.

It is important to bear in mind that there are significant variations in monthly data consumption within all regions, with individual countries and service providers having considerably higher monthly consumption than any regional averages.

## 5G OFFERINGS PICKING UP SPEED

An updated Ericsson study<sup>1</sup> of retail packages offered by 311 mobile service providers worldwide shows that, although the type of service packaging remains similar to previous studies, an increasing number of service providers are expanding the list of options available to consumers. However, the most common variants are the same and the innovation is mostly found in variations of existing themes.

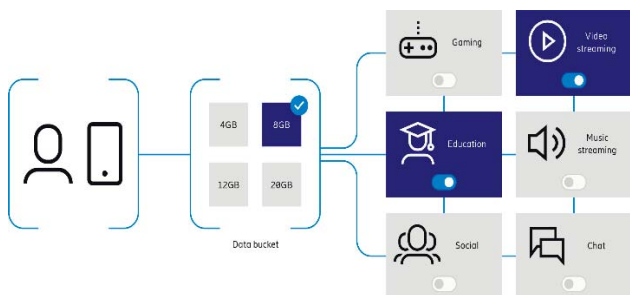
Data buckets remain the default offerings for nearly all service providers (99%). A common approach is to complement with “service-based connectivity packs” or an unlimited option at the premium end. Nearly 40% of all service providers surveyed offer unlimited data under their premium packages. However, boundary conditions, such as not allowing tethering or limiting the use of IoT devices, are becoming more common with these offerings.

More than 90% of service providers applying these conditions have launched 5G. It may sound counterintuitive to put limitations on packages that are being sold as “unlimited”. However, it highlights some of the challenges that these types of packages bring, especially with 5G offering throughput which could mean that certain usage may equal hundreds, if not thousands, of GB per month.

The service-based connectivity model seems to be going through a change. The total number of service providers offering any type of service-based connectivity

continues to increase. At the same time, the number of those targeting data-intensive services, such as gaming or video and music streaming, have decreased somewhat. However, many of these seem to have been refining their packaging.

Previously, add-on packs were often found under a separate website “tab” and were at risk of going unnoticed by many consumers. Now, numerous service providers have made them an integral part of the subscription selection process. After choosing the bucket size, and perhaps a speed tier, it is a matter of choosing click-to-add extras such as a “video pack” or an “education pack” (Figure 11).

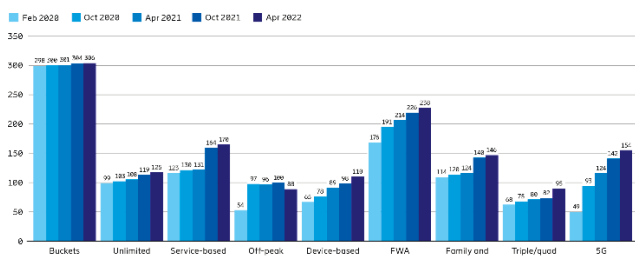


**Figure 11.** Example of how consumers can build custom service packages

This selection then provides additional GB to use for that particular service class, or even unlimited use without depleting the basic bucket. Service-based connectivity packs offer GB or hours (unlimited also available) to be used only for a specific service, without consuming data from the base subscription. Commonly, these offerings target data-intensive services like video streaming/conferencing or cloud gaming. The offering only provides the connectivity; service subscriptions must be purchased separately.

During the early days of the pandemic, specific service-based connectivity packages, often labeled “work and education packs” were offered in some markets. These packages typically offered discounted GB to use for a combination of video conferencing services, streaming, office software suites and web browsing.

These types of packages have now become quite common, especially in markets with lower income levels, mostly in South East Asia and Eastern Europe (Figure 12).



**Figure 12.** Number of service providers per type of offering

### Extracting a premium for 5G

The number of networks that offer 5G continues to increase and nearly 50% of the service providers surveyed have now launched 5G for smartphones. Of these, 35% charge a premium for 5G services. The average price premium over 4G is around 11%.

### Using speed tiers to incentivize consumers

A significant% age of service providers offering fixed wireless access (FWA) have been using speed tiers (also known as quality of service, or QoS) to segment the market and motivate consumers to move up to higher-priced tiers. Similarly, 5G service providers are now starting to use speed tiers for smartphones to extract additional value. Some of them also offer speed tiers for 4G services, but it is the wider range of speed enabled by 5G that makes such offerings attractive. Nearly 18% of 5G service providers are utilizing speed as a segmentation tool.

In Western Europe, however, this proportion is nearly 30%. A majority (60% ) of the service providers using speed tiers are doing so in combination with both bucket and unlimited packages. In many cases, speed is used in combinations where the consumer can choose between similarly priced packages with a high speed but limited data allowance, or a lower speed coupled with unlimited traffic.

Others simply provide the highest speeds with the most expensive plans. One interesting, and somewhat unique, example is a service provider which offers consumers a choice between two premium packages (a 15GB bucket or unlimited data) followed by a choice between three speed tiers: 15Mbps, 150Mbps or 1Gbps – at different price points.

### Gaming draws consumers to 5G

So far, cloud gaming services have exclusively been launched alongside 5G packages, with 35 service providers offering this at the time of the study. Generally, these services are developed by a partner company that provides the cloud gaming hardware acceleration platform, which is then packaged and offered by the service provider. This is often done with a revenue share model and the service provider implementing some form of “carrier billing”.

About one in five service providers have taken this approach a step further, and have created specific connectivity packages targeting gaming users.

These are designed as service-based connectivity packs which offer unlimited or time-based gaming sold as add-on packages. This allows consumers to play cloud-based games without consuming data from their regular buckets.

So far, only one service provider surveyed has created a package targeting the frustration at the heart of all gamers – lag. They use marketing terms like “priority” and “more network resources to beat lag when gaming” as a way to attract gamers and make 5G stand out in terms of the low-latency capability it offers.

Beside the use of speed tiers and adding new advanced services, like gaming, it is common to bundle with popular streaming services. Around 45% of 5G service providers are doing this in various forms with their more expensive offers. To summarize, there is an increased effort to differentiate 5G subscription offerings to provide additional value compared to 4G.

### **5G SA DEPLOYMENT: MOVING BEYOND EMBB**

An increasing number of progressive service providers in several markets are deploying 5G SA networks. More than 20 had launched public 5G SA networks on mid- and low-band by the end of 2021. This figure is expected to double during 2022 as more service providers deploy 5G New Radio (NR) SA and 5G Core networks. China and North America were the first markets in which 5G SA was launched, followed by commercial launches in several other markets, including Australia, Japan, South Korea, Singapore, Thailand, Germany and Finland. 5G SA networks provide a substantial competitive advantage for service providers that leverage its full benefits and potential.

5G SA mid-band (TDD) deployments with continuous coverage are important to deliver a consistent user experience for the new differentiated service offerings enabled by SA architecture.

#### ***Realizing 5G's full potential***

The overwhelming majority of commercially launched 5G networks are based on NR non-standalone (NSA) technology, using existing 4G radio access for signaling, and an Evolved Packet Core (EPC) network. However, many use cases for Critical IoT, enterprises and industrial automation will only be feasible with the 5G NR SA and 5G Core architecture. In 5G SA architecture, automated end-to-end network slicing is simplified, with assured quality of service (QoS), security and flexibility, to multiple customer segments. The 5G SA core is a flexible and programmable platform, allowing services to be flexibly designed based on customers' specific requirements.

5G Core is built using cloud-native technologies which allow upgrades and new functionalities to be more cost-efficiently deployed, without impacting live services. The possibility to add new network functionalities, quickly scale capacity and run in-service software upgrades will make it possible for service providers to create and deploy new services for automated and customized connectivity in hours, rather than days or weeks. With 5G Core, service providers will be able to provide better network slicing and offer end-to-end service-level agreements (SLAs) to customers. Service exposure and traffic steering functionalities introduced in 5G Core will provide additional tools for service differentiation. Edge computing support enables distribution of user plane functionality to break out traffic

dynamically at the edge. The reduction in latency and increased service reliability leads to enhanced end-user service experience.

### **5G SA DEVICE AVAILABILITY INCREASING**

5G SA-compatible devices are increasingly becoming available, accounting for over half of all announced 5G devices. China is moving fast towards 5G SA-only networks.

In China, it has been mandatory for 5G devices to be SA-capable since early 2020, and since February 2021, both new and existing 5G devices are on "SA by default". 5G network traffic has increased due to continued 5G subscriber uptake, plus part of the traffic previously generated on the 4G network moving to 5G NR.

The device ecosystem is also developing support for multiple network slices on commercial smartphones. End users can be provided with differentiated services, for example, setting separate personal and work profiles, with one slice for generic mobile broadband traffic, another for services like gaming, and one or several slices for enterprise applications like video conferencing and collaboration. This functionality will only be supported in 5G SA architecture.

The need for network and business transformation Consolidated feedback from service providers who have already commercially launched 5G SA networks highlights a set of business, network technology and operational drivers for their deployments.

A common driver is the sense of urgency to transform the network into a new service delivery machine as the foundation for creating new business opportunities for top-line revenue growth. Another driver mentioned is the importance of overcoming learning-curve barriers related to new operating models, business strategies and service innovation.

Early deployment of 5G SA architecture provides a first-mover advantage for service providers with market-leading ambitions (frontrunners). Service providers that do not evolve as fast as their competitors risk falling behind during this significant transformation.

### **REFERENCES**

- [1] <https://www.ericsson.com/en/reports-and-papers/mobility-report>.
- [2] Ericsson ConsumerLab, 5 ways for a better 5G (May 2021).
- [3] Ericsson and OMDIA, Survey of Indian Enterprises (March 2022).
- [4] Adjusted for revised service provider base, April 2022.
- [5] Source for network and device statistics: GSA and GSMA (March 2022).
- [6] <https://www.ericsson.com/en/reports-and-papers/mobility-report/mobility-visualizer>.
- [7] <https://www.ericsson.com/en/internet-of-things/platform>.