



3GPP-A MOBILE CONNECTED WORLD

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The role of 3GPP technologies in our mobile world

Executive summary

5G - the new generation in mobile communication, was released in 2019, and as of end of March 2022, 213 commercial 5G networks around the world have been launched. 5G networks are the latest 3GPP standard – with its speed between 10 and 100 times faster than 4G.* Largely thanks to this massive increase in speed, 5G is expected to revolutionize mobile communication and enable the digitalization of many aspects of everyday life. Perhaps the most important aspect for future innovation of 5G technology is the ability to transfer massive amounts of data in real-time. 5G could serve as the basis for a "Fourth Industrial Revolution" and provide the connectivity required for smart cities of the future. In addition to these macro-level benefits, this technology will bring ease and efficiency to the lives of countless individuals around the world.

But are we boasting about this technology, or are there tangible effects of 3GPP that can be measured?

This Statista report quantifies the impact of 3GPP mobile standards (commonly known as 3G, 4G & 5G **) on today's connected society, starting from the time that these technologies entered the market and

providing insight into their future development; described in six dimensions:

1. Constantly evolving technology timeline
2. Growing penetration (adoption by end users) of the technology
3. Increasing affordability
4. Fast time to market reflecting the popularity of the services
5. Benefits/opportunities enabled by the 3GPP standard for other digital services
6. Digital Transformation enabled by 5G

What is 3GPP?

3GPP technologies cover cellular telecommunication technologies, which include radio access, core network and service capabilities, and provide a complete system description for mobile telecommunications. The association was founded in 1998 and started with introducing the 3G technology.

3GPP or the third-generation partnership project, consists of **seven*** standard organizations** which develop **protocols for mobile telecommunication**.

3GPP is a **global** and **open** standard ensuring **interoperable** equipment and devices.

Note(s): * actual download speeds will depend on a number of factors including location and network traffic **2G is not a part of 3GPP standard, however included in this report figures & stats ***ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, and TTC. For more information see also: <https://www.3gpp.org/about-3gpp/partners>

Sources: GSA



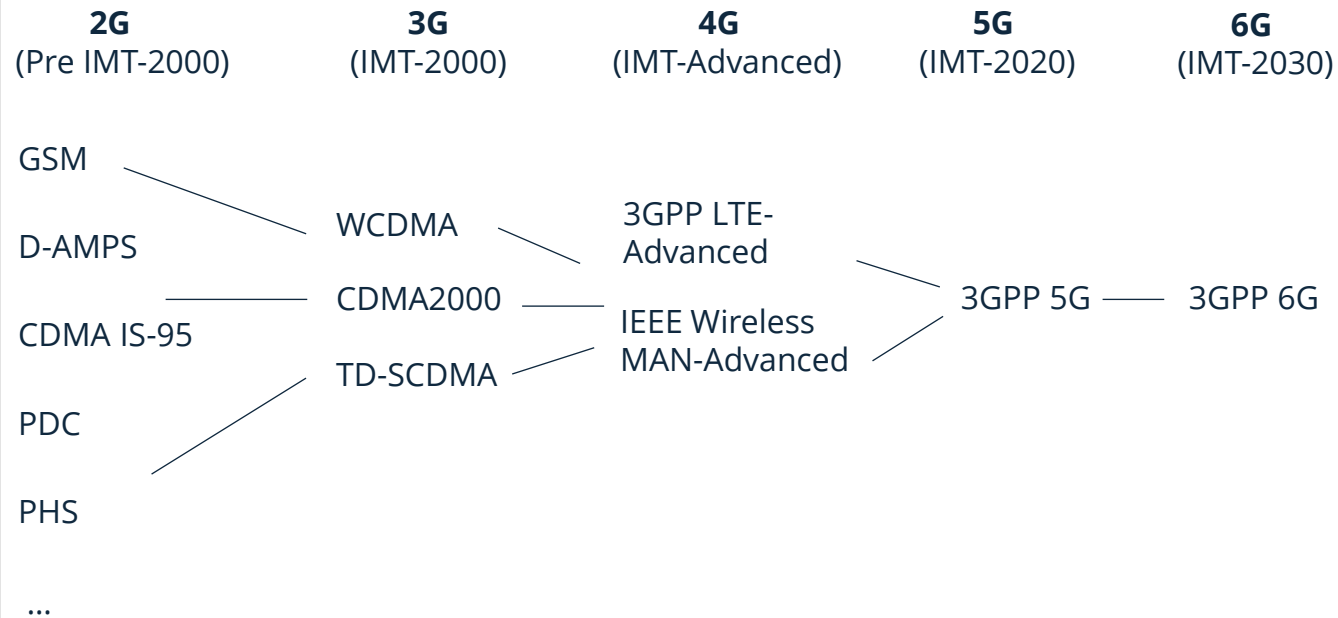
01 A unique standard

- Technical background
- Historical timeline
- 3GPP partners ecosystem
- Benefits of standard

How 3GPP “G” standards lays the foundation for a successful global mobile internet ecosystem

Technical background: 3GPP Standard Development

ITU-R progress toward the global harmonization of IMT technologies



Technical Development from 2G to 6G:

For the past 30 years, the ITU Radiocommunication sector (ITU-R) has been coordinating efforts with governments and industries to develop unified global broadband multimedia international mobile telecommunications systems, also known as IMT.

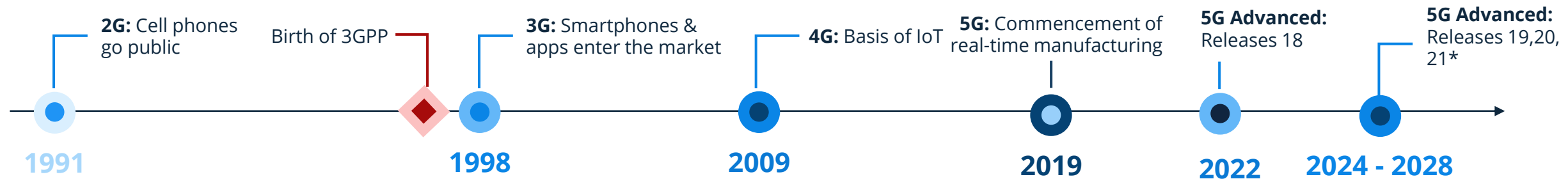
Global operation and economies of scale are key requirements for the success of mobile telecommunication systems.

In order to achieve this goal, ITU-R established the concept of IMT, which includes a harmonized timeframe for future development, taking into account technical, operational, and spectrum-related aspects.

Since then, ITU-R has been striving for harmonized global standards, all through the processes of IMT-2000, IMT-Advanced and the soon-to-be IMT-2030.

History shows us that 3GPP mobile standards are a key driver for technical inventions and social evolution

Constantly evolving mobile data timeline



- **Key difference:** Phone calls to cellphones (regardless of the location) made possible
- **Reach:** Enables voice calls & texting via mobile phones for the public
- **Security:** Digital signals instead of analogue, phone conversations became encrypted & more secure

- **3GPP:** The first standard introduced by the 3GPP association
- **Rise of Smartphone:** Use of the smartphone for the wider public, data-based apps
- **More devices:** Mobile modems for laptops made possible

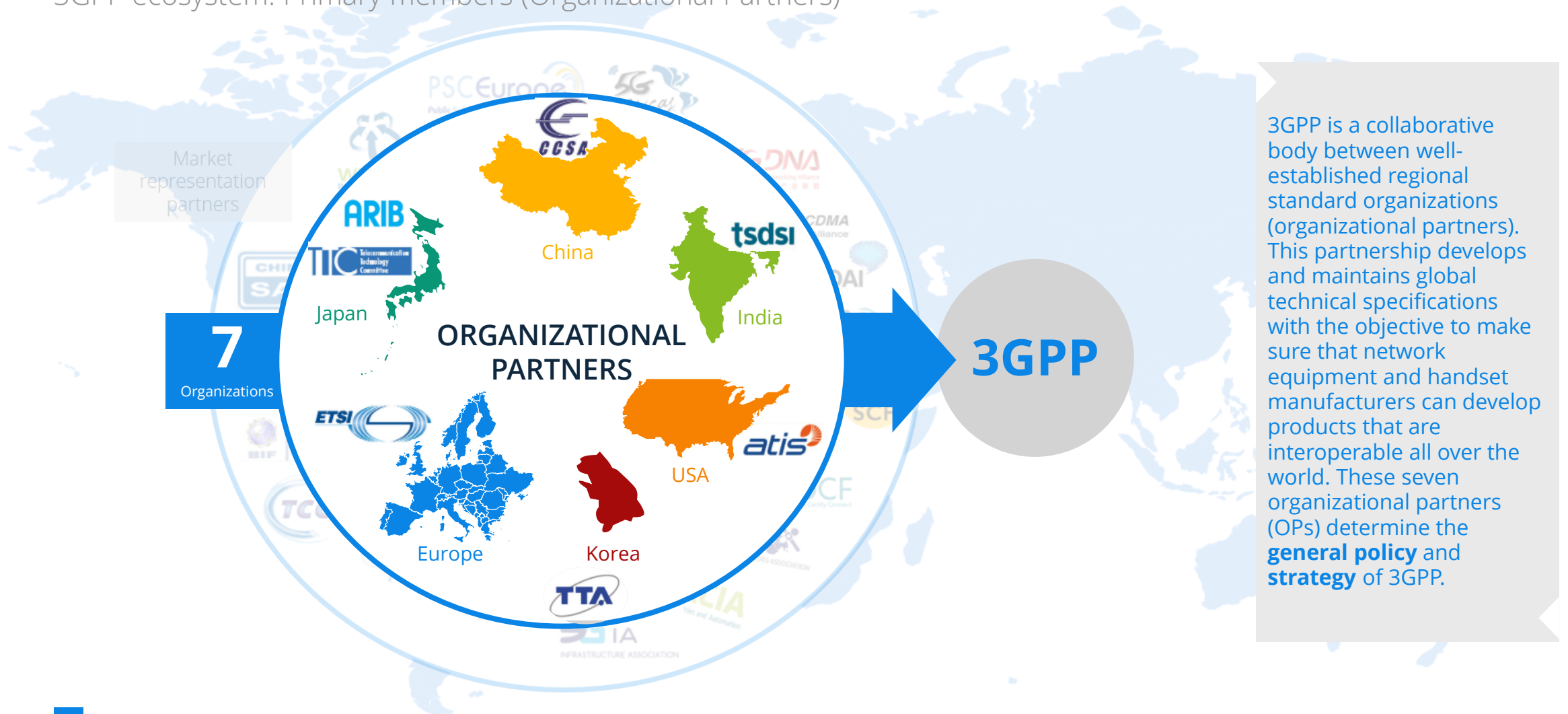
- **More Media:** Real time streaming of videos & faster gaming
- **IoT NB:** Enabling IoT narrow-band → transferring small amounts of data for a long time, providing energy saving for IoT device.
- **All-IP standard:** uses a standard communications protocol → data can be sent without being corrupted

- **Higher Performance:** Network speed up to 10Gbps, lower latency, much higher response rate
- **IoT:** Realization of the full potential of IoT. Enabler of real time manufacturing & logistics as well as Autonomous cars, smart cities & smart homes

- **Enhancements:** Advancements for uplink and downlink in mobile context
- **Artificial Intelligence:** Providing AI and ML** in air-interface. Providing extended reality services over 5G
- **Energy savings:** 5G networks are more energy efficient in transmitting data than older generations

3GPP is a partnership aiming to ensure the interoperability of network equipment and handsets all over the world

3GPP ecosystem: Primary members (Organizational Partners)



3GPP partnership includes seven regional telecom standard development organizations and twenty-six associate members

3GPP ecosystem : Associate members (Market representation partners)

MARKET REPRESENTATION
PARTNERS

26

Market
representatives



The twenty Market Representation Partners (MRPs) of 3GPP, together with organizational partners, perform tasks such as maintenance of the 'Partnership Project Agreement', approval of applications for 3GPP partnership, and making decisions related to the dissolution of 3GPP. Specific inputs, in the form of market requirements may also come into the project via any of these MRPs.

3GPP also has a variety of external co-operations with other standard bodies & different groups in the way of formal liaisons

3GPP ecosystem: External liaisons

STANDARD BODIES



5G PROJECTS



CERTIFICATION BODIES



FORMAL EXTERNAL LIAISONS*

Ecma International	\$GPP2
Expert Group for Emergency Access (EGEA)	450 MHz Alliance
Eurescom	AISG
European Co-operation in the field of Scientific and Technical Research (COST)	Bluetooth
European Radiocommunications Committee (ERC)	Broadband Forum (BBF)
Fixed Mobile Convergence Alliance (FMCA)	CableLabs
Global Certification Forum (GCF)	International Special Committee on Radio Interference (CISPR)
Global TD-LTE Initiative (GTD)	CTIA
GPS Industry Council	DVB project
GSM Association	OMA (Open Mobile Alliance)
HomeRF Forum	Open Networking Foundation (ONF)
IDB Forum	Open IPTV Forum
IEEE	Object Management Group (OMG)
Internet Engineering Task Force (IETF)	O-RAN Alliance
IrDA	PCS Type Certification Review Board (PTCRB)
International Multimedia Telecommunications Consortium (IMTC)	Portable Computer and Communications Association (PCCA)
Internet Streaming Media Alliance	Presence and Availability Management (PAM) Forum
ISO-ITU expert group	RSA Laboratories
ISO MPEG / JPEG	PCS Type Certification Review Board (PTCRB)
ITU-T SG2	Portable Computer and Communications Association (PCCA)
JAIN tm (Javatm APIs for Integrated Networks)	Presence and Availability Management (PAM) Forum
The Java Community Process (JCP)	RSA Laboratories
Liberty Alliance Project	SDR Forum
LTE/SAE Trial Initiative (LSTI)	Sun Micro Systems Inc
Metro Ethernet Forum (MEF)	NGMN (Next Generation Mobile Networks)
NENA	oneM2M

Standards having a beneficial impact in various areas of our society and economy

Benefits of standards



Disseminating information

Having set standards is beneficial, as it codifies information about technologies, products, and processes, so that all manufacturers and service providers have access to the same information.



Contributing to efficiency in companies that use standards

Standards can reduce operational costs by establishing procedures that reduce expenses for repeated activities.



Supporting market efficiency

Standards help to prevent market failures, facilitate network externalities, reduce production costs, and increase company productivity.



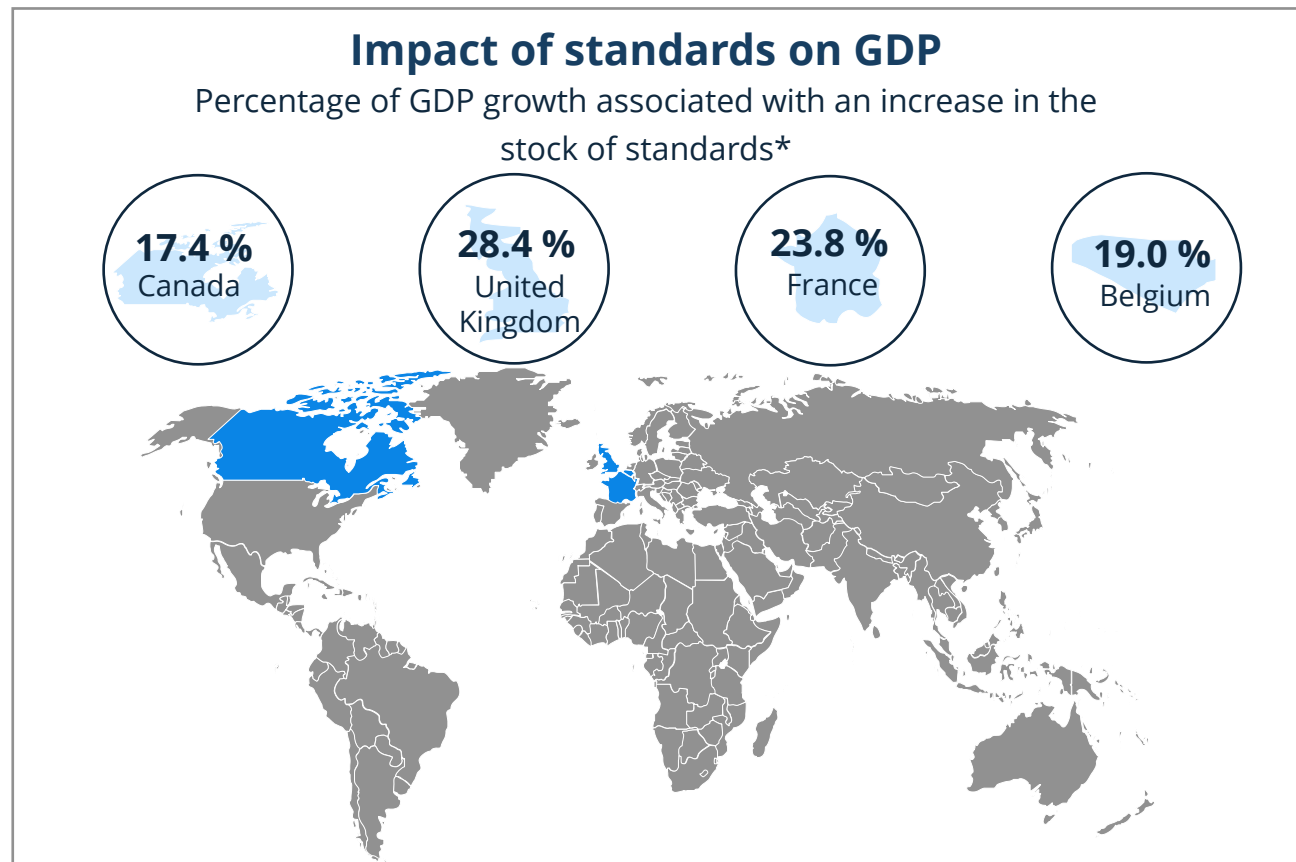
Facilitating innovation

Standards are thought to support innovation by establishing the playing field for technologies on which new products and services can be built.

Standards are an important part of a multifaceted system of technology development and knowledge diffusion. The overall “stock of standards” in any given country will include a range of different standard types, all of which can be expected to have different types of impacts. They are thought to contribute to economic growth by serving as a component of Total Factor Productivity (TFP). Additionally, they have impacts on other outcomes that directly relate to economic productivity such as international trade and innovation.

Output from economies are accelerated by the introduction of standards

Impact of an increase in stock of standards on GDP by country



Standards are thought to contribute to economic growth by serving as a component of Total Factor Productivity (TFP). Furthermore, they are contributing to the overall “knowledge stock” in an economy, and therefore improve the efficiency of use of capital or labour (or both).

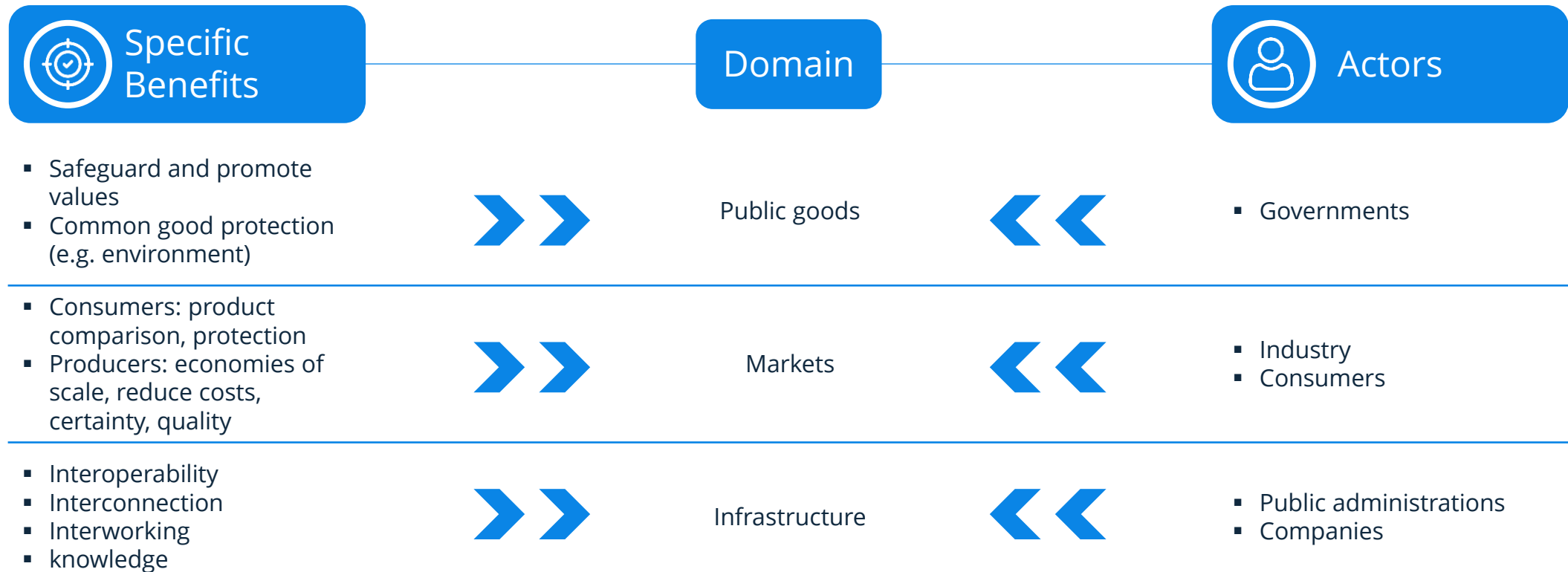
Standards also have impacts on other outcomes that directly relate to economic productivity such as international trade and innovation.

Note(s): * Time period: Canada 1950 – 2007; United Kingdom 1921 – 2013; France (1950 – 2007), Belgium (1994 – 2018)

Source(s): [ISO report](#)

Standards are the basis for economic and societal activities across the world

Benefits of standardization and the main actors



Notes:

Source(s): [The Geopolitics of Standardisation » directions blog](#)

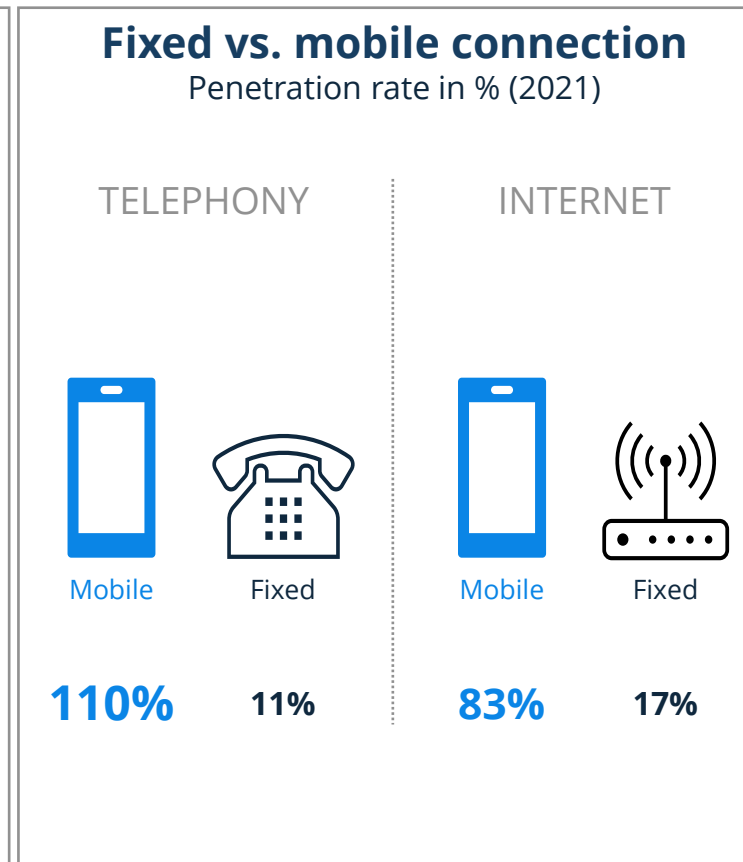
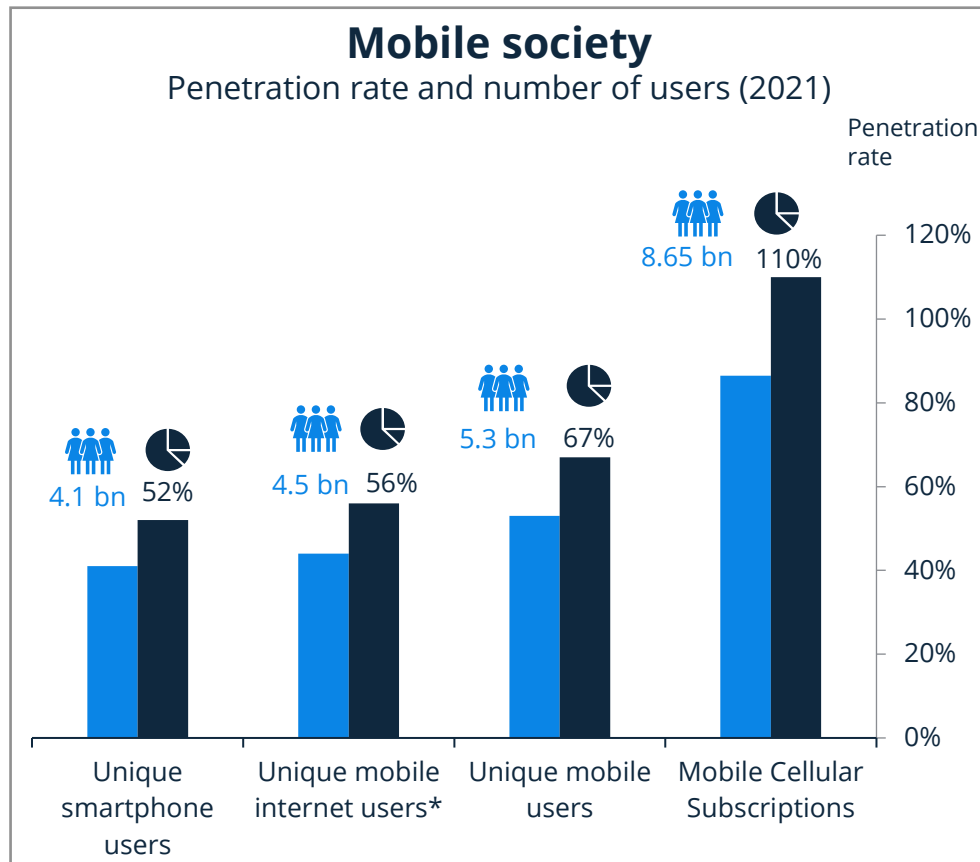


02 End user benefits

- Penetration
- Time to market
- Affordability

The spread of 3GPP communication technologies has resulted in unprecedented global penetration today ...

Mobile Technology as a part of our society (1/2)



3GPP cellular technologies are an integral part of our society, unique mobile subscribers reached 67% of population.

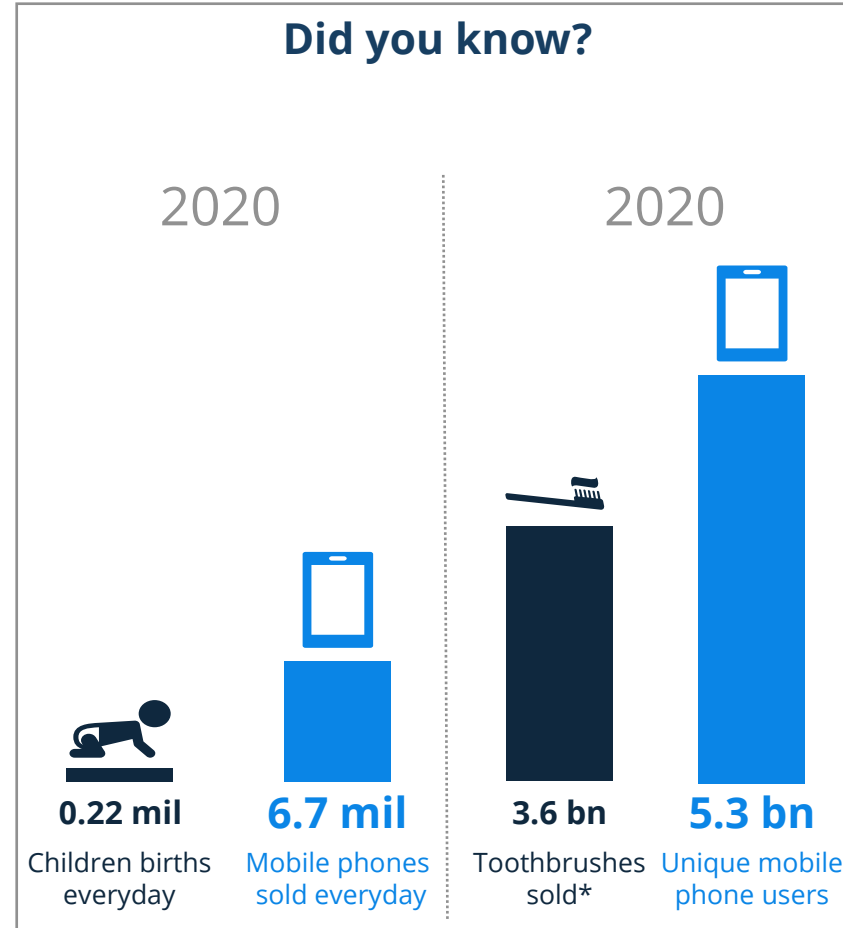
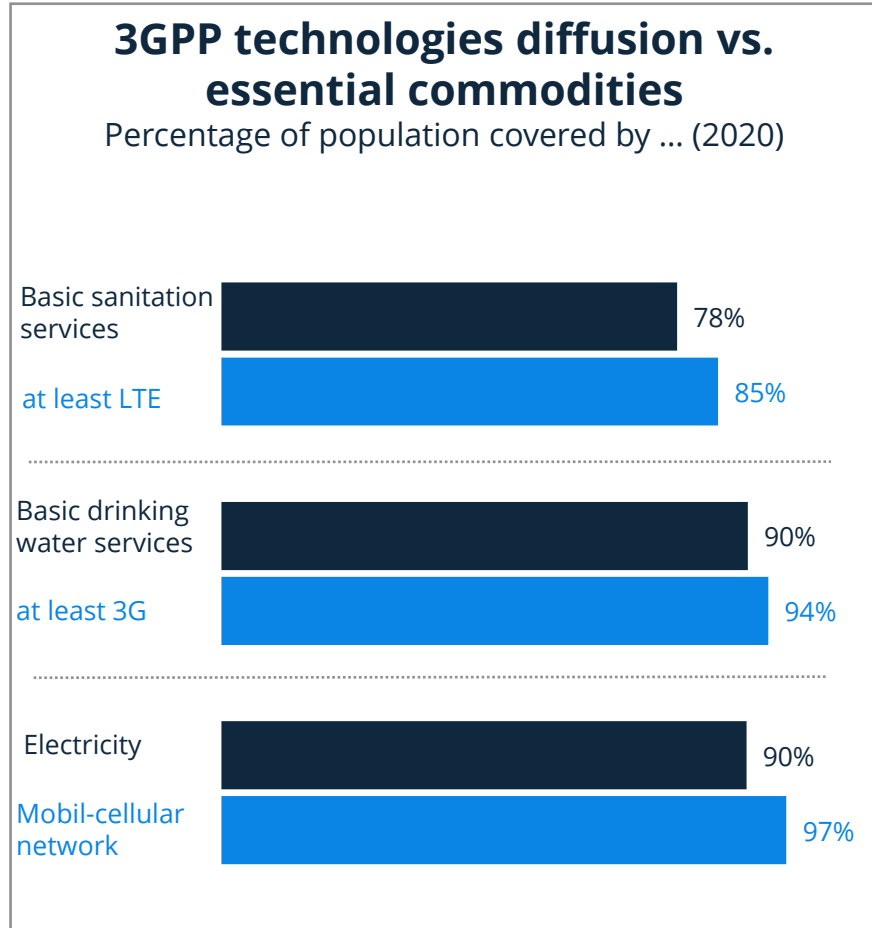
3GPP mobile networks enable access to mobile communication technology in regions where other communication technologies, such as fixed telephony and fixed broadband, failed to establish itself (e.g., in Asia and Africa).

Note(s): * cellular or Wi-Fi. Data points are based on estimations for the year 2021 by ITU or Statista calculation of unique number of users -> Penetration rate defines as the number of subscribers over the World Population in 2021, unless it is mentioned as unique number of subscribers. World population is assumed to be 7.89 billion by end of 2021

Source(s): [GSMA](#), [ITU](#), [Datareportal](#)

... and has even overtaken some long-established basic commodities in our society

Mobile Technology as a part of our society (2/2)



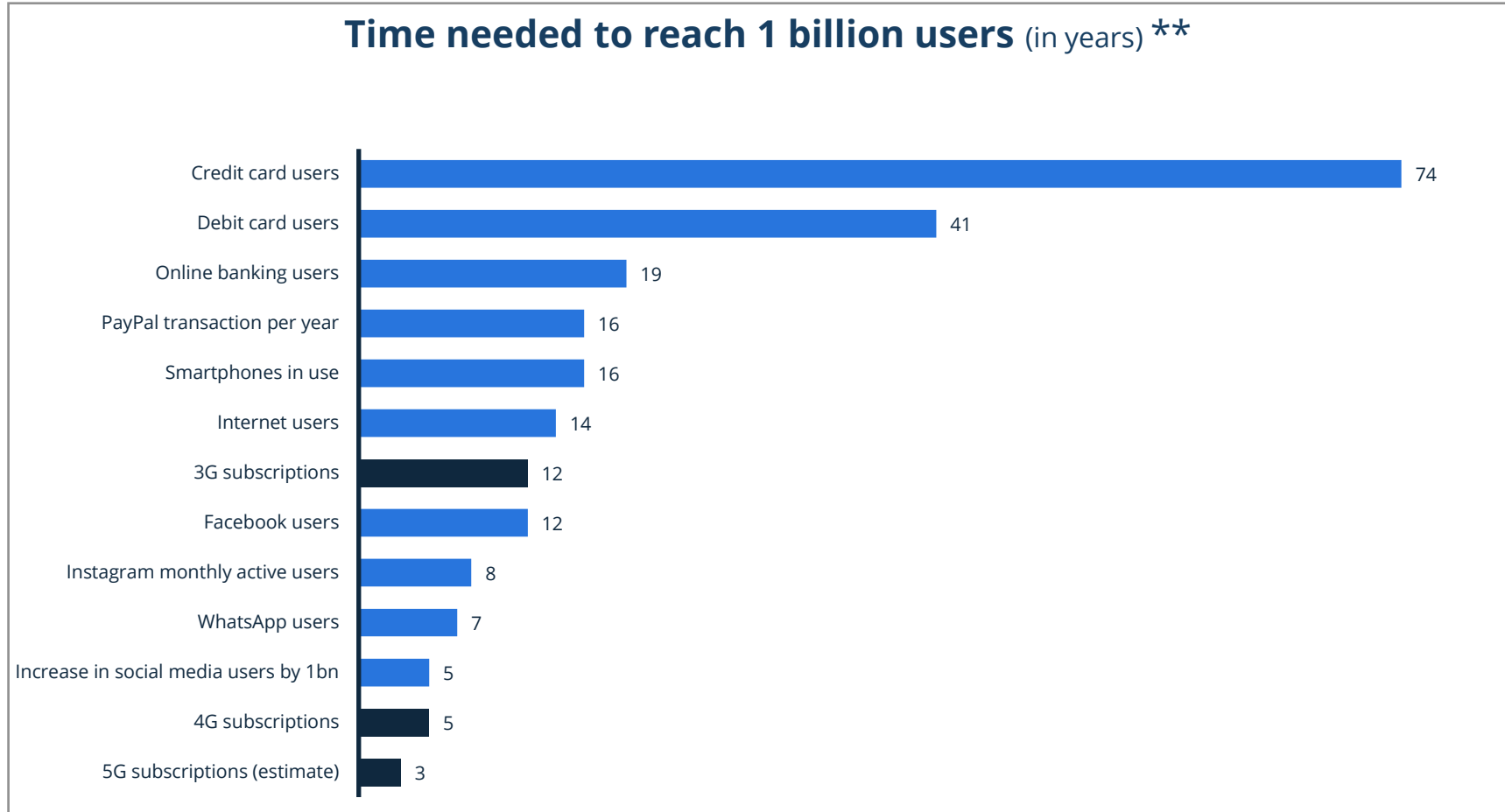
3GPP network providers are offering unprecedented levels of coverage for telecommunications technology, even in comparison to other basic needs.

Fun facts:

1. More cellular phones are sold each day than children are born.
2. Perhaps more surprising, there were more unique mobile phone users than toothbrushes sold globally in 2020.

5G is expected to reach 1 billion subscriptions faster than any other technological phenomenon

Time to market of 3GPP standards* compared to other technologies

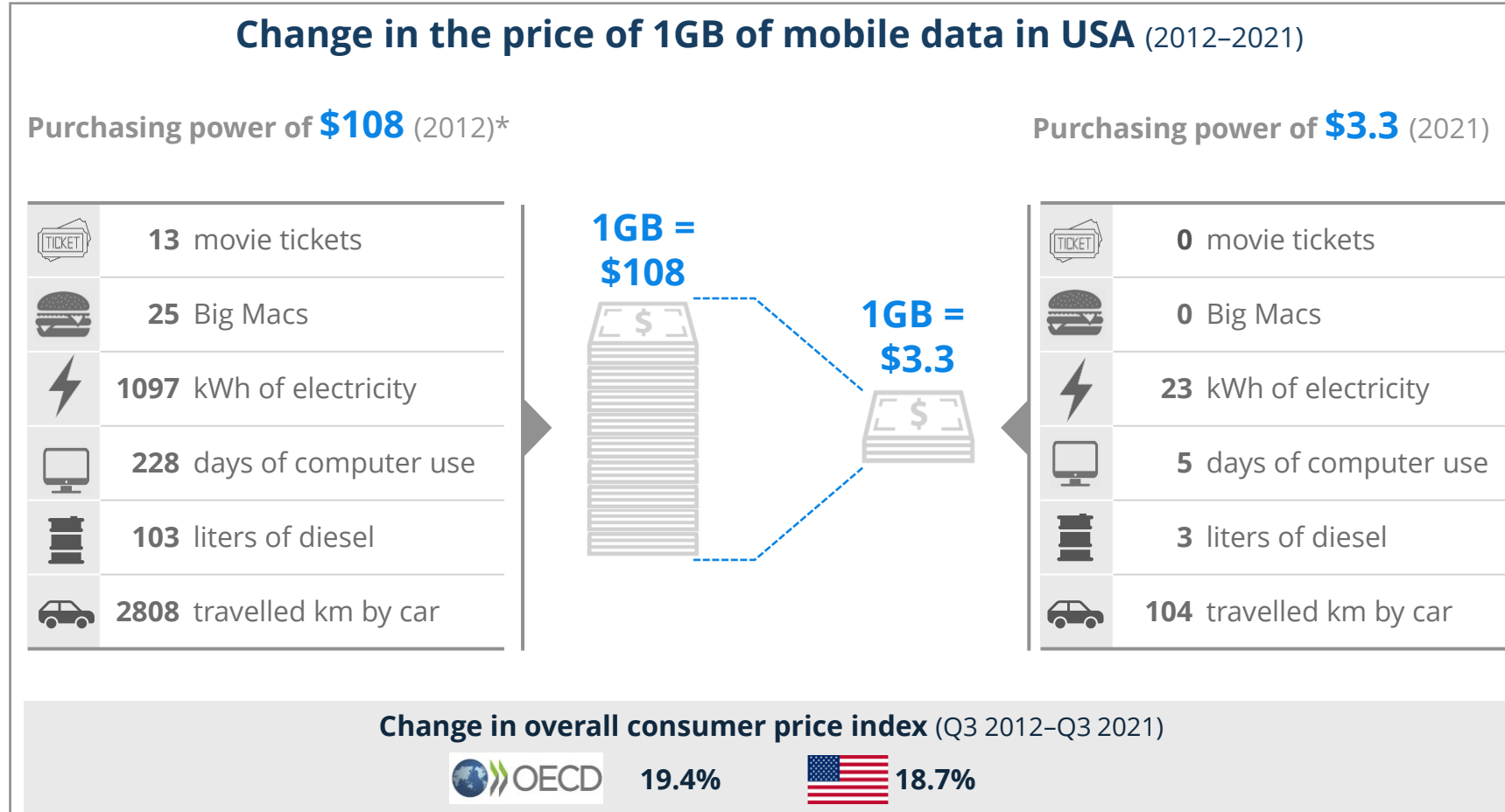


Since the introduction of 2G mobile networks in 1991 and the subsequent introduction of 3GPP, mobile data technology has been adopted faster than many other technologies in the world. Estimates suggest that 5G will have the fastest time to market cycle and will be used by one billion individuals worldwide in 3 years.

This rapid adoption forecast is mainly due to its relatively affordable price, ease of building capacity, and its prominent benefits to society.

3GPP – Global scale and efficiency: Mobile data promptly becoming more affordable and more accessible

Change in affordability of mobile data services - USA (1/3)



Data volume is important – and gets increasingly more affordable. In the USA, the price for a 1GB package has decreased by 97% in 9 years. In other words, in 2012, 1GB of mobile data cost consumers the same as using a computer for 228 days, whereas today it would only cost the same as 5 days.

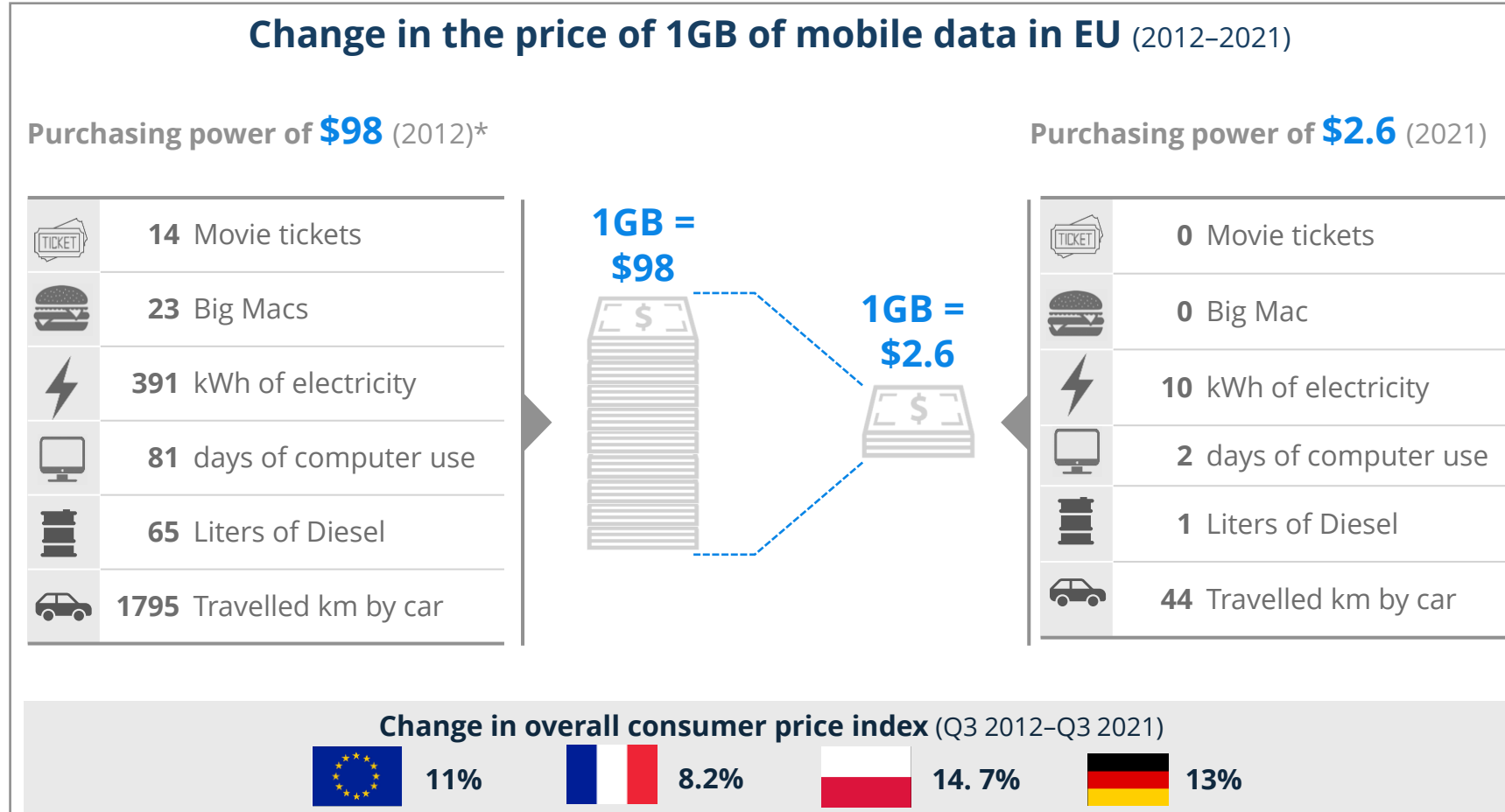
Comparing this decline to the general consumer price indexes, although overall, commodity prices have inflated over years, mobile data became significantly more affordable.

Note(s): * The quantities were rounded down after calculation. The value refers to the mobile-broadband basket, prepaid handset-based with a data volume allowance of 500 MB. Kilometers travelled is based on Toyota Corolla 1.4D4D 3,67 liters per 100 km. Computer use refers to desktop computer energy take-up.

Source(s): [Cable UK](#), [Choose energy](#), [Economist](#), [EIA](#), [Expatistan](#), [ITU](#), [MPAA](#), [Spritmonitor](#), Statista analysis, [Time](#), [USA today](#), [Whole sale solar](#)

Change in affordability is not limited to the USA: Strong price decline is also notable in Europe

Change in affordability of mobile data services - Europe (2/3)



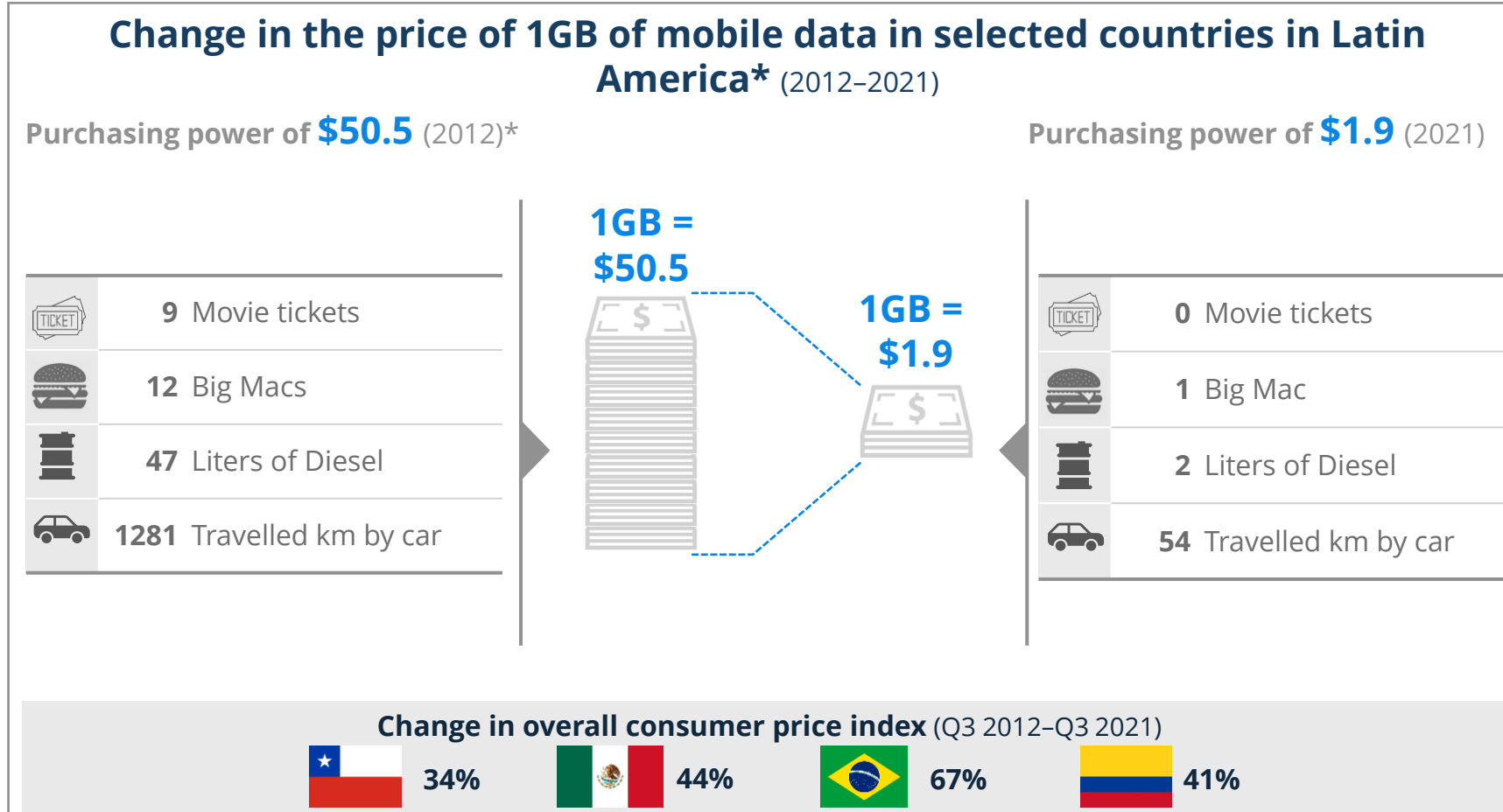
In Europe, the price of 1 GB mobile data has decreased strongly. The price of 1 GB of mobile data in 2012 cost an equivalent to 65 liters of diesel, which amounted to around 1795 km of car travel. Whereas in 2021, 1 GB of mobile data only cost an equivalent 1 liter of Diesel, i.e., 44 km of travel by car. Comparing this decline to consumer price indices in Europe, mobile data has become significantly more affordable. This development enables an increase in purchasing power, from which everyone benefits.

Note(s): *Mobile GB prices are based on data models with the usage of package prices. Europe is based on European Union (27 countries) /Kilometers travelled is based on Toyota Corolla 1.4D4D (one of the most popular cars in the world) 3,67 liters per 100 km. The quantities were rounded after calculation. Computer use refers to desktop computer energy take-up

Source(s): [Cable UK](#), [Economist](#), [EEA](#), [Eurostat](#), [ITU](#), [Spritmonitor](#), Statista analysis, [Global petrol prices](#), [Time](#), [UNIC](#), [OECD](#)

A significant, but slightly smaller, decline in prices can also be observed in selected Latin American countries

Change in affordability of mobile data services – Selected countries in Latin America (3/3)



In all selected countries of Latin America, the price of 1 GB mobile data has decreased strongly. Whereas in 2012 it was possible to buy 9 movie tickets for the price of a gigabyte, in 2021 it was not even enough for one whole movie ticket. The biggest difference is in the price of diesel, which decreased almost by a factor of 25 in the considered period. Although the consumer price index has changed around 50% between the selected countries, mobile data has become significantly more affordable. This development enables an increase in purchasing power, from which everyone benefits.

Note(s): *Selected countries are Brazil, Mexico, Colombia, Chile. **Mobile GB prices are based on data models with the usage of package prices. Kilometers travelled is based on Toyota Corolla 1.4D4D (one of the most popular cars in the world) 3,67 liters per 100 km. The quantities were rounded after calculation.

Source(s): [Cable UK](#), [Economist](#), [TheGlobalEconomy](#), [ITU](#), [Spritmonitor](#), [canacine](#), [NetCredit](#), Statista analysis, [Global petrol prices](#), [OECD](#)

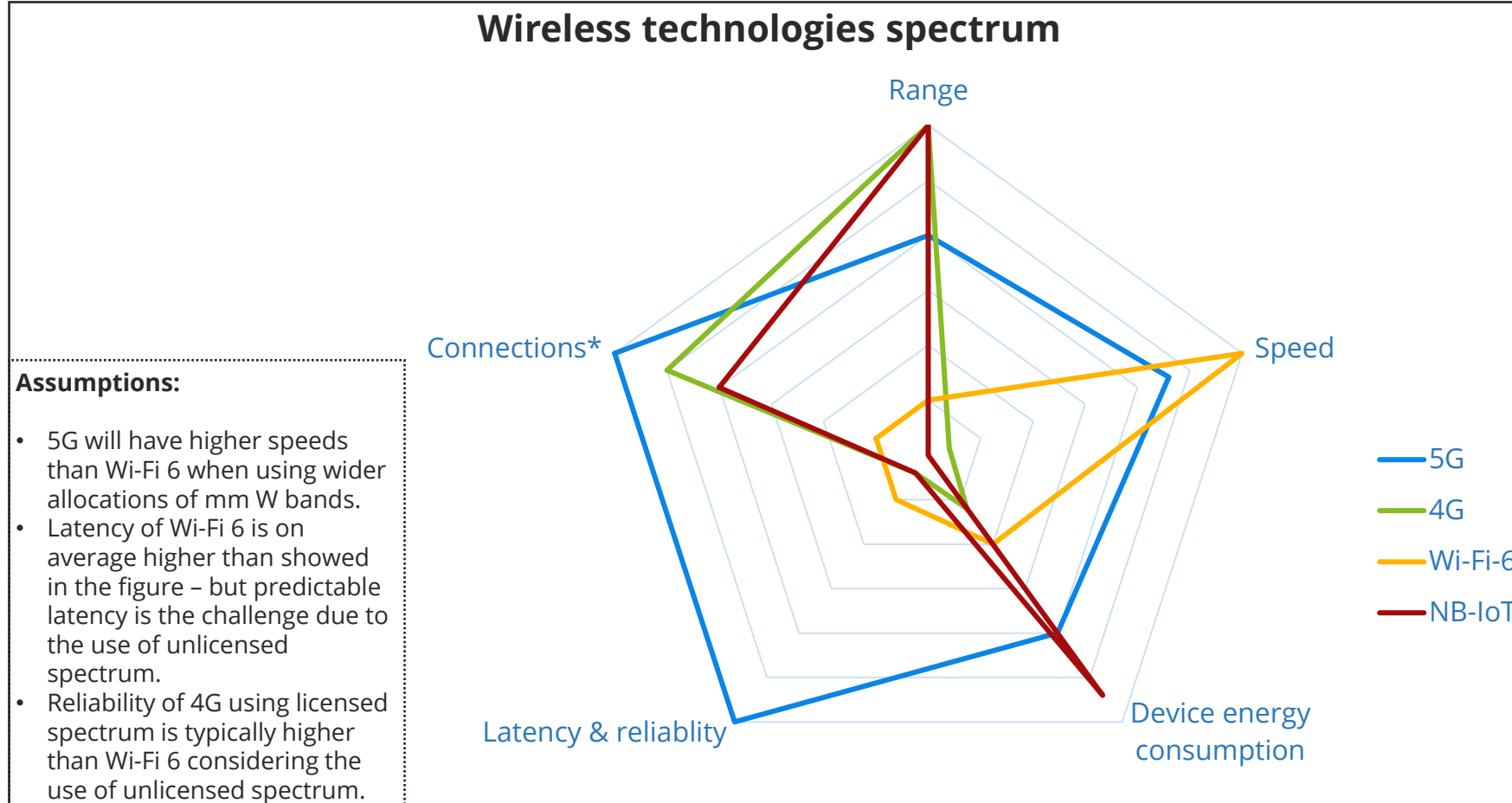


03 5G and future

- 5G vs. other wireless technologies
- Coverage, penetration & commercialization
- 5G operator's geographical expansion
- 5G commercial ecosystem
- 5G vendor options
- 3GPP as a mean to interoperability

5G is more attractive due to improvements in speed, latency, reliability, and power consumption while supporting more devices

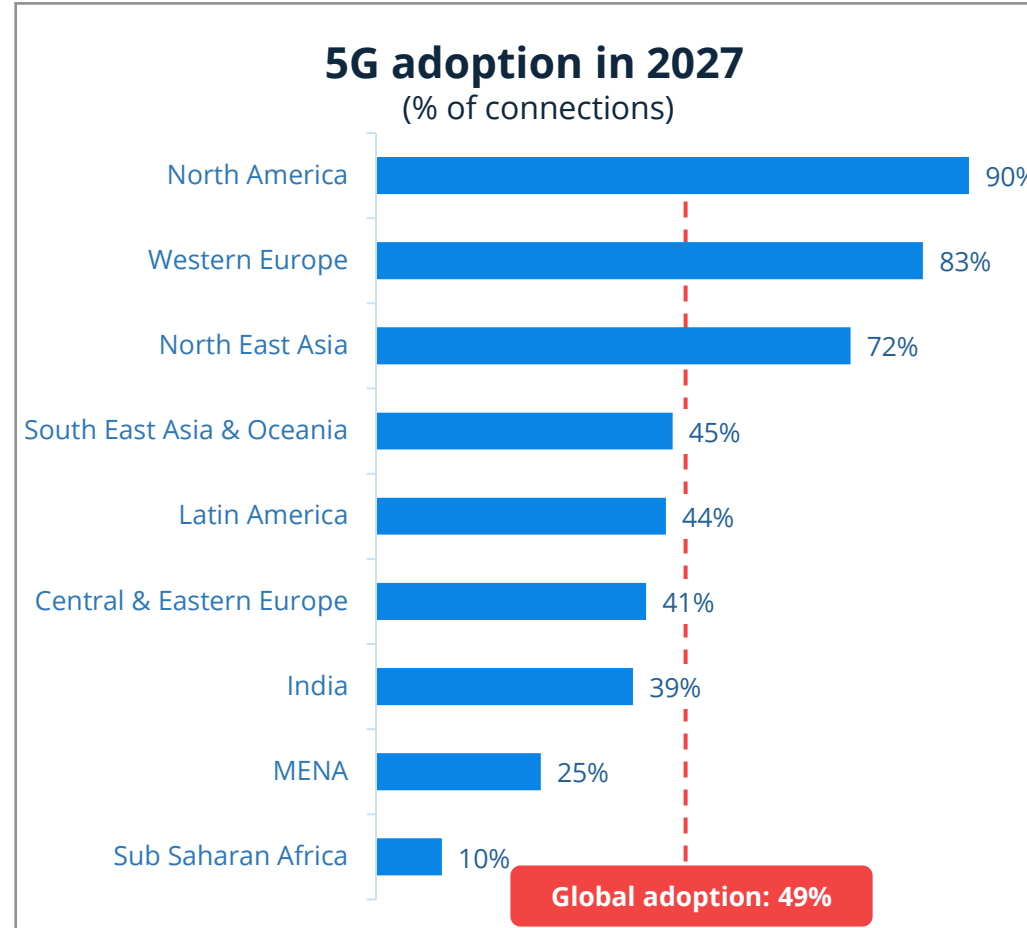
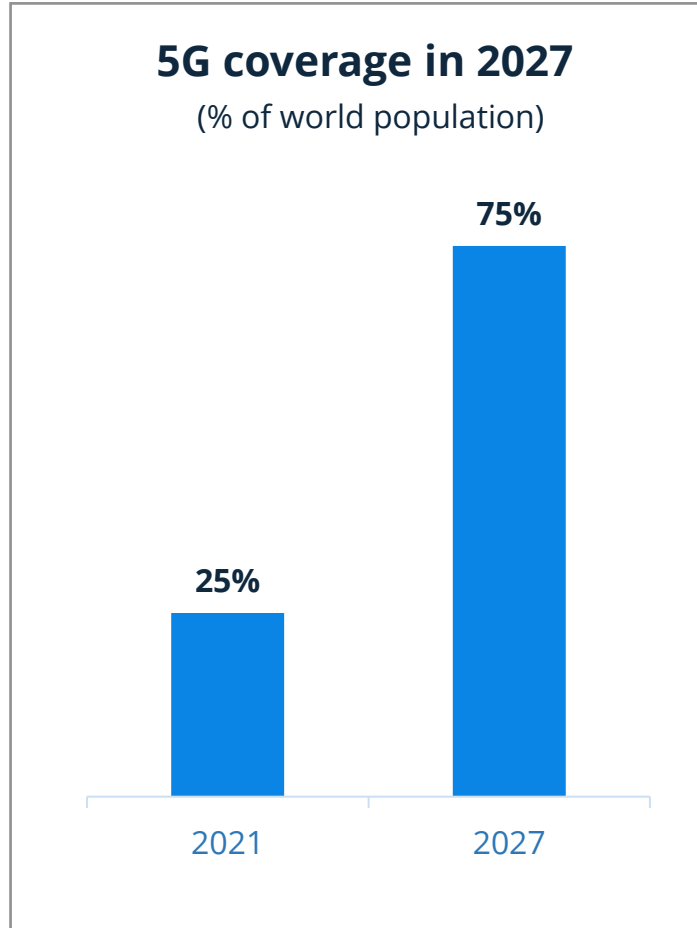
5G vs. other wireless technologies



Although 5G does not yet provide optimal results for all these dimensions simultaneously because of current technological and infrastructure limitations, it will eventually become the technology of choice for critical communications that require extreme reliability and service quality, including those within industrial settings. However, not all performance dimensions can be maximized at the same time. There are trade-offs between speed, range, energy efficiency, and latency.

The 3GPP-5G standard enables a quick roll out: West Europe and North America are the forerunners

5G Coverage & Connections

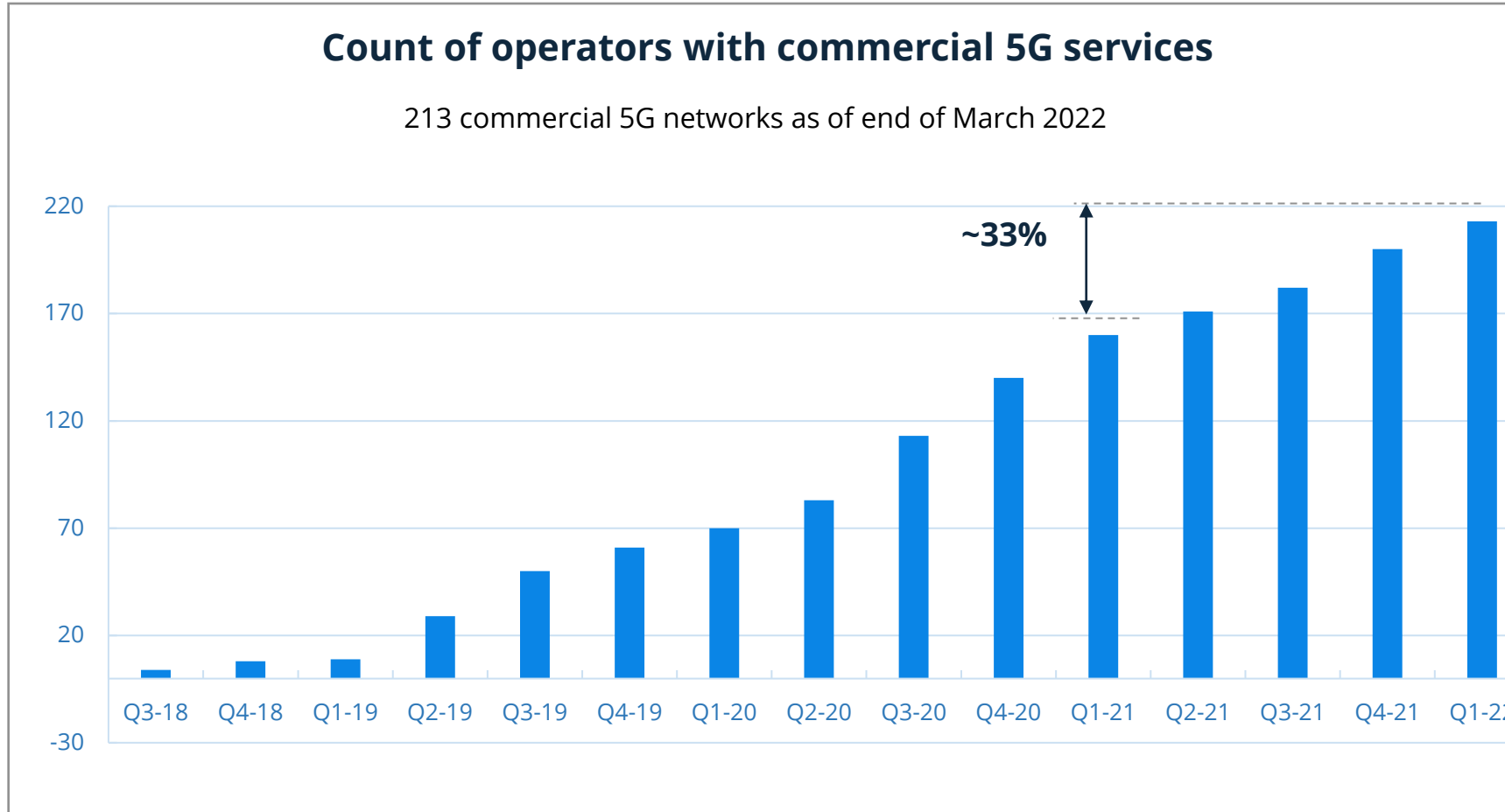


By the end of 2021, 5G subscriptions are expected to reach 660 million. Looking into the future, North America is in the leading position of adopting and establishing 5G mobile networks with more than 90% (410 million) of connections using 5G standards, closely followed by West Europe (83%) and developed Asia (72%).

The global average for adoption of 5G mobile networks will be around 49%, that is 4.4 billion individuals, by 2027.

The 3GPP-5G commercial network launches keep the momentum

5G operators with commercial 5G services

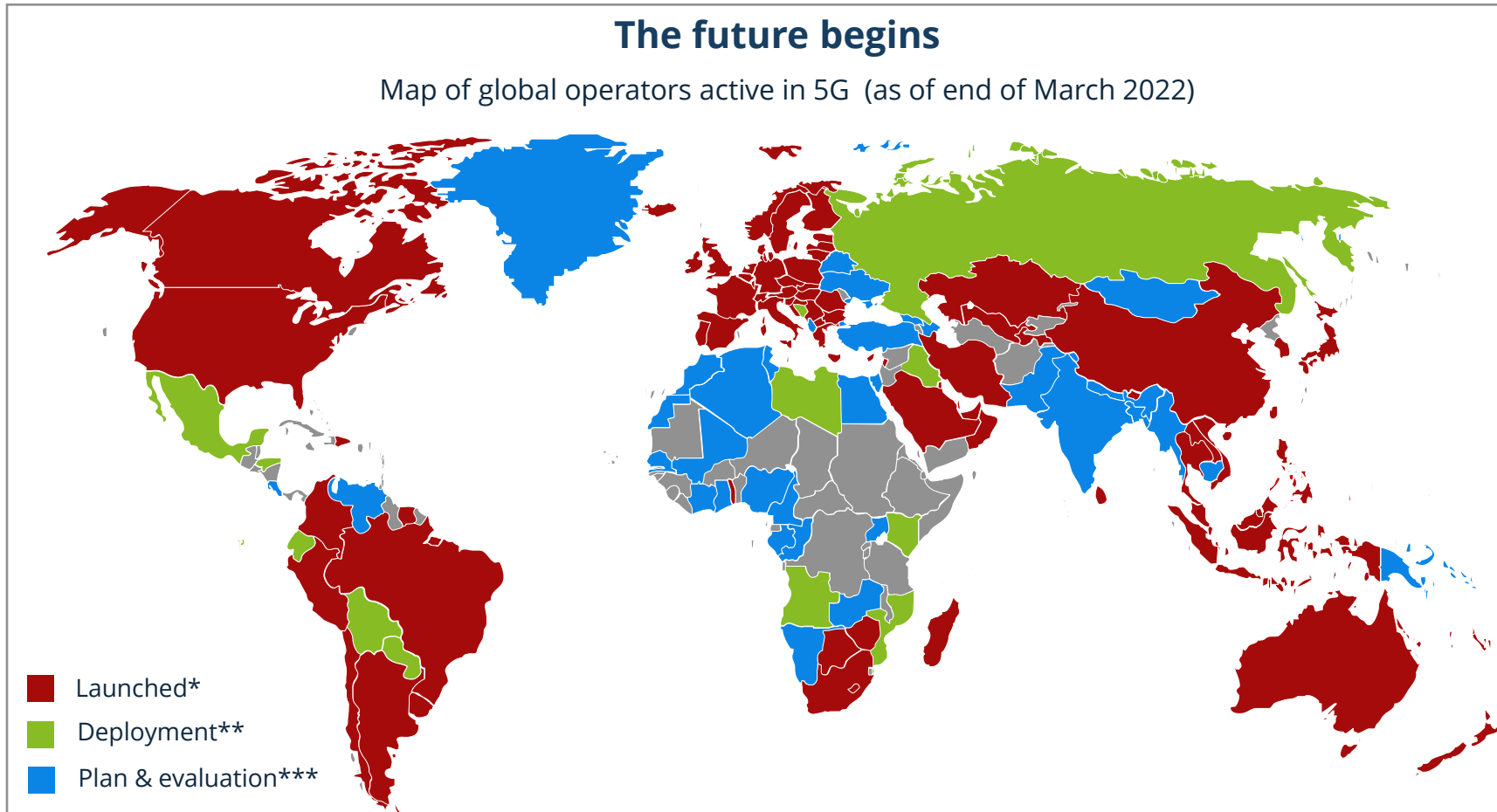


By end of March 2022, the number of operators worldwide who have launched 5G services commercially has reached 213 in 85 countries/territories.

Additionally, 5G standalone public networks are on the rise. 102 operators are identified as investing in standalone options in the form of trials, plans paying for licenses deploying, or operating networks. Additionally, 23 operators in 17 countries having deployed or launched standalone 5G in public networks.

3GPP-5G network expansion: 149 countries have already started the journey

5G expansion map around the globe

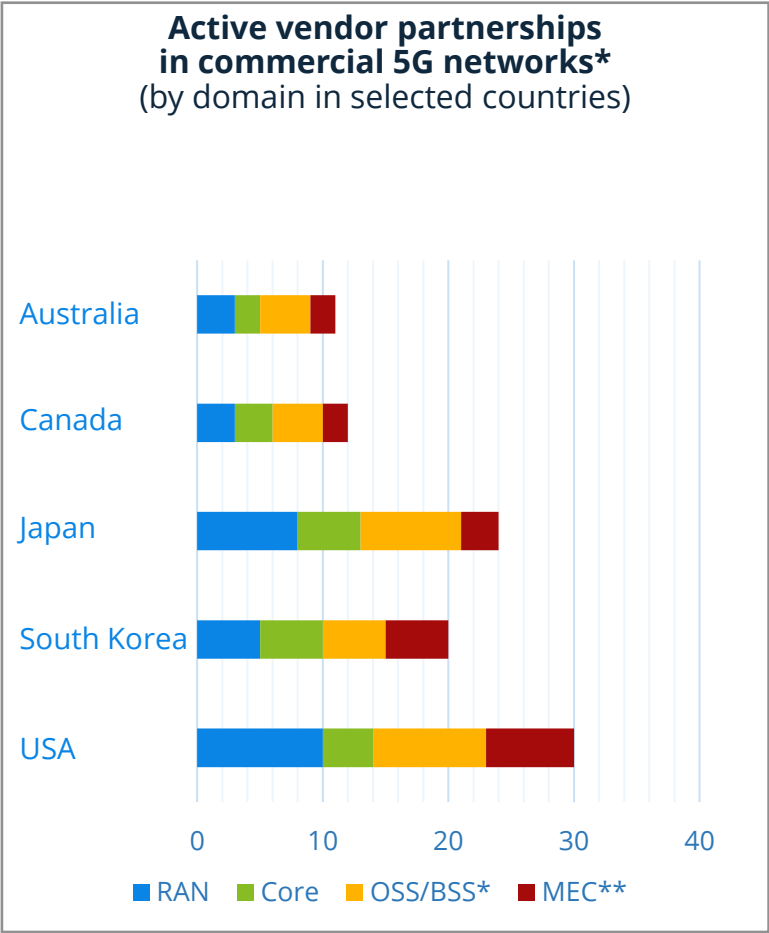


5G has launched globally. According to the plans of various telecommunication operators, most countries will get access to 5G in the coming years. By end of March 2022, **492** operators in **149** countries had announced that they had at least started investing in mobile or fixed wireless access 5G networks. These investments have been in the form of tests, trials, pilots, planned and actual deployments. Out of these operators, **213** have already made it commercially available.

Notes: *Commercial services are generally available to customers over a live 5G network, soft launches included ** deploying or deployed in network but still precommercial.*** Planning, evaluating, testing and trialing
Source(s): [GSA 2022](#)

3GPP defines a common standard, providing operators with numerous choices of 5G vendors

5G mobile network vendor ecosystem



Examples of current 5G network solution suppliers				
RAN	Transport	Core	OSS/BSS**	Edge
Airspan	Adtran	Casa	Amdocs	Amazon
Altistar	Airspan/Mimosa	Cisco	Cerillion	Dell
Casa Systems	Aviat Networks	Ericsson	Cisco	Google
Commscope	Ceragon	HPE	Comarch	Huawei
Corning	Ciena	Huawei	CSG	Intel
Ericsson	Cisco	Mavenir	Ericsson	Microsoft
Fujitsu	Commscope	Microsoft (Metaswitch; Affirmed)	HPE	QTC
Huawei	DragonWave-X	NEC	Huawei	Radisys
Nokia	Ericsson	Nokia	NEC/Netcracker	Red Hat (IBM)
Mavenir	Huawei	Oracle	Nokia	
NEC	Juniper	Samsung	Openet	
Parallel Wireless	Nokia	ZTE	Optiva	
Samsung	Siklu		Sigma Systems	
ZTE	ZTE		ZTE	

The transition from one mobile generation to the next has, historically, been a time when mobile operators evaluate their current suppliers and explore new ones. With 5G, unlike previous generations, there is unified agreement on what 5G technology should be. 5G ecosystem provides operators with many vendor choices.

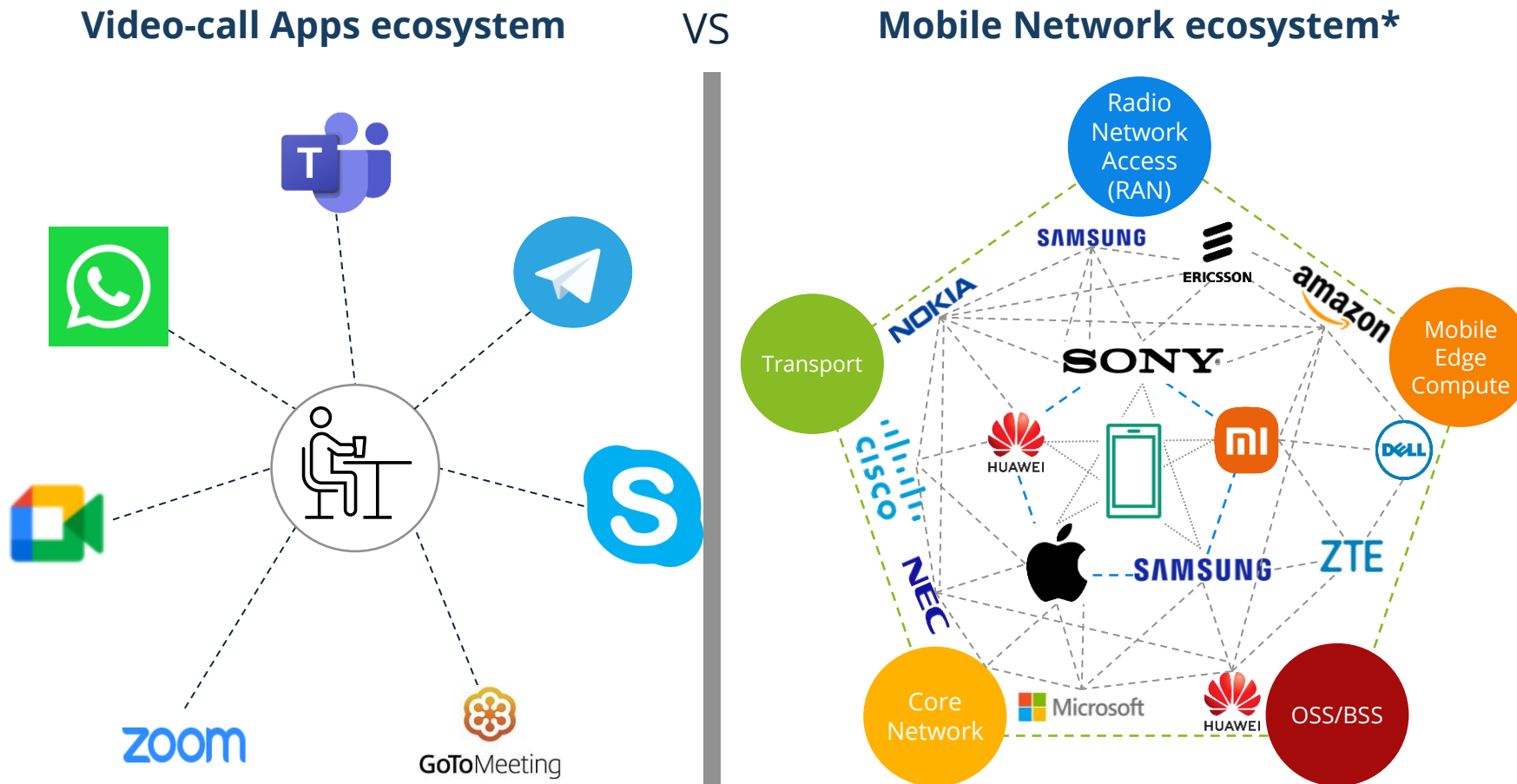
In seven countries where network rollouts are in advanced stages (Australia, Canada, China, Japan, South Korea, the UK, and the US), numerous active vendor partnerships can be seen to enhance competition and provide a good variety of choice for the operators.

Notes: * Omdia tracks the vendors active across different network domains that are currently supporting live commercial 5G networks. Vendor data was gathered using Omdia's sources, including the Telecoms Vendor Contract Database, which captures publicly available service provider contract information. Several vendors provide products and solutions across several mobile network domains. Vendors that operate in multiple domains are counted for each domain where we have identified an active partnership. *OSS/BSS stands for network management. **MEC stands for mobile edge compute

Source(s): [Omdia 2022](#), [Omdia 2021](#)

3GPP defines a common standard, providing a seamless connection between the users and providers

3GPP as a mean to interoperability



Unlike countless other technologies which surround us, mobile networks are interoperable. Using different video call apps, one can see that they are in most cases incompatible - it is impossible to send or receive calls from, for instance, Skype to Zoom directly. Considering mobile calls, we take it for granted that all kinds of cell phones are seamlessly compatible, regardless of their type. In addition, 3GPP standard has made it possible for all numerous providers and suppliers throughout the supply chain to be able to sync.

Sources

3GPP

5G security

Cable UK

canacine

comvia

Datareportal

Delloro

Directions

Ecnomist

EEA

EIA

EMarketer

Ericsson

Expatistan

Fortune Business

Global petrol prices

Grandviewresearch

GSMA

ITU

ISO

Jeffries & Companies

McKinsey

MPAA

NetCredit

OECD

omdia

Paypal

Rantcell

RCRwireless

Round solutions

Spritmonitor

TheGlobalEconomy

Time

USA today

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HANNANE AGHAYAN

Expert – Digital Markets

TEL (+49) 40 284 841 923

E-MAIL Hannane.aghayan@statista.com

WWW.STATISTA.COM