




Understanding the Digital World

IDATE
Consulting

Enjeux économiques de la 5G

Quels marchés et quels investissements pour
la 5G ?

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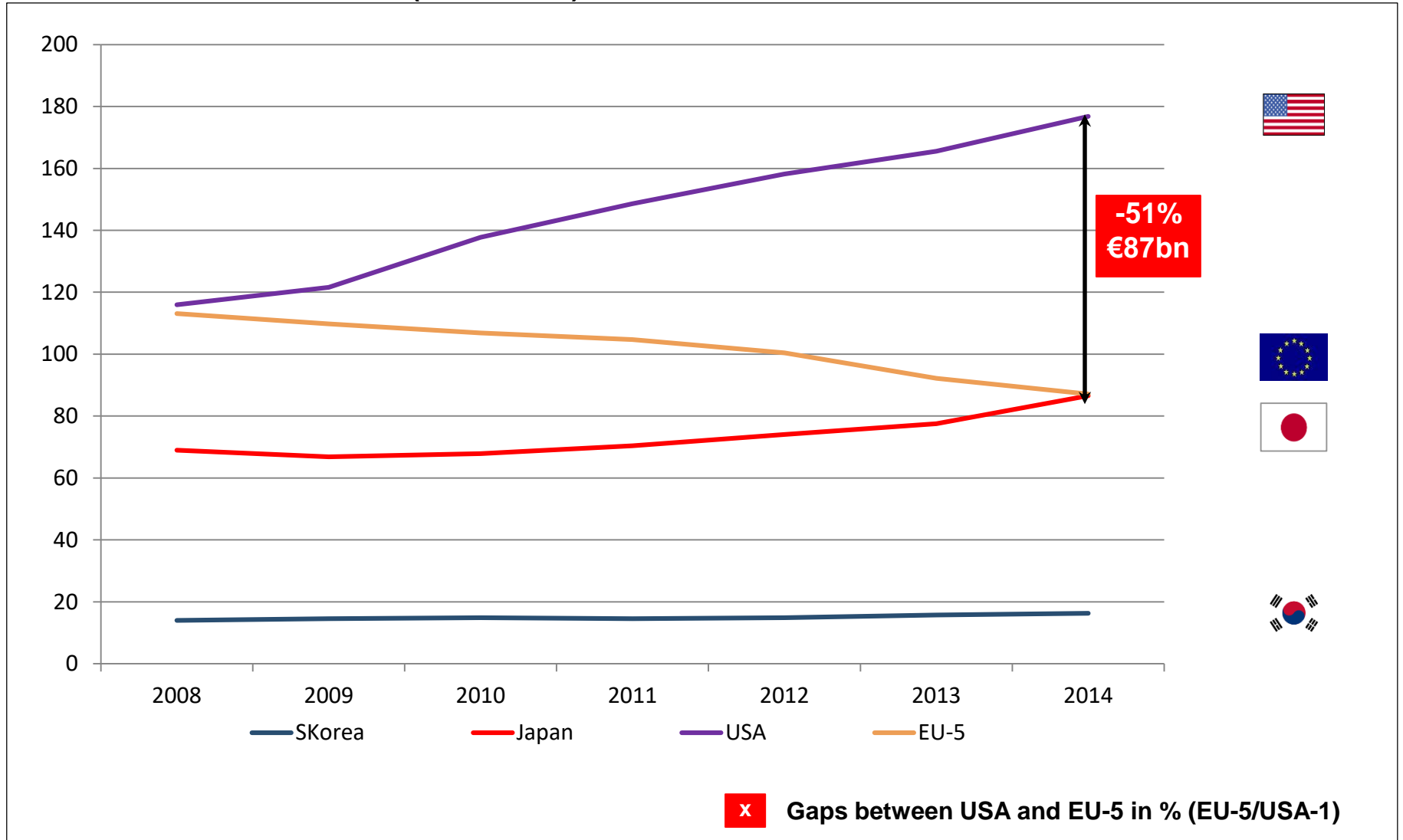
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 **DIGIWORLD**
by IDATE

The mobile landscape – a USA-EU comparison

Mobile revenues: increasing in USA, Japan, SK, decreasing in EU

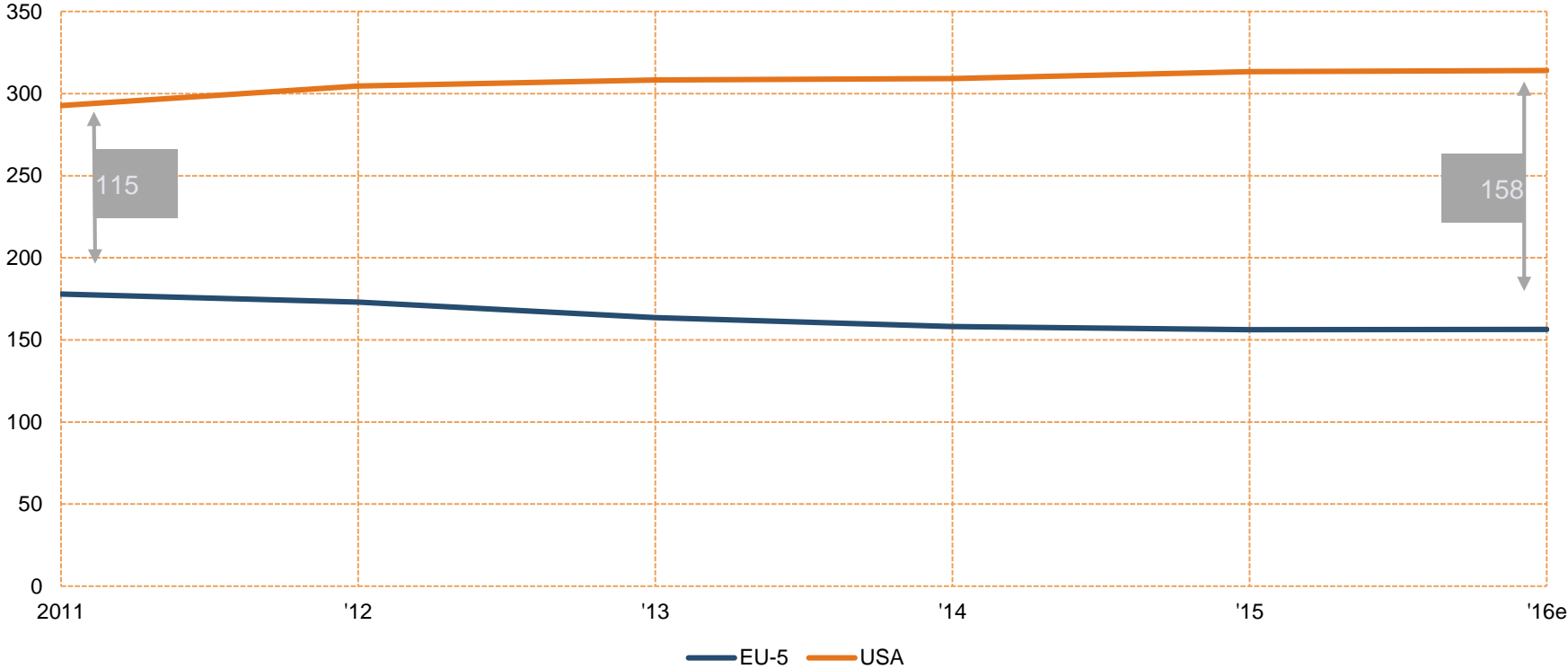
Mobile revenues evolution (billion EUR)



Source: IDATE, based on NRAs and players

Telecom services revenues (2011-2016)

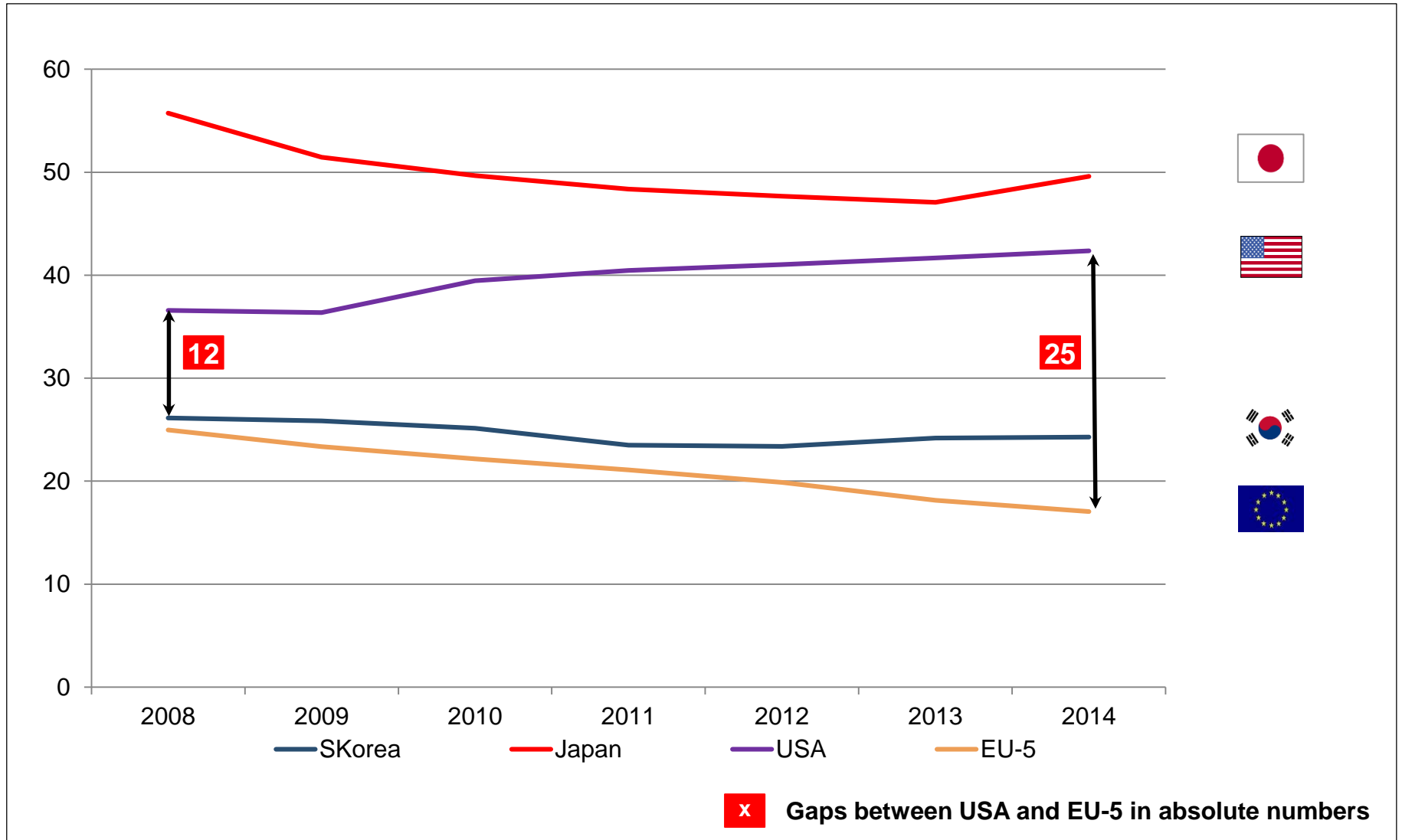
Telecom services retail revenue
(Billion EUR)



Source: IDATE DigiWorld

ARPU: stable in USA, Japan, SK, strongly decreasing in EU

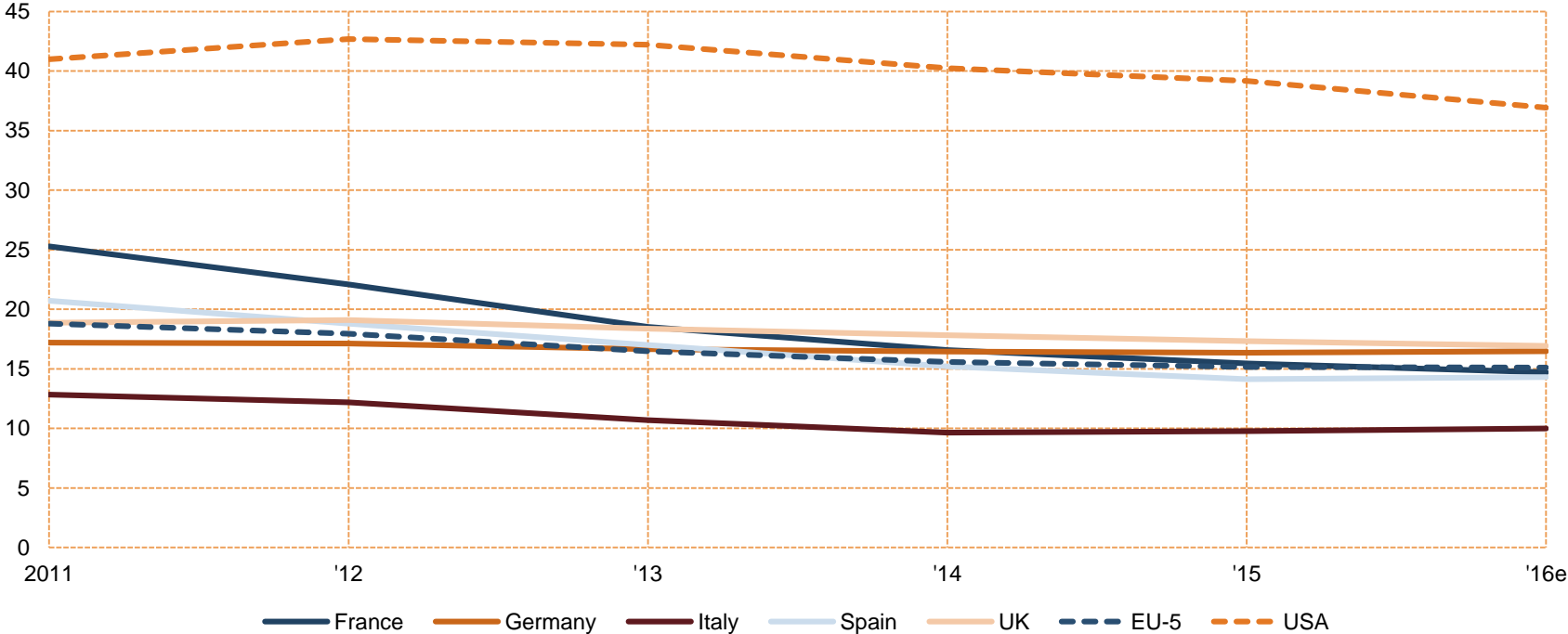
ARPU evolution (EUR)



Source: IDATE, based on NRAs and players

ARPUs (2011-2016): now decreasing in the USA, stable elsewhere

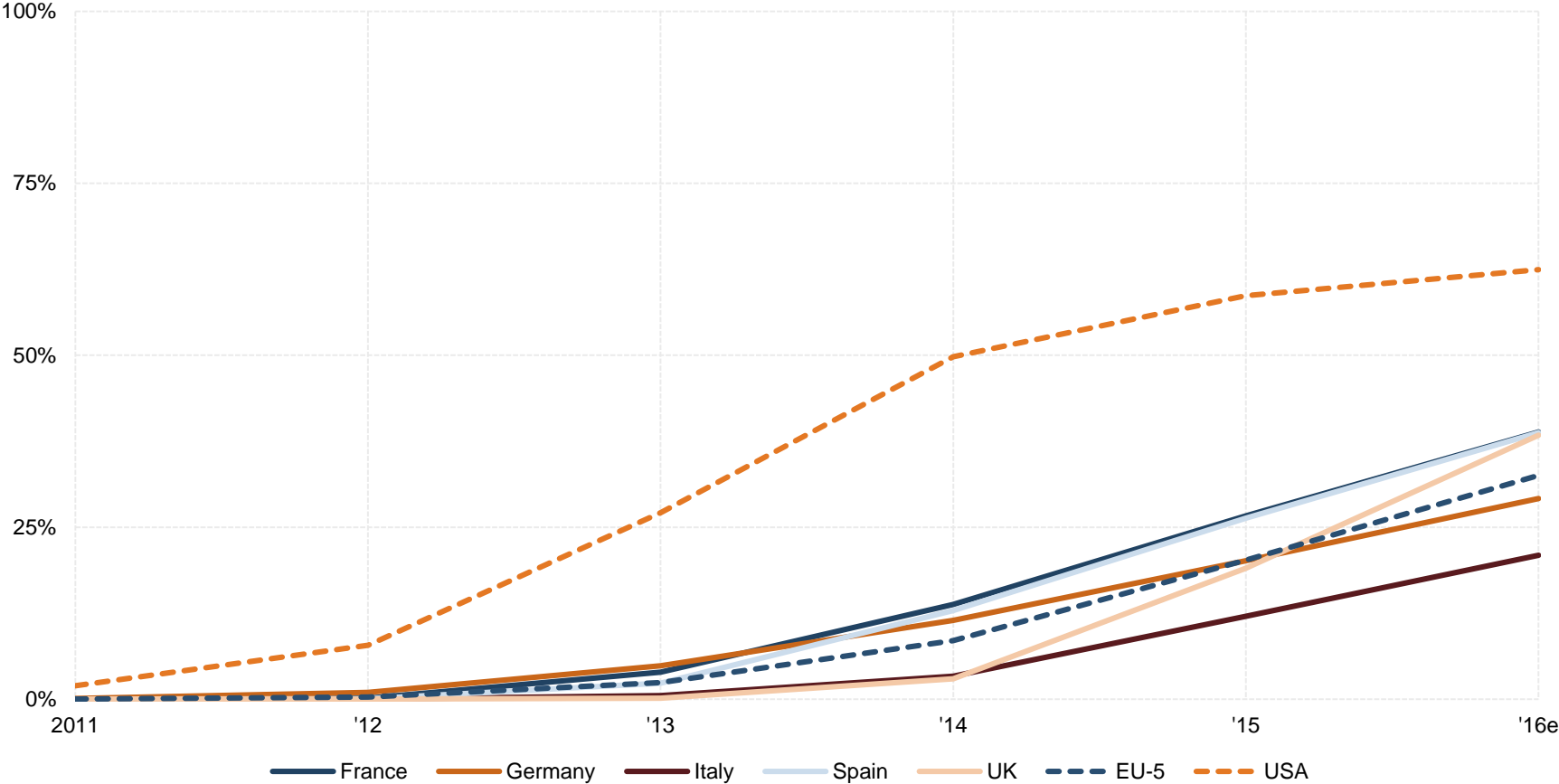
Mobile retail ARPU, 2011-2016
(EUR excl. tax/VAT/month)



Source: IDATE DigiWorld

4G share (2011-2016): an earlier move in the USA

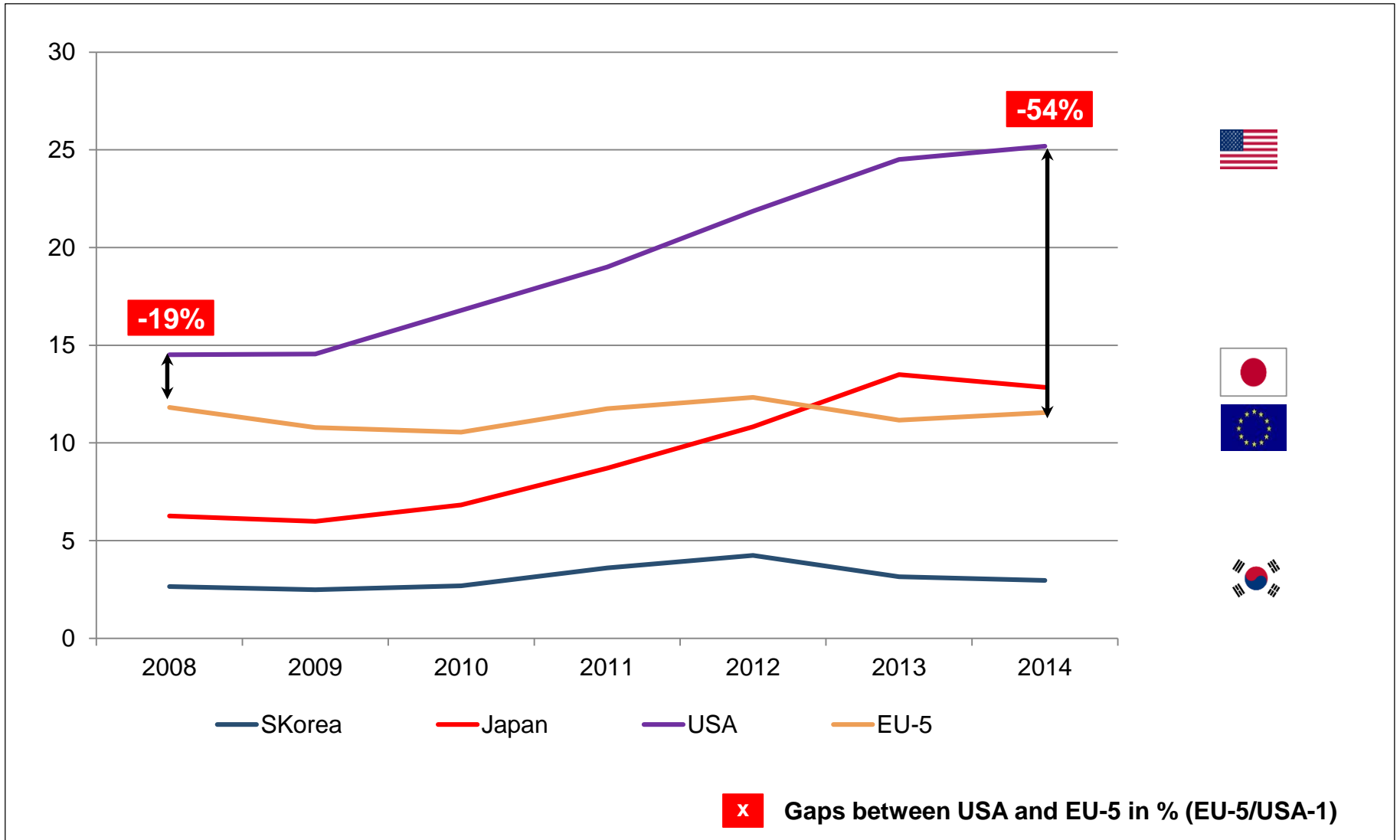
LTE customers as a percentage of total mobile subscribers, 2011-2016 (%)



Source: IDATE DigiWorld

Mobile CAPEX is much higher in the USA

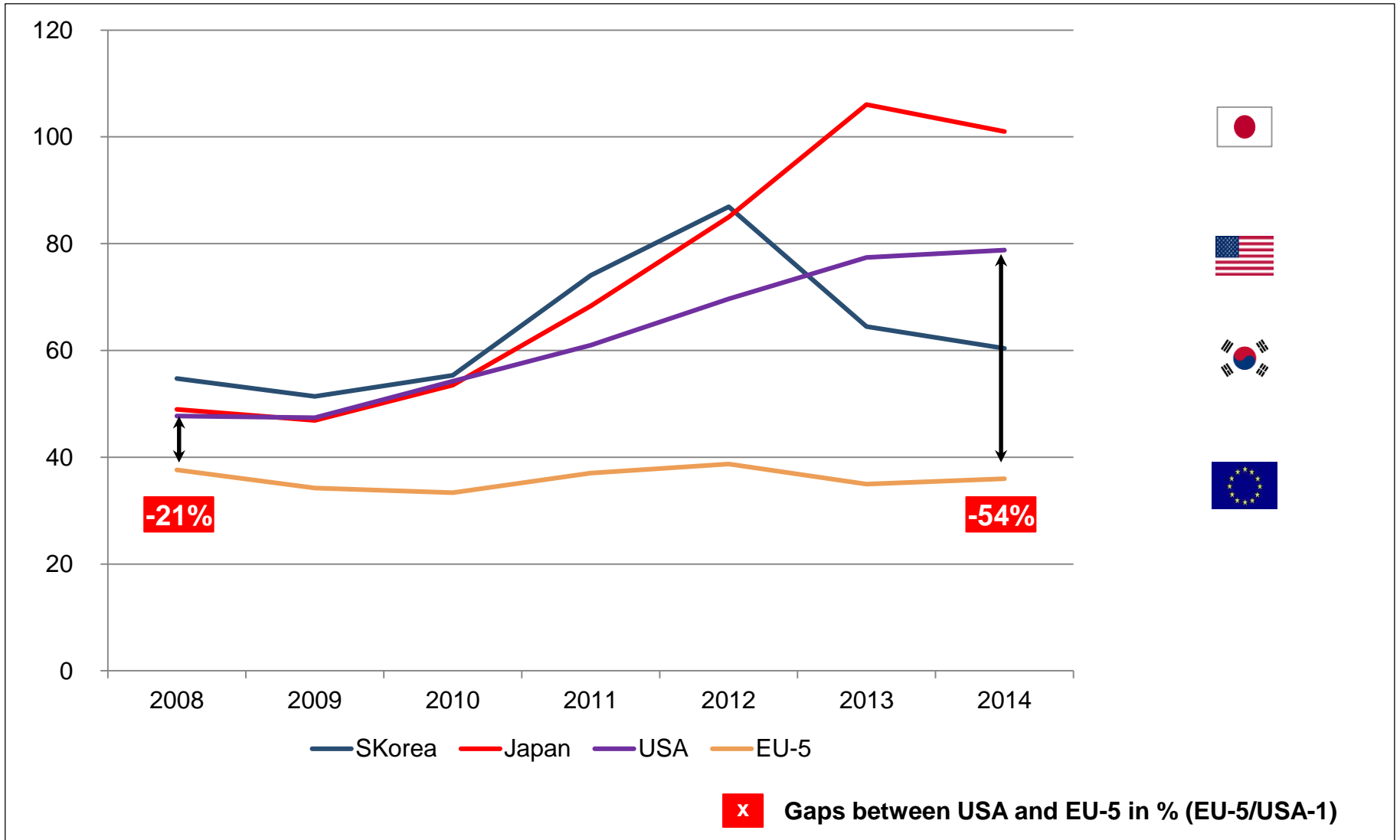
Mobile CAPEX in domestic networks (billion EUR)



Source: IDATE, based on NRAs and players

CAPEX per pop. are much higher in Asian countries and the USA

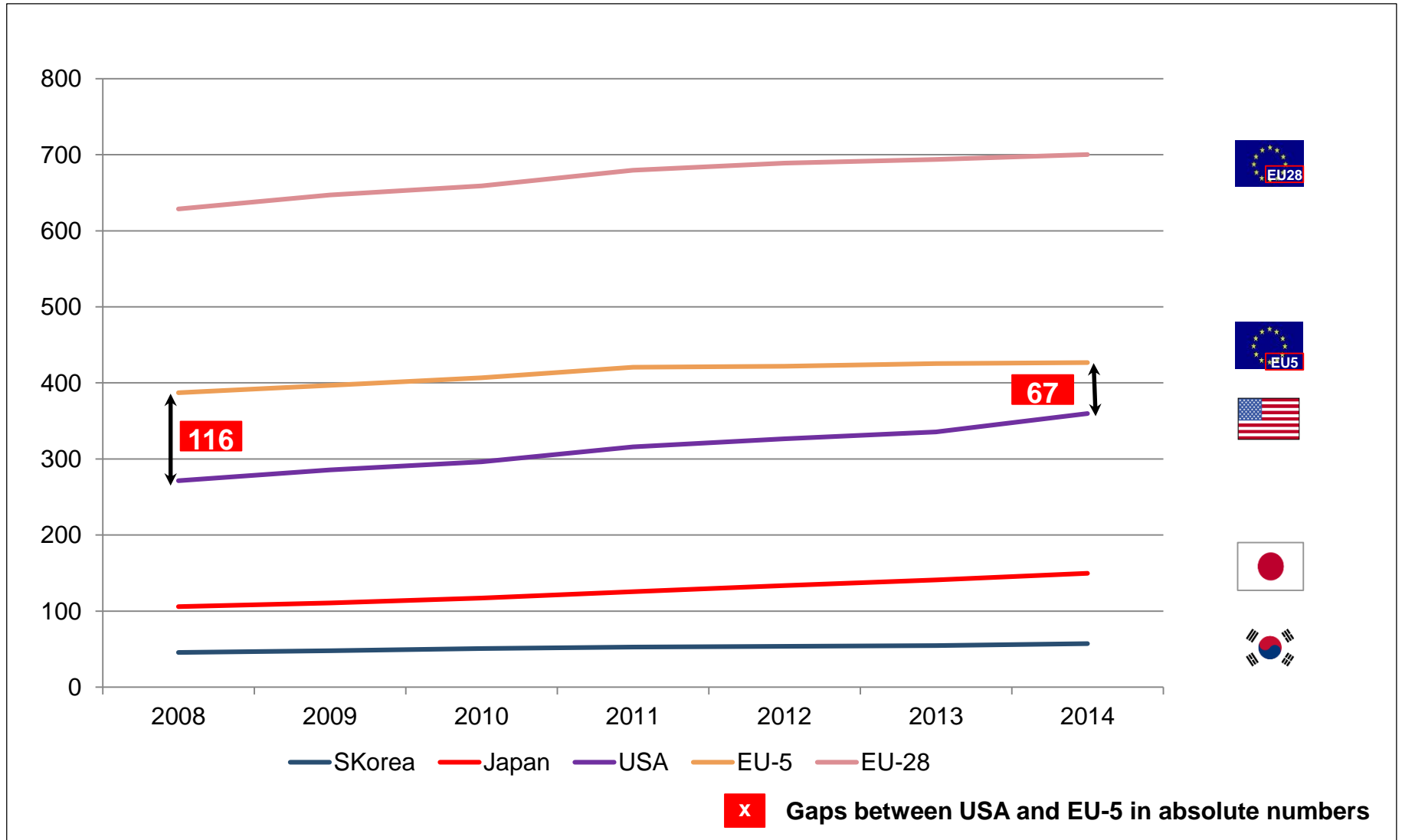
CAPEX per pop. (EUR/inhab.)



Source: IDATE, based on NRAs and players

EU is by far a larger mobile market

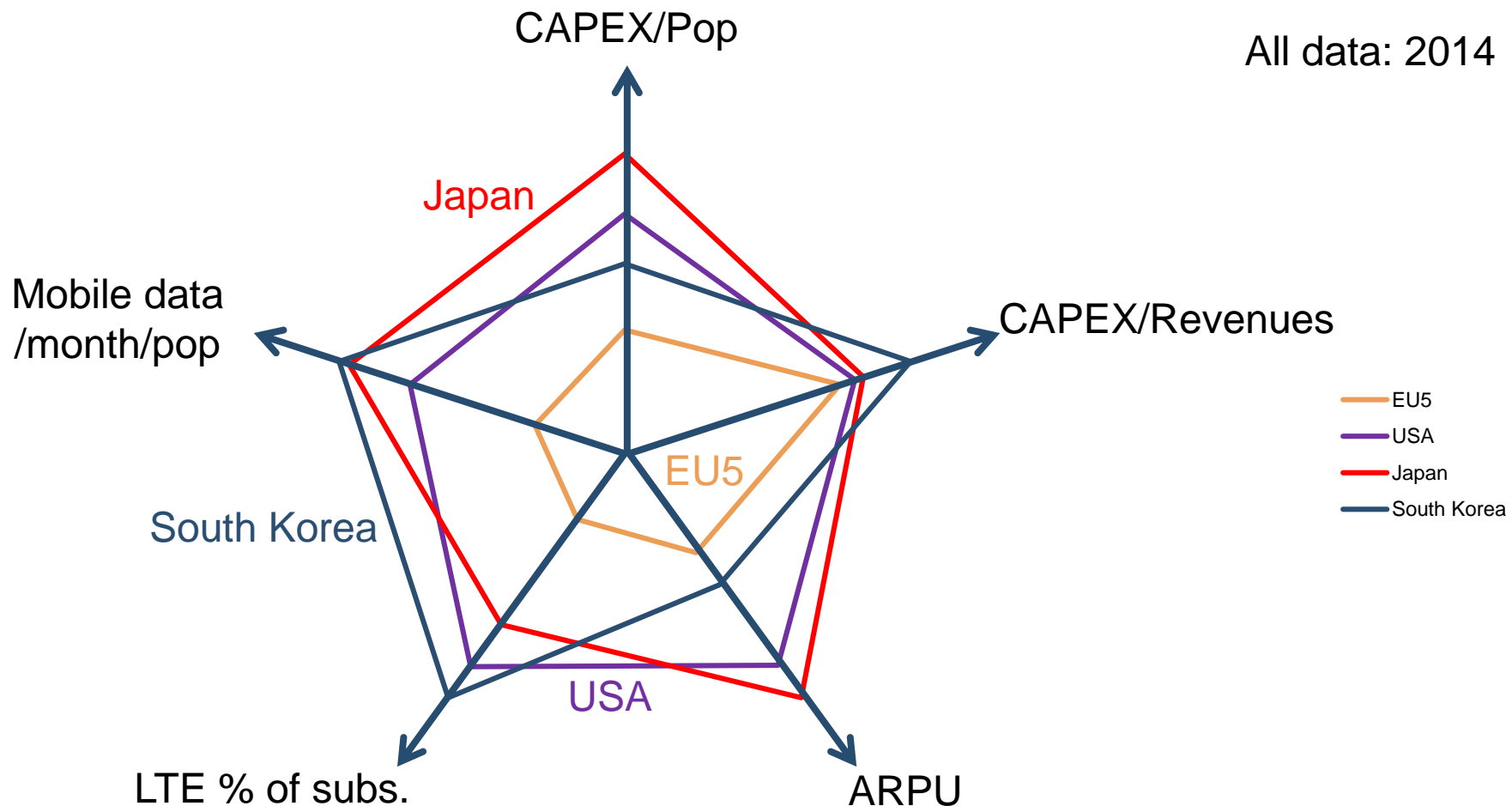
Number of subscriber (million)



Source: IDATE, based on NRAs and players

Mobile Performance – a worldwide comparison

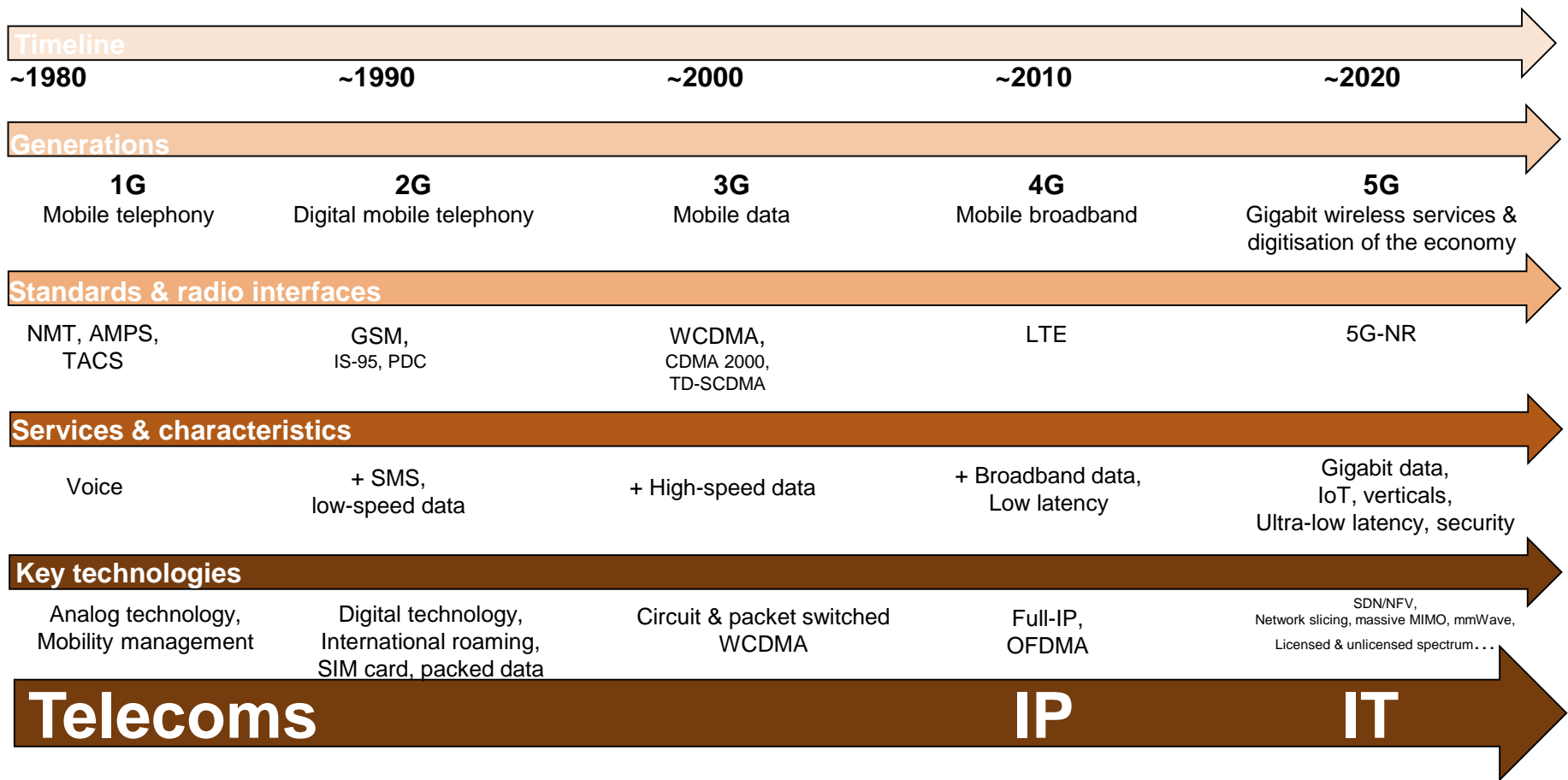
Europe (EU5) performs poorly compared to USA, Japan and South Korea



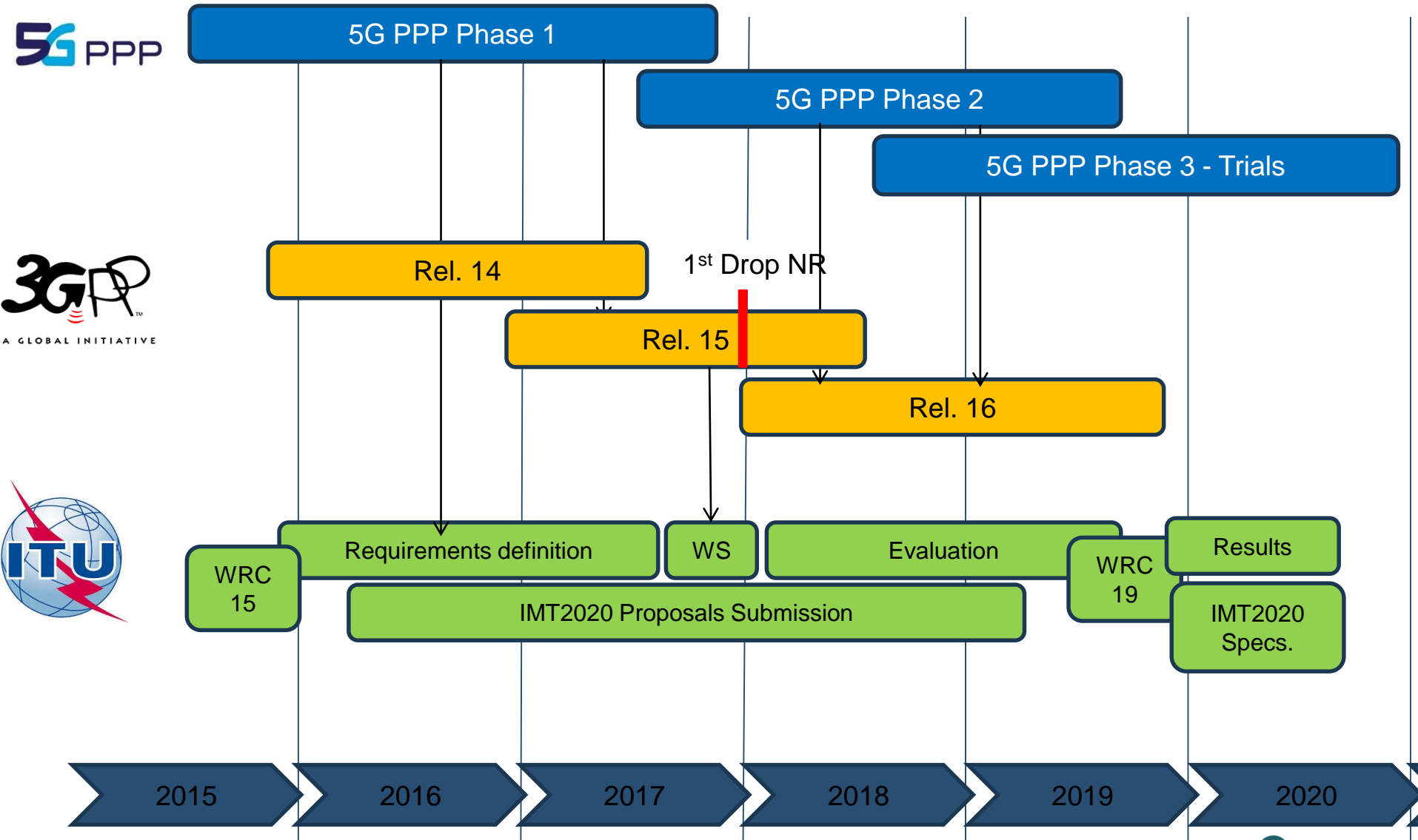
Source: IDATE for Qualcomm & Ericsson

5G standardisation

Mobile generations: timeline, standards and services

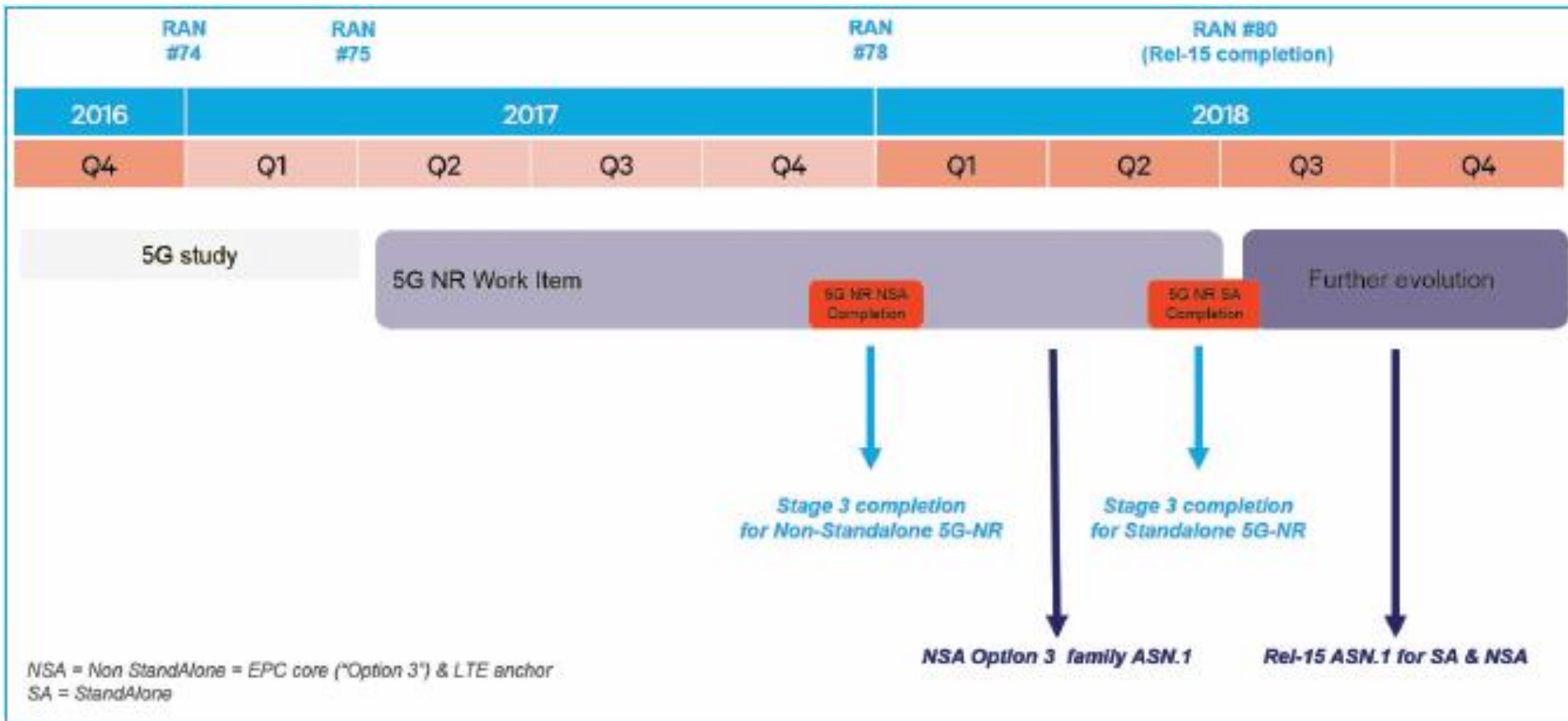


Standardisation accelerating



Standardisation accelerating

3GPP standards roadmap



5G and verticals

Expectations and likely adoption by verticals

Verticals targeted by 5G

NGMN and the regional associations have identified various promising vertical sectors for 5G

Automotive, Energy, eHealth, Media & Entertainment, Factory of the Future look promising

Transport & logistics, Agriculture & forestry could also contribute to 5G growth



Source: Bosch

Creation of the 5G Automotive Association

Founded by Audi, BMW Group, Daimler AG, Ericsson, Huawei, Intel, Nokia and Qualcomm in September 2016

- Defining and harmonizing use cases
- Supporting standardization and regulatory bodies
- Addressing vehicle-to-everything technology requirements
- Running joint innovation and development projects



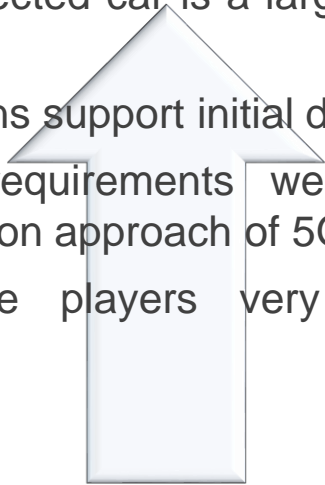
5G and the Automotive Sector

Key requirements

- High bandwidth for infotainment services
- Low bandwidth uplink communication for telematics, security and insurance services
- Ultra low latencies for automation and high reliability for autonomous driving services

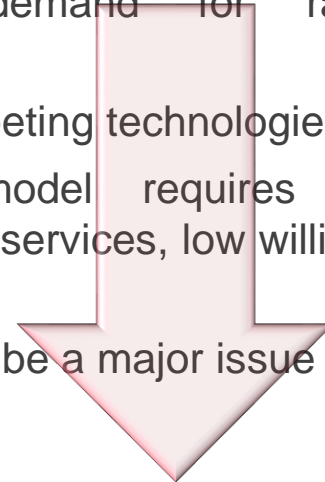
Drivers

- The connected car is a large, developing market
- Regulations support initial deployments
- Diverse requirements well fit for the virtualization approach of 5G
- Automotive players very involved in 5GPPP



Barriers

- Timeline: demand for rapidly available technologies
- Risk of competing technologies
- Business model requires clarification for infotainment services, low willingness to pay for end user
- Security can be a major issue



A market with a strong potential to be exploited rapidly

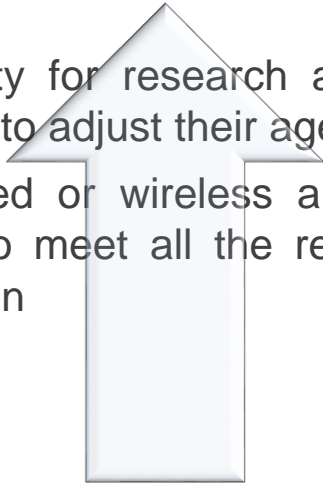
5G and Manufacturing

Key requirements

- High bandwidth for video, AR/VR services
- Low power and cost communication for sensor networks
- Ultra low latencies for automation
- High reliability and dependability of the network

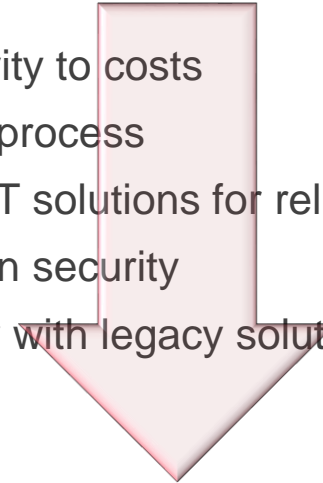
Drivers

- Development of the factory of the future trend
- opportunity for research and innovation initiatives to adjust their agendas
- older wired or wireless alternatives are unlikely to meet all the requirements of the domain



Barriers

- Slow take up (5 – 10 years after consumer markets)
- Strong sensitivity to costs
- Long decision process
- Low trust in ICT solutions for reliability
- Strong focus on security
- Interoperability with legacy solutions



A market with a significant potential, but a delayed adoption

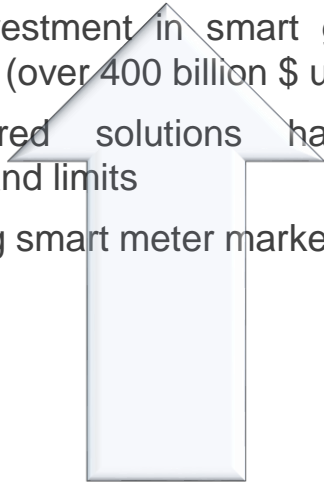
5G and Energy

Key requirements

- Low cost, low bandwidth uplink for smart meters monitoring
- Long equipment lifespan and support (15+ years)
- High reliability, security and robustness
- Guaranteed quality of service
- Ultra low latency and ultra high availability for network control use cases

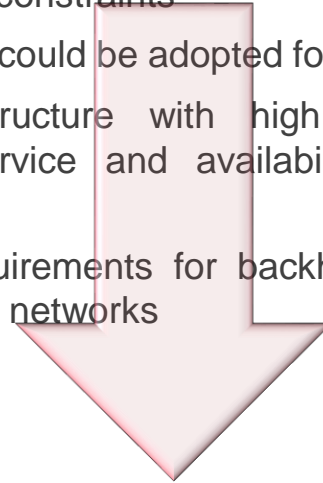
Drivers

- Growing investment in smart grid equipment and projects (over 400 billion \$ until 2020).
- Current wired solutions have significant drawbacks and limits
- A developing smart meter market.



Barriers

- Important cost constraints
- 2G and LPWA could be adopted for smart meters
- Critical infrastructure with high requirements for Quality of Service and availability in worst case scenarios.
- Very high requirements for backhaul and backbone communication networks



A market for 5G in smart meters, if costs can be brought down

5G value chain

Value chain and business model impacts

> 5G will lead to more complex connectivity value chains

- More actors to provide connectivity
- Composite offers to provide connectivity through a mix of technologies
- Vertical actors to act as connectivity providers

> More and more vertical-specific offers will emerge

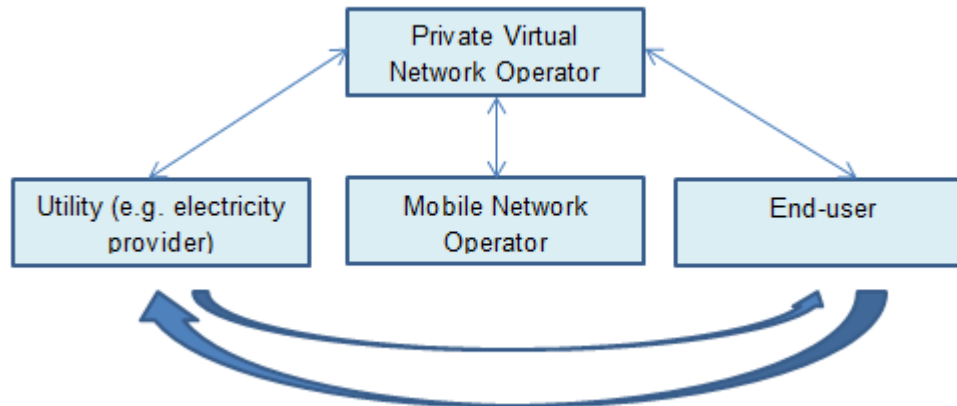
- Offers combining connectivity with vertical-specific services
- Pricing based on metrics relevant to vertical needs (latency, reliability and autonomy rather than bandwidth).
- Connectivity based on mix of consumer network and vertical-specific deployments.

> Various actors will assume the roles of new connectivity providers

5G value chain

The Private Virtual Network Operator (PVNO) value chain

- A utility provider would decide to rely on frequencies and radio infrastructures of a commercial MNO (wholesale agreement) but would still own and operate all or part of the elements of the access / core network. It would provision communication devices themselves and customize part of the core network and information system (such as the customer database for instance).
- The MNO would keep control on frequencies and radio network
- This model is very similar to a MVNO but with the differences of ownership/control on network elements (& devices) and those users would only be either employees or customers of the utility only.
- The service provided to the customer could be completely transparent to the MNO such as in the B2B2C model.



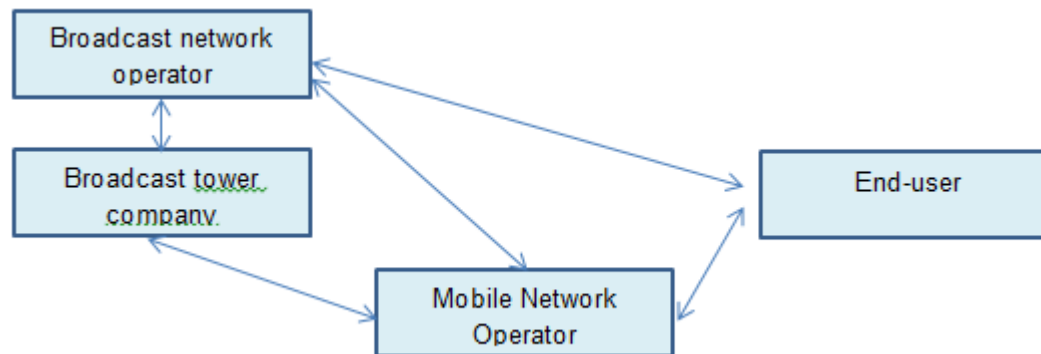
Source: METIS-II/IDATE

5G value chain

Enhanced connectivity provider value chain: T0o5G

- High Tower High Power (HTHP) model used by broadcast players enables to have a wide coverage at low cost and could be especially interesting to broadcast content/applications/updates over 5G network.
- Complementary to the Low Tower Low Power model (LTLP) currently used by mobile operators
- This concept of collaboration is called Tower Overlay over 5G (T0o5G).
- Broadcast network: broadcasting or multicasting of popular content/software. 5G architecture
- Broadcast operator would partner with telecom operator but end-users devices would have to support an additional RAT.
- Could also be suitable for public safety players: broadcast network for critical services with the insurance of being covered and reaching the appropriate (group of) people.

Tower overlay over 5G value chain

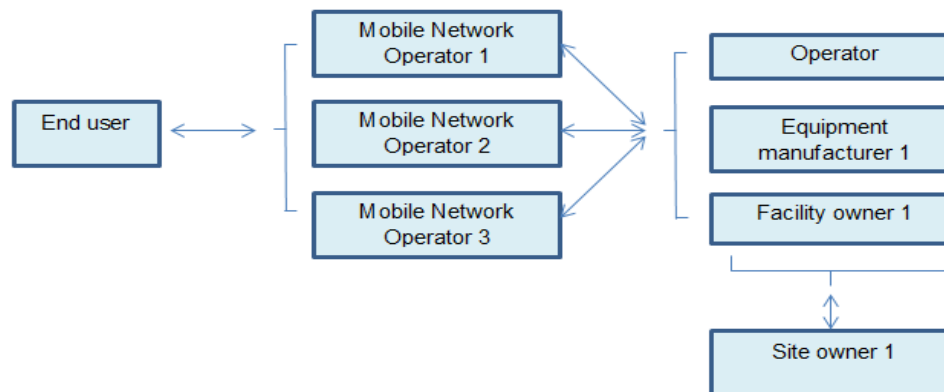


Source: METIS-II/IDATE

5G value chain

The Small Cell as a Service value chain

- One or several players invest in the deployment of small cells in a particularly crowded place.
- This “host” small cell network could be deployed by different players:
 - A MNO decides to do the initial investment. By proposing SCaaS to other carriers, initial investment would then be mitigated.
 - A JV between several operators, similar to network sharing agreements for the macro cell network.
 - A third party such as an infrastructure vendor willing to offer additional managed services to either MNOs or MVNOs. Ericsson notably made an announcement at the Mobile World Congress related to its own SCaaS proposition.
- Other players: municipalities or real estate owners
- Urban furniture managers may play this role, alone or in collaboration with one of the players mentioned above

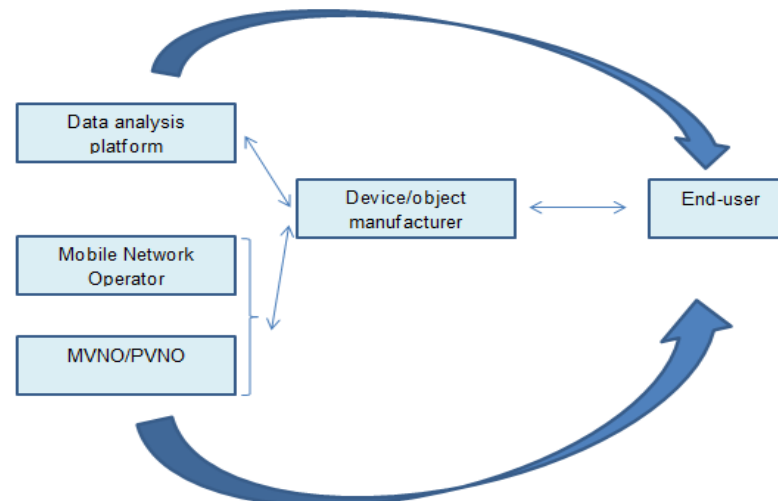


Source: METIS-II/IDATE

5G value chain

The partner service provider value chain

- In this configuration, a device or object manufacturer would sell its product to the end-user. This product would include a service relying on a connectivity that could be provided in different ways:
- Either directly by contracting a MNO,
- Or indirectly through a partnership between the device manufacturer and a connectivity provider. This connectivity provider could be of course a MNO or a MVNO/PVNO that would be created by the device manufacturer to provide specific services.
- Additionally, a player providing a platform to gather and analyze data would partner with the device/object manufacturer to provide service to the end user. This platform could be directly integrated in the network in the case where a PVNO would be created. Some device/object manufacturers could provide the platform themselves as some of them have developed the service competence internally or through the acquisition of specialized players.
- The end user has regular relationship with the mobile operator (subscription) and the data analysis platform (sends periodic reports to the user).
- In the same way, OTTs or verticals could replace the device/object manufacturer in the value chain below and manage the relationship with the end user. As an example, industry players could add data analysis services on top of connectivity provided by MNOs.

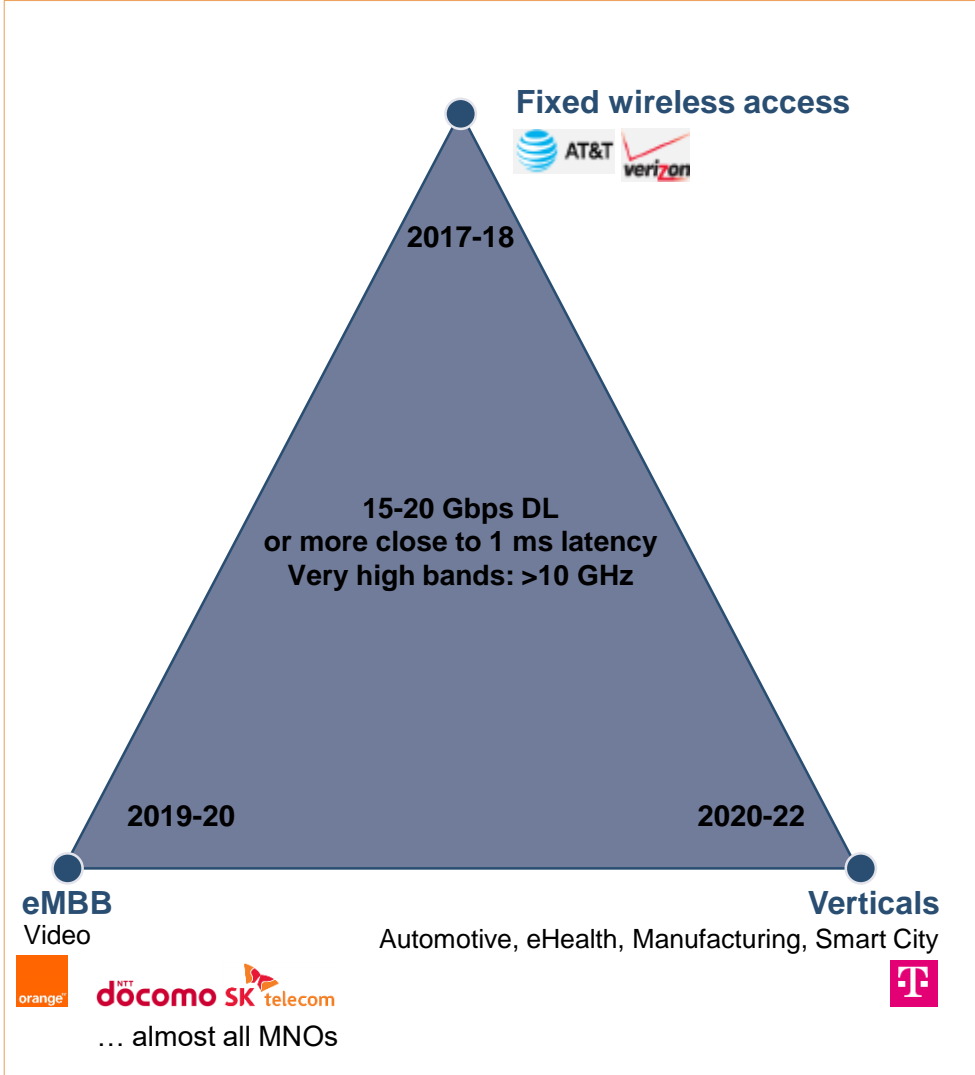


Source: METIS-II/IDATE

5G trials

5G services and trials

5G services



Source: IDATE DigiWorld, 5G plans and investments, May 2017

5G trials

Highest data rates

35 Gbps



70 Gbps



Most commonly bands trialled

28 GHz



15 GHz



Lowest latency

1 ms - 0.5 ms



5G tests - Nokia, Qualcomm to collaborate on mobile 5G NR



- Interoperability testing and over-the-air field trials based on the 5G NR Release 15
- Commercial network launches in 2019 - 3GPP standard compliant 5G NR
- Multi-gigabit per second data rates
- Latency: 1 millisecond
- “significantly better reliability than today’s network”
- For:
 - streaming high-fidelity video,
 - immersive virtual/augmented reality
 - connected cloud computing
- Spectrum:
 - sub-6 GHz spectrum: 3.5 GHz & 4.5 GHz
 - & mmWave bands (28 GHz, 39 GHz)
- Technologies:
 - Massive Multiple-Input Multiple-Output (MIMO) antenna technology,
 - beamforming techniques,
 - adaptive self-contained TDD,
 - scalable OFDM-based waveforms to support wider bandwidths,
 - advanced coding and modulation schemes
 - a new flexible, low-latency slot structure based design



- **September 12, 2017**
- **Racetrack: Everland Speedway (South Korea)**
- **5G millimeter wave (mmWave) technology**
- **Handover of a 5G device from one base station to another at a speed of 192km/h**
- **28 GHz**



- Pre-standard 5G network in central Berlin
- 2Gb/s connection over a 3.7GHz spectrum





- U.K. - 2017 07
- **PoC of 5G NR for Fixed Wireless Access as a potential competitive proposition to FTTH and G.fast.**
- **5G trialed Functionalities: mmWave NR (pre-standard), Virtualised Ran, Virtualised Core, Virtualised EMS**
- **Distance: 240m (maximum distance could be >1km)**
- **Speeds >1.1 Gbps - 300MHz bandwidth (27.715 – 28.015GHz)**
- **Base Station Antenna: integrated BBU, all other network components virtualised**
- **CPE has total of 64 antenna, base station has 1024**



- **3.5 GHz Citizens Broadband Radio Services (CBRS)**
- **& LAA small cells**

5G investments

5G Investments

MNOs investments

- **T-Mobile (USA):** \$25 billion to build a nationwide 5G network
 - 600MHz
 - By the end of 2020
 - Represents €317 per subscriber
- *iGR* has forecast that a total of \$56 billion will be spent in the U.S. from 2017 - 2025 on the build of 5G
- **EC study** (“Identification and quantification of key socio-economic data to support strategic planning for the introduction of 5G in Europe”):
 - 5G CapEx needs at €145 (+7% over 4G) per subscriber
 - €58Bn for Europe

Conclusions

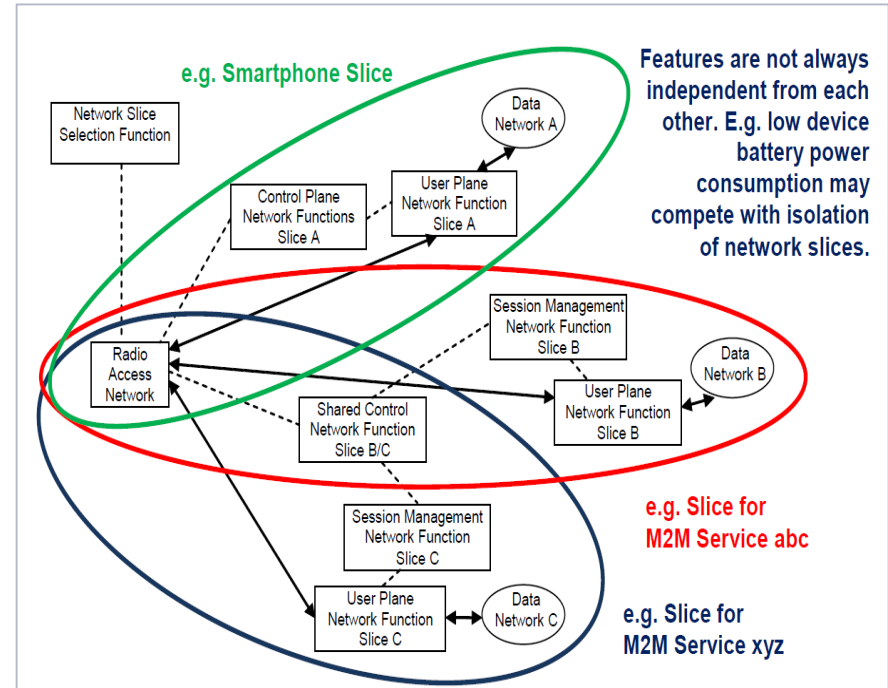
5G challenges

Network slicing

- **Network slicing (network virtualization)** is a key feature to enable several players with **diverging needs to coexist** on the same infrastructures with guaranteed level of QoS.
 - A native SDN / NFV based architecture
 - 3 independent layers (infrastructure, business enablement & application)
 - An orchestrator to create independent slices and allocate resources of each layer to fulfill specific use case

5G business models

- Mobile operators are looking at new ways to monetise 5G: pay-per-use, Private network with dedicated spectrum operated by MNOs...
- IoT challenge
- Will 5G really drive industry transformation?



Source: 3GPP

5G forecasts

5G will be launched in 2018, becoming more widespread in 2020

- **According to IDATE, there will be 1.6 billion 5G subscribers in 2025**

- Mostly in Asia (58%, 950 million). With 274 million 5G subscriptions, Europe is expected to account for 17% of the world total in 2025, and EU-28 will account for 11% in 2025.
- Growth will really start as from 2022 when 5G subscriptions will head past 200 million.
- 5G will become mainstream as from 2023 in IDATE/METIS-II assumptions
- Europe will pull the overall growth in %
- Asia will pull the volume growth.

Figure 46: 5G subscribers forecasts (million)

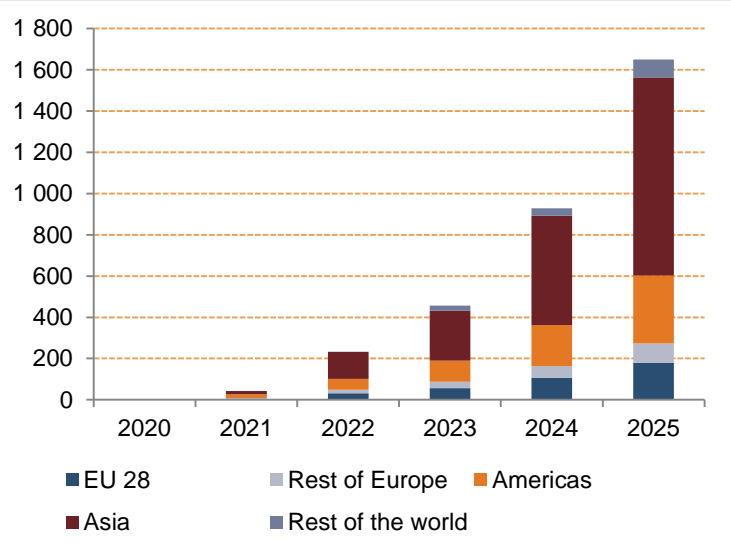
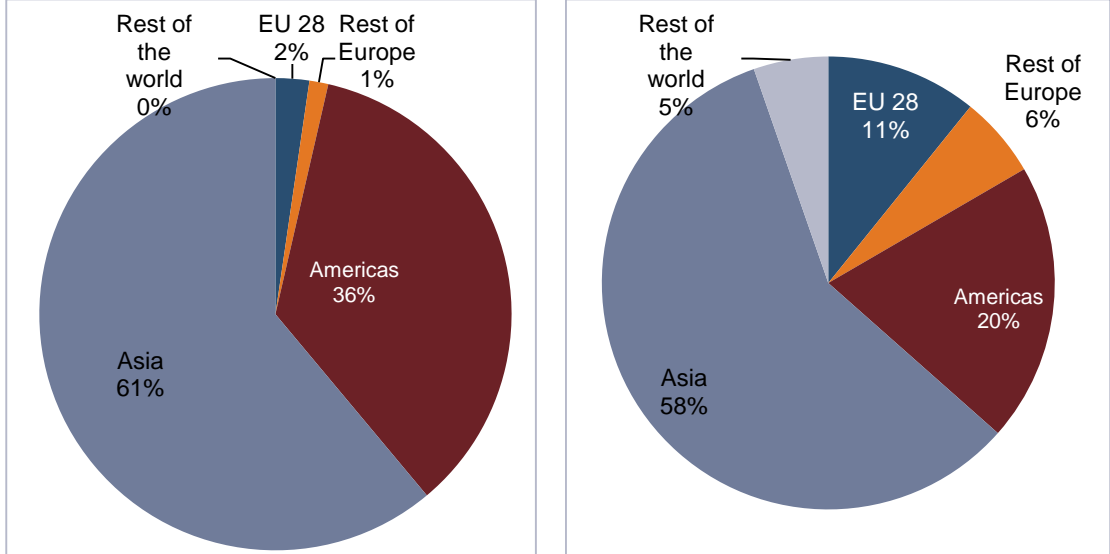


Figure 47: 5G subscribers breakdown by region in 2020 and 2025 (%)



Source: IDATE DigiWorld

Summary

First 5G service is likely to be fixed wireless access

- Focus on high data rates and capacity in Japan, South Korea and USA
- Also a focus on vertical markets in Europe?

5G challenges

- Network challenges: slicing, smooth introduction of technological innovations
- Spectrum harmonisation
- Business models

Verticals & 5G

- Most promising verticals?
- Is 5G timetable and characteristics adapted to vertical requirements?
- Role for satellite & broadcasting?

5G investment

- R&D progresses
- Will European MNOs invest quickly in 5G?

Thank you!

Who we are

Founded in 1977, IDATE has gained a reputation as a leader in tracking telecom, Internet and media markets, thanks to the skills of our teams of specialized analysts.

Now, with the support of close to 40 member companies – which include many of the digital economy's most influential players – the newly-rebranded DigiWorld Institute has entered into a new stage of its development, structured around three main areas of activity:



- **Time-tested analysis and consultancy** Our expertise and client list > [Consulting](#)
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