



5G Spectrum Access

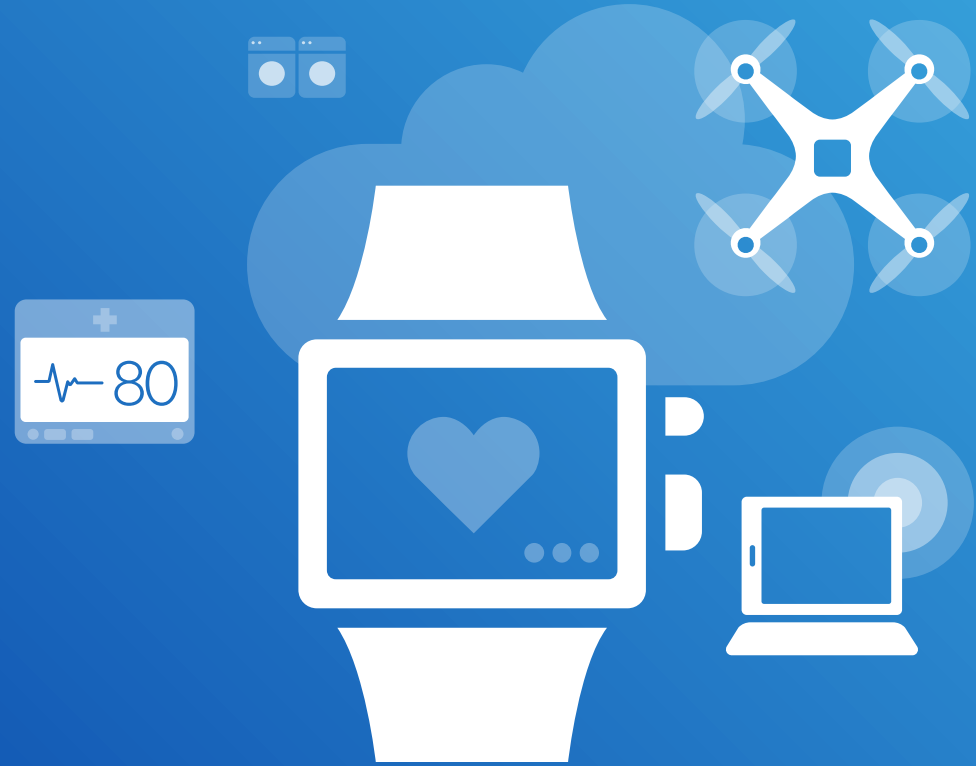
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Pioneering 5G bands for Europe



A unifying connectivity fabric

Always-available, secure cloud access



Enhanced mobile
broadband



Mission-critical
services



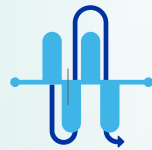
Massive Internet
of Things

Unifying connectivity platform for future innovation

Convergence of spectrum types/bands, diverse services, and deployments,
with new technologies to enable a robust, future-proof 5G platform



5G NR will natively support all different spectrum types



Licensed spectrum

Exclusive use



Shared spectrum

New shared spectrum paradigms



Unlicensed spectrum

Shared use

EU 5G bands

26 GHz (mmWave)

Extreme bandwidths and data rates eMBB

3.6 GHz

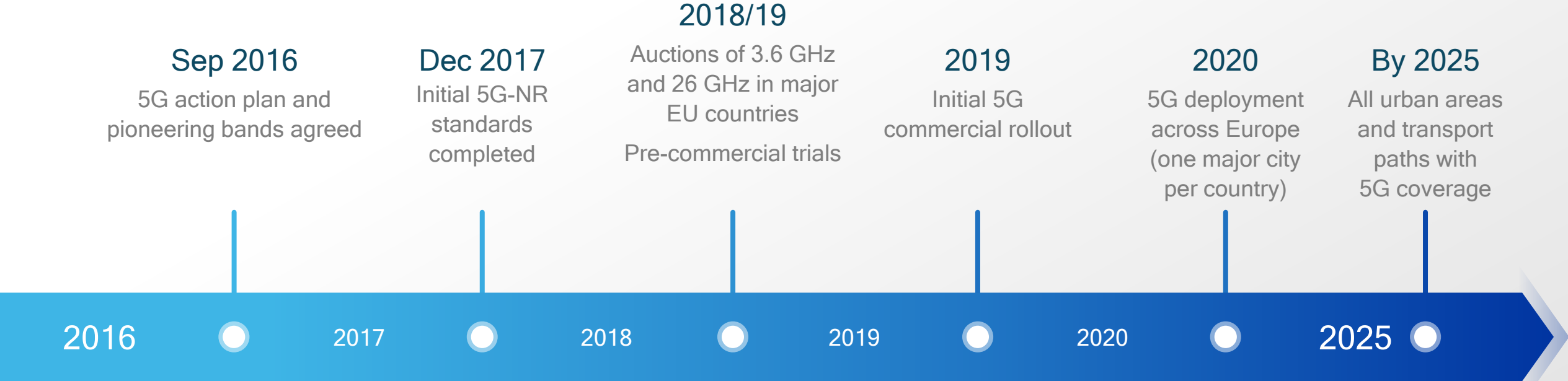
Wider bandwidths eMBB and mission-critical

700 MHz

Longer range MBB and massive IOT

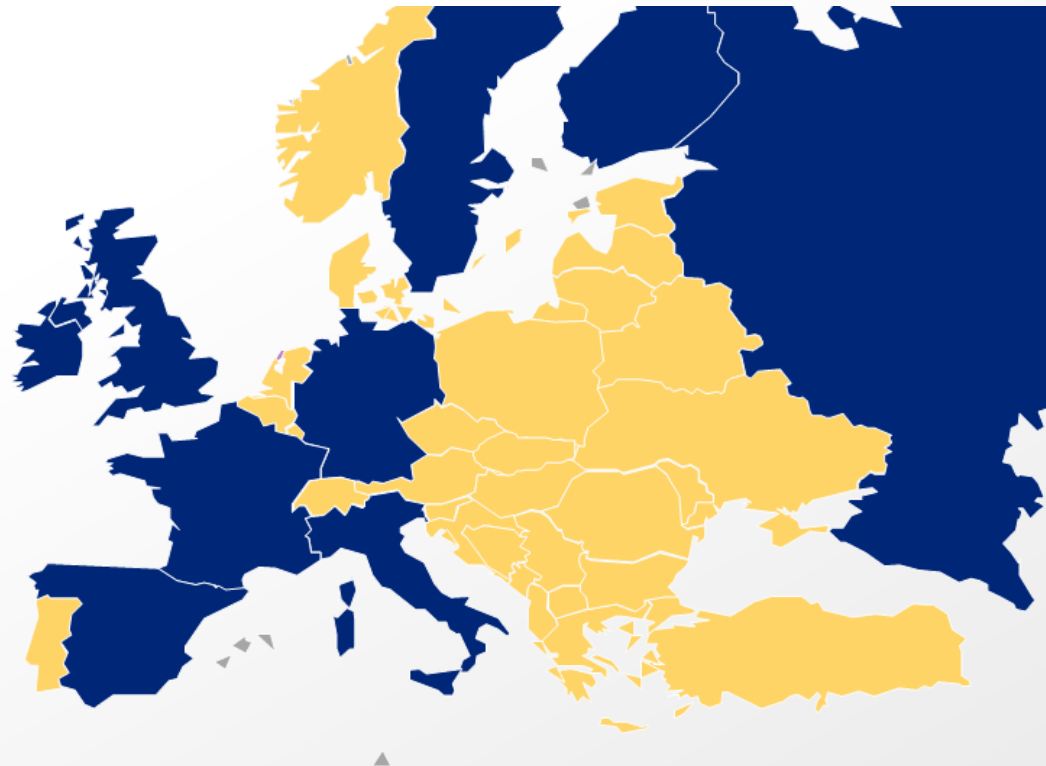
The EU Roadmap to 5G—Initial Rollout in 2019

5G deployment across Europe in 2020

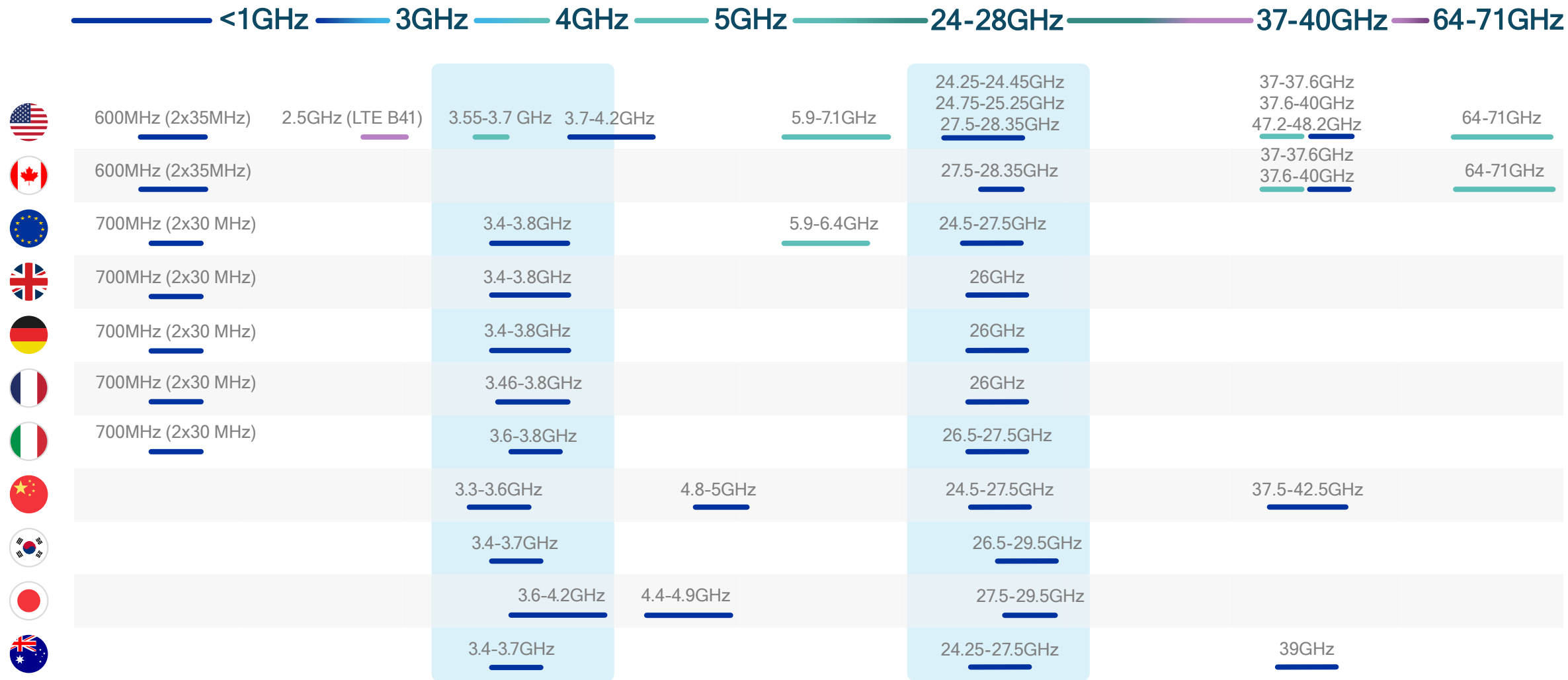


European Countries Focusing on the Release of 3.4 GHz & 26 GHz Bands

 Band	Award
<ul style="list-style-type: none"> • 3.4 - 3.8 GHz (350 Mhz) • 26 GHz 	2017 2018
 Band	Award
<ul style="list-style-type: none"> • 3.46 - 3.8 GHz • 26 GHz 	2019 2020
 Band	Award
<ul style="list-style-type: none"> • 3.6-3.8 GHz • 26.5 - 27.5 GHz 	2018 2019/2020
 Band	Award
<ul style="list-style-type: none"> • 3.6 - 3.8 GHz • 26.5 - 27.5 GHz 	2018 2018
 Band	Award
<ul style="list-style-type: none"> • 3.4 - 3.6 GHz (150 MHz) • 3.6 - 3.8 GHz (116 MHz) • 26.5 - 27.5 GHz 	Done 2019 2019/20



 Band	Award
<ul style="list-style-type: none"> • 3.4 - 3.8 GHz • 26.5 - 27.5 GHz 	2019 2020
 Band	Award
<ul style="list-style-type: none"> • 3.4 - 3.8 GHz • 26.5 - 27.5 GHz 	2018 2018
 Band	Award
<ul style="list-style-type: none"> • 3.4-3.8 GHz • 26 GHz 	2018 2018
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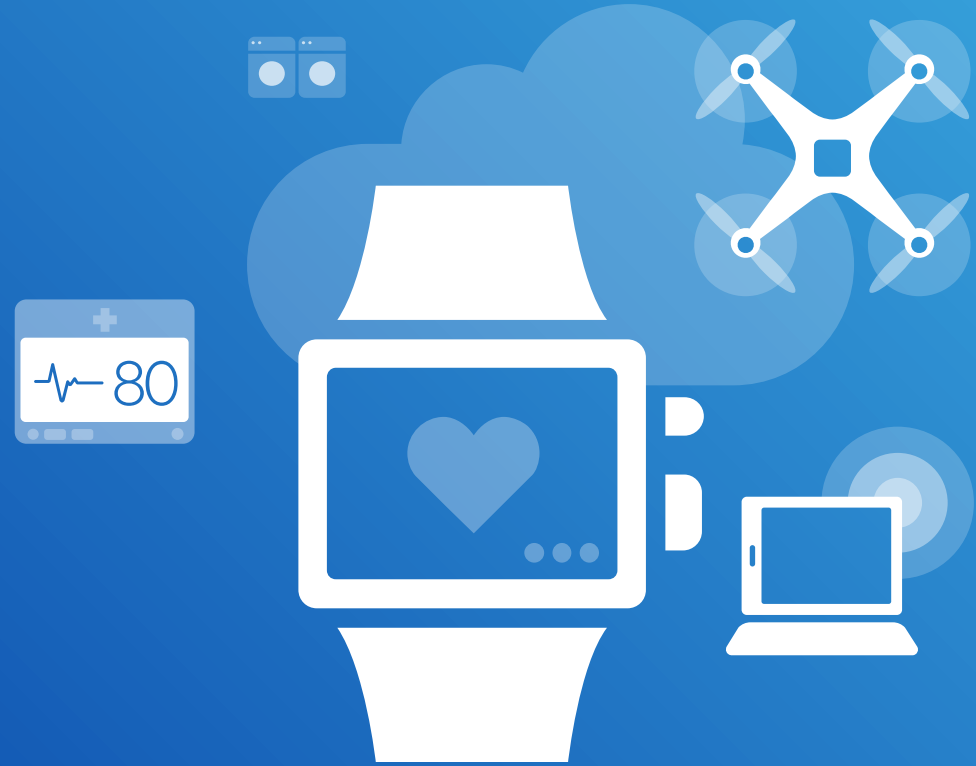
Global snapshot of 5G spectrum

Around the world, these bands have been allocated or targeted

New 5G band

- Licensed
- Unlicensed / shared
- Existing band

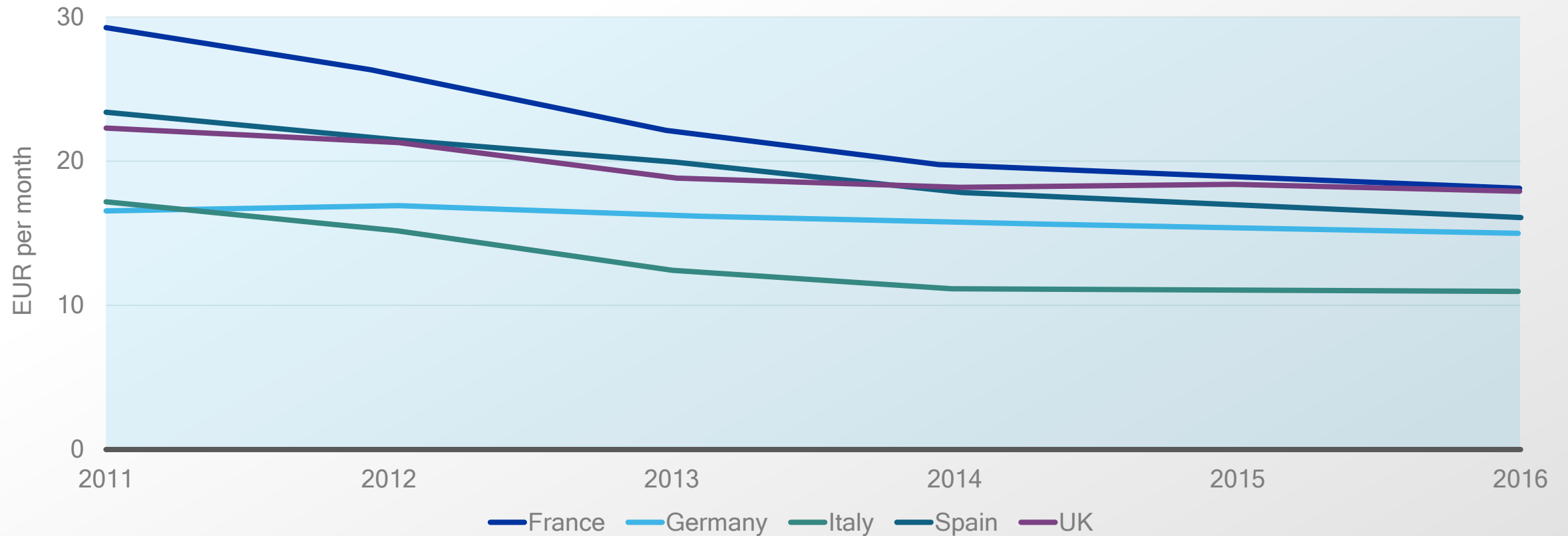
5G infrastructure Economics



ARPU has substantially decreased in Europe

Leading to an investment gap in 5G

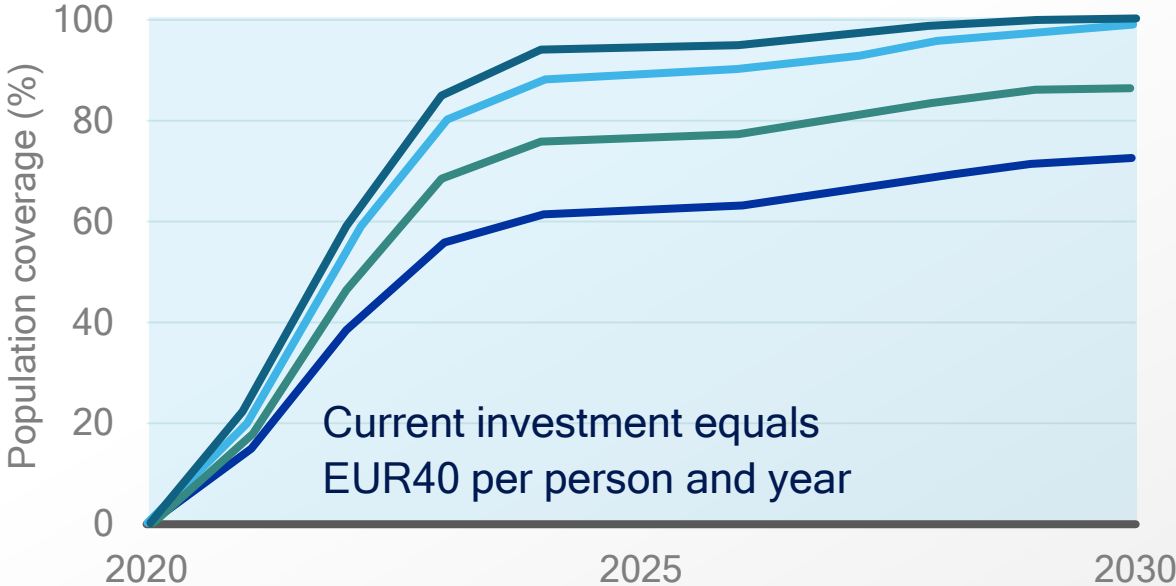
Evolution of mobile ARPU in Western Europe



Current investment levels are not sufficient

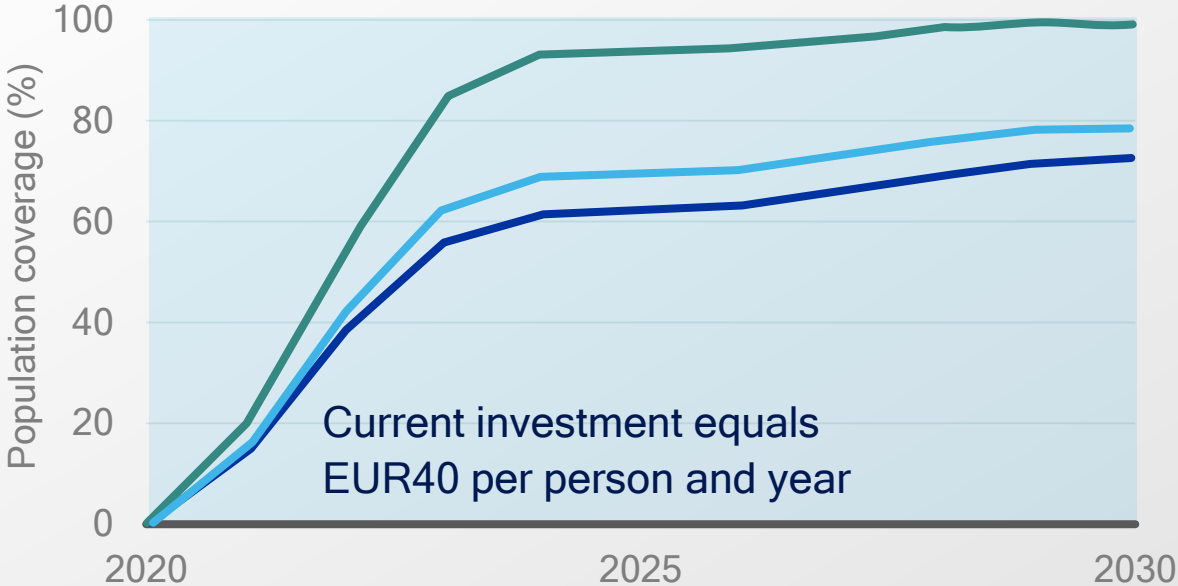
Need policies to create demand, enable network sharing, lower spectrum fees

5G Pop coverage: France



- Current investment
- Current investment + infrastructure sharing
- Current investment + 10%
- Current investment + 10% + infrastructure sharing

5G Pop coverage: Germany



- Current investment
- Current investment with infrastructure sharing or current investment + 10%
- Current investment + 10% + infrastructure sharing
- Current investment + 10%

Towards connected and autonomous driving with C-V2X

Intelligent Transport System (ITS) and 5G

Vehicle-to-infrastructure (V2I)

e.g. traffic signal timing / priority



Vehicle-to-network (V2N)

e.g. real-time traffic/routing, cloud services



Vehicle-to-vehicle (V2V)

e.g. collision avoidance safety systems



Vehicle-to-pedestrian (V2P)

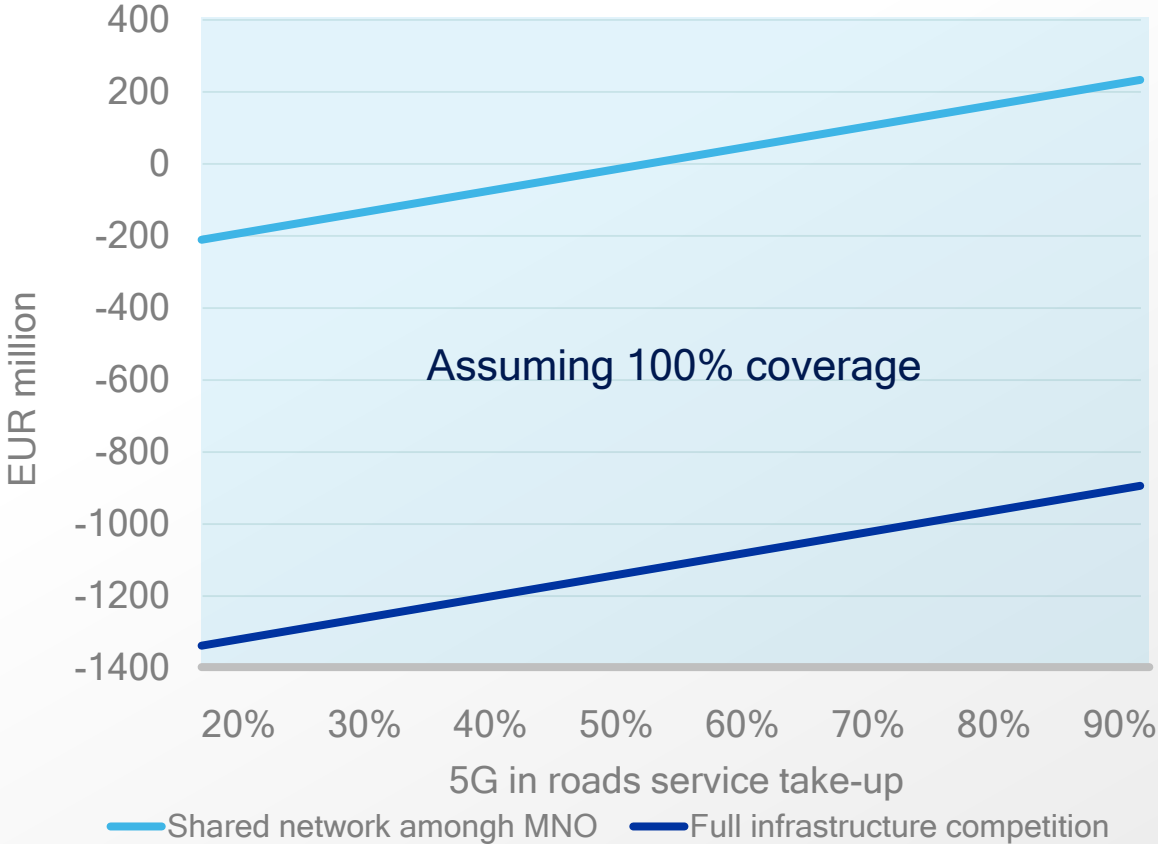
e.g. safety alerts to pedestrians, bicyclists



5G and ITS infrastructure sharing enables full road coverage

Key for connected and autonomous driving with C-V2X

NPV of 5G in highways and motorways business by service take-up in France



5G MBB coverage of 100% road coverage along highways not viable

Business case improves if operators are allowed to share infrastructure

Collaborative road infrastructure/ 5G model improves business case further

Acting on demand is key to success

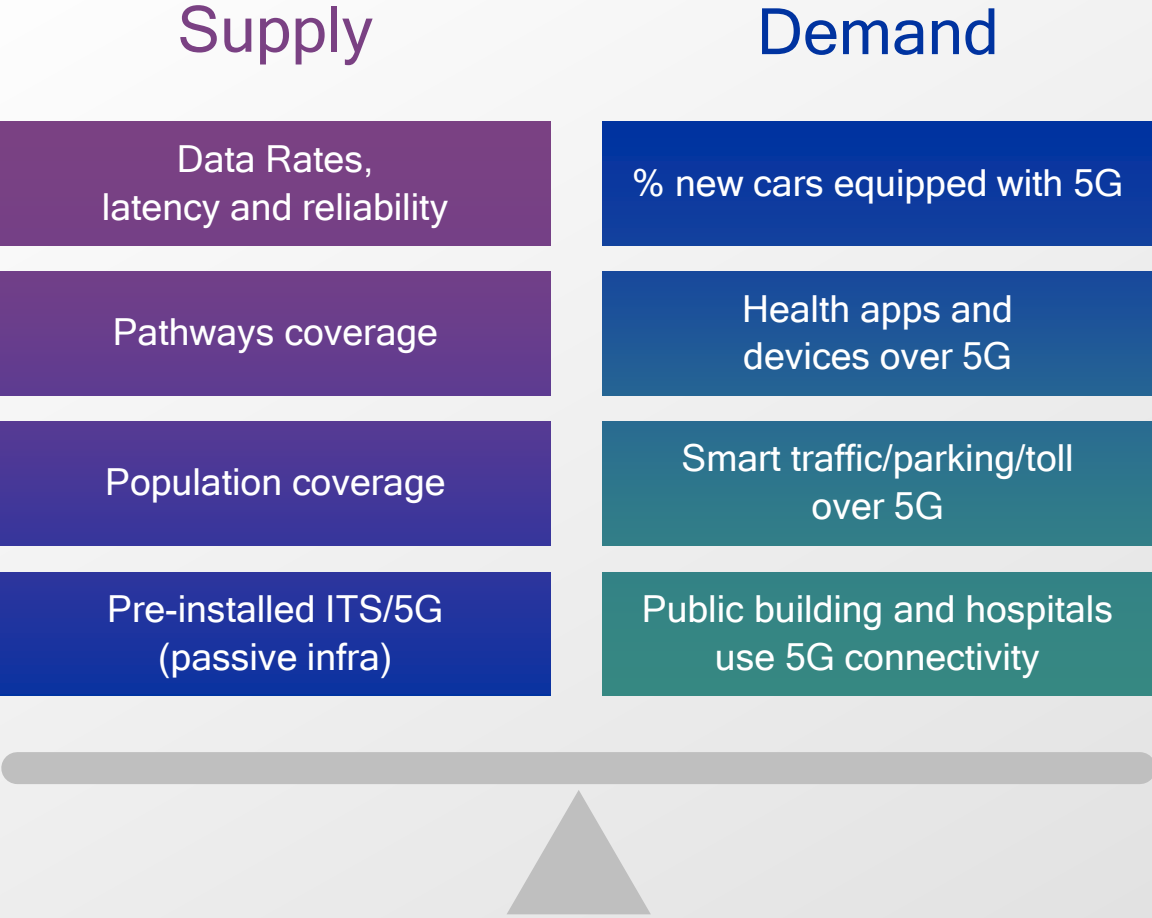
Rethinking the digital agenda targets & licenses objectives

Act on supply and demand

New targets

Reflecting the pivot from connecting people to connecting (every)thing

Acting on supply and demand for 5G services



Thank you

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