Passenger Terminal Expo

5G deployment models and beyond 5G – future developments

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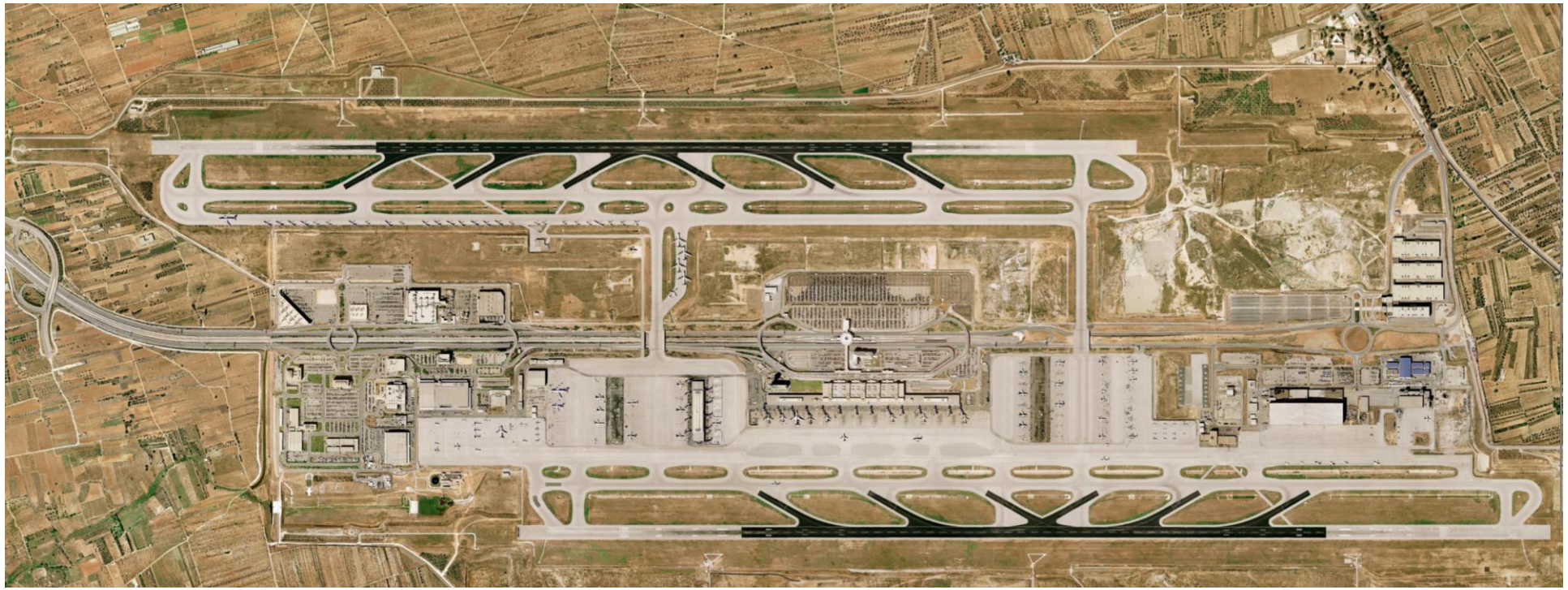
2023-03-15

TrialsNet project has received funding from the European Union's Horizon-JU-SNS-2022 Research and Innovation Programme under Grant Agreement No. 101095871

Presentation contents

- How 5G – B5G – 6G mobile networks contribute to the digital airport concept
- The use cases that future mobile networks can support at airports
- The operational and business benefits of different deployment strategies for 5G mobile networks at airports
- What the future holds for mobile networks – beyond 5G and 6G mobile networks

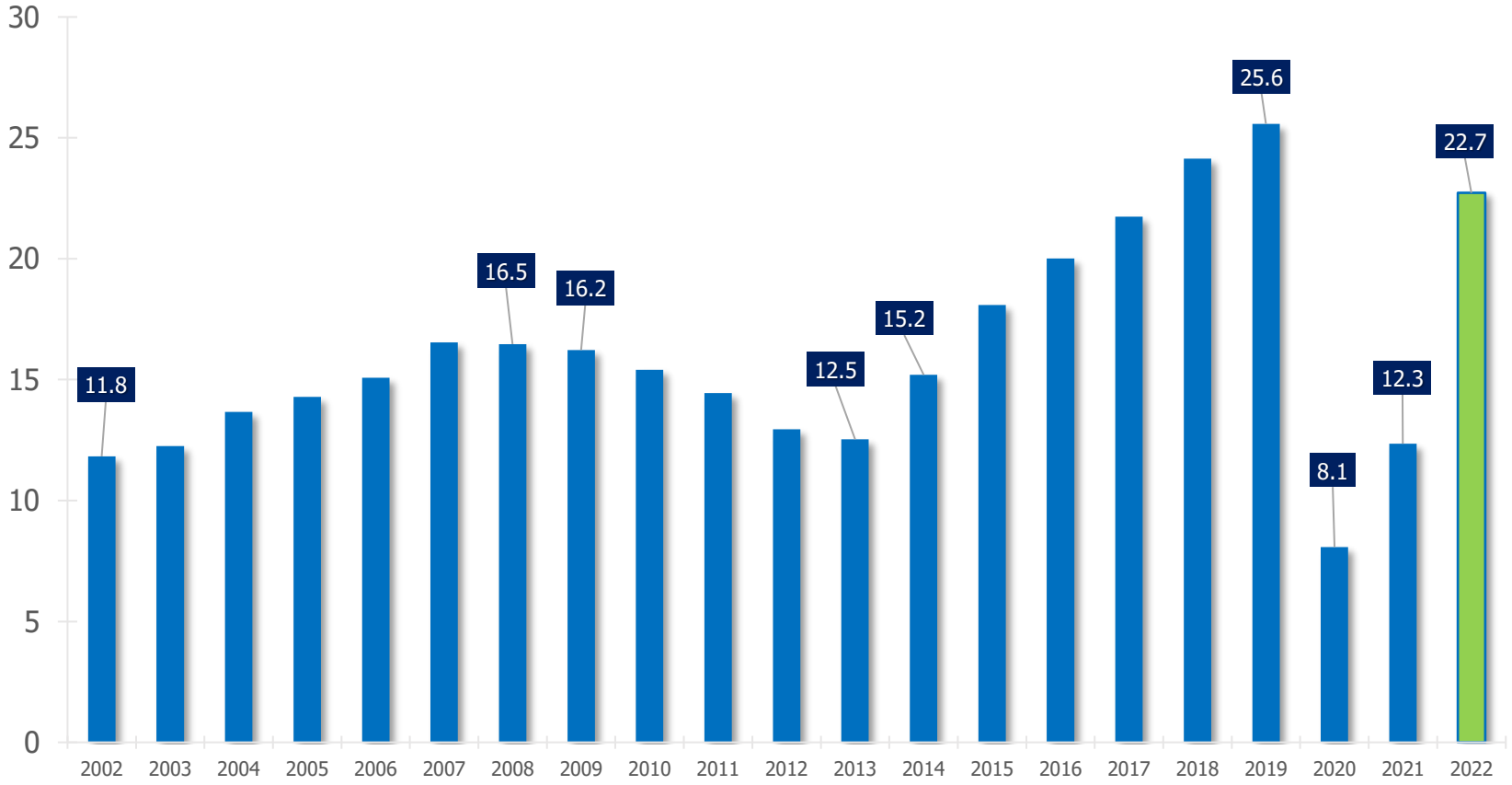
Athens International Airport



An Airport city (Aerotropolis) hosting more than 370 companies with more than 16,000 employees servicing approx. 100,000 passengers and 800 flights per day during peak periods.

Athens' passenger traffic overview

- Strong year-on-year growth as of 2013, achieving record performance in 2019 and rapid recovery following the pandemic's sharp drop …



ATHENS INTERNATIONAL AIRPORT ELEFTHERIOS VENIZELOS

	22vs21	22vs19
PAX	84%	-11%
Flights	34.2%	-5.4%

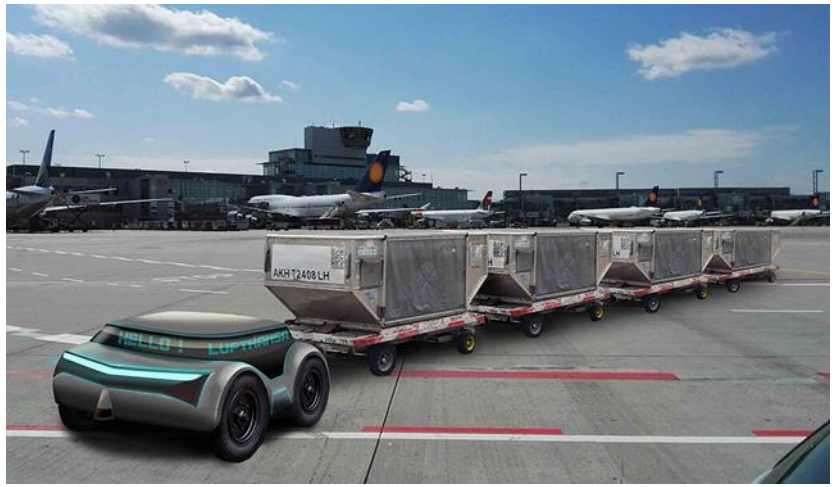
Athens International Airport is a highly awarded airport

Athens Airport was ‘Highly Commended’ at the ACI Europe Best Airport Awards for 2022 in the ‘25-40 million passengers’ category

Best Airport Award for 2021 at the ACI Europe Best Airport Awards in the ‘25-40 million passengers’ category

How 5G mobile networks contribute to the digital airport concept

- Data connectivity landscape at airports is quickly changing, enabling new features and capabilities to be considered and developed.
- Advantages of the latest generations of mobile networks' services over wired networks:
  - Geographical coverage area
  - Mobility
  - IoT connectivity
  - Investment expenditure
  - Coverage of ultra large number of assets
  - Complex and/or vast building structures
  - Remote areas



- Airport related use cases are characterized by increased mobility, ultra-reliability, high security, isolation, and QoS for indoor and outdoor coverage.

5G Mobile Networks are becoming de-facto standard in aviation

5G mobile networks are expected to prevail in all aspects of the Aviation Industry

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PRESS RELEASE | Publication 24 November 2022

5G on planes, Wi-Fi on the road – Commission decision opens up new opportunities for innovation

Airlines will be able to provide the latest 5G technology on their planes, alongside previous mobile technology generations as the Commission updated the implementing decision on spectrum for mobile communications on-board aircrafts, designating certain frequencies for in-flight 5G technology.

photo of the wing of an airplane with 5G written next to it

iStock photo Getty images plus

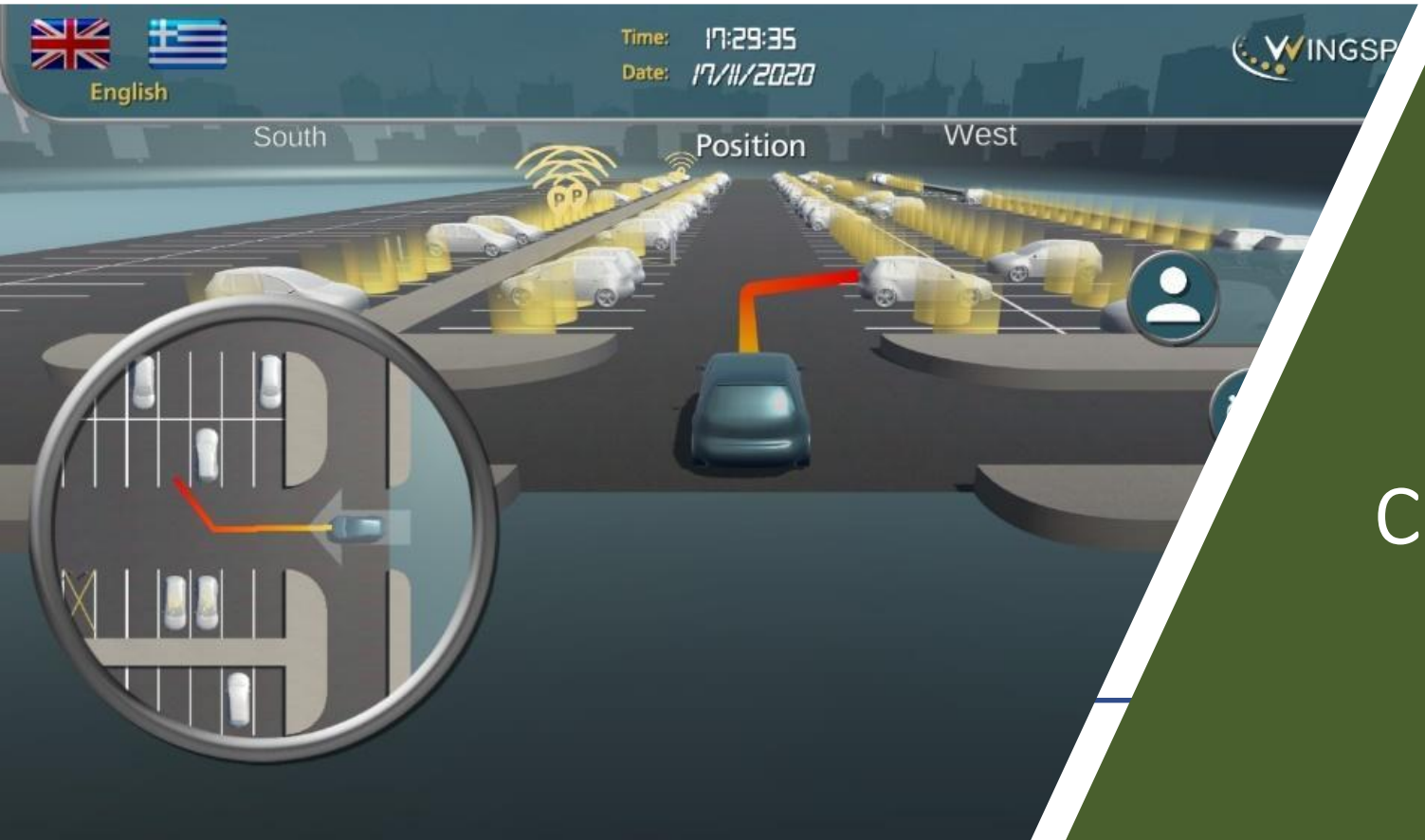
Passengers aboard flights in the EU will be able to use their mobile phones to the maximum of their capacity and features, just like with a ground-based 5G mobile network.

Thierry **Breton**, Commissioner for the Internal market, said:

> 5G will enable innovative services for people and growth opportunities for European companies. The sky is no longer a limit when it comes to possibilities offered by super-fast, high-capacity connectivity.

Related topics

Radio Spectrum Policy | Connectivity | 5G/6G



Realized 5G use cases at the Athens Airport

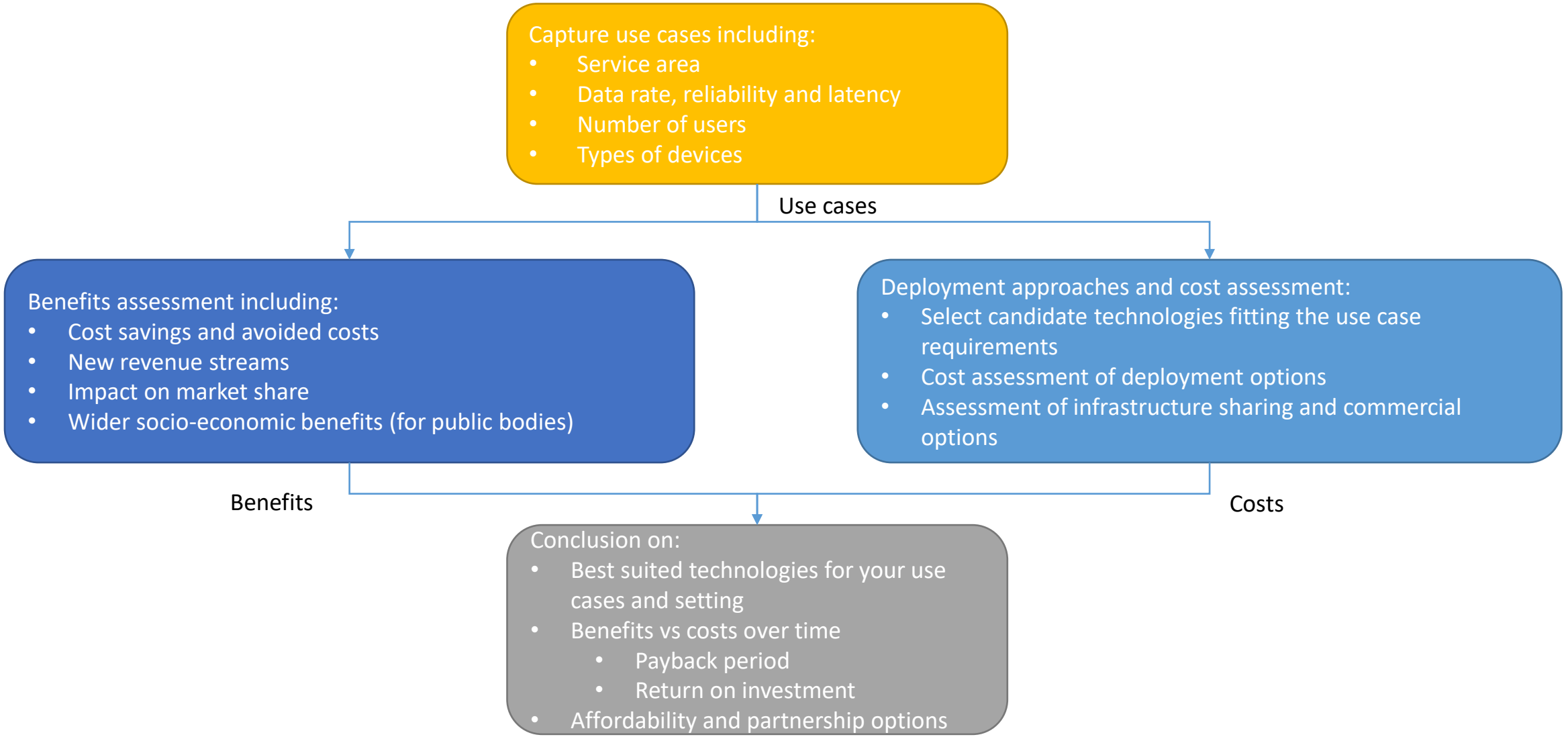
5G Use cases at Athens International Airport

At a high level, the key sources of value that 5G can offer airports in our analysis are:

- Improved safety
- Additional convenience to passengers
- Improved airport efficiency leading to cost savings

Use case or 5G application considered	Value generated for the airport
Emergency evacuation	- Safer environment and reduced loss of life in a case of emergency - Faster re-opening of airport, reduces the cost of airport downtime
Smart airport parking management	- Additional time in terminal (less time finding a parking space) and hence additional spending in the terminal building - Potential premium charge for more convenient parking
Video-enhanced ground-based moving vehicles	- Reduction in average flight delays reduces the impact of delays on airport revenues - Reduction in the costs associated with accidents on the airport apron

Assessing return on investment for advanced wireless



Operational and business benefits

- Affordability of wireless connectivity should not be constrained purely by existing IT budgets
- Need to assess the return on investment over a number of years
- This includes the commercial benefits (potential extra income, avoided costs and cost savings) to the business
- Example of quantification of these benefits shown on the right for AIA
- Assumes a modest improvement of 10% in areas such as:
  - Premium charge for airport parking
  - More passenger time in terminal and increased spend
  - Less accidents on airport apron and improved response resulting in less delayed flights and related airport costs
- Even for a handful of use cases these benefits can be significant – up to 2% of AIA's revenues in our example

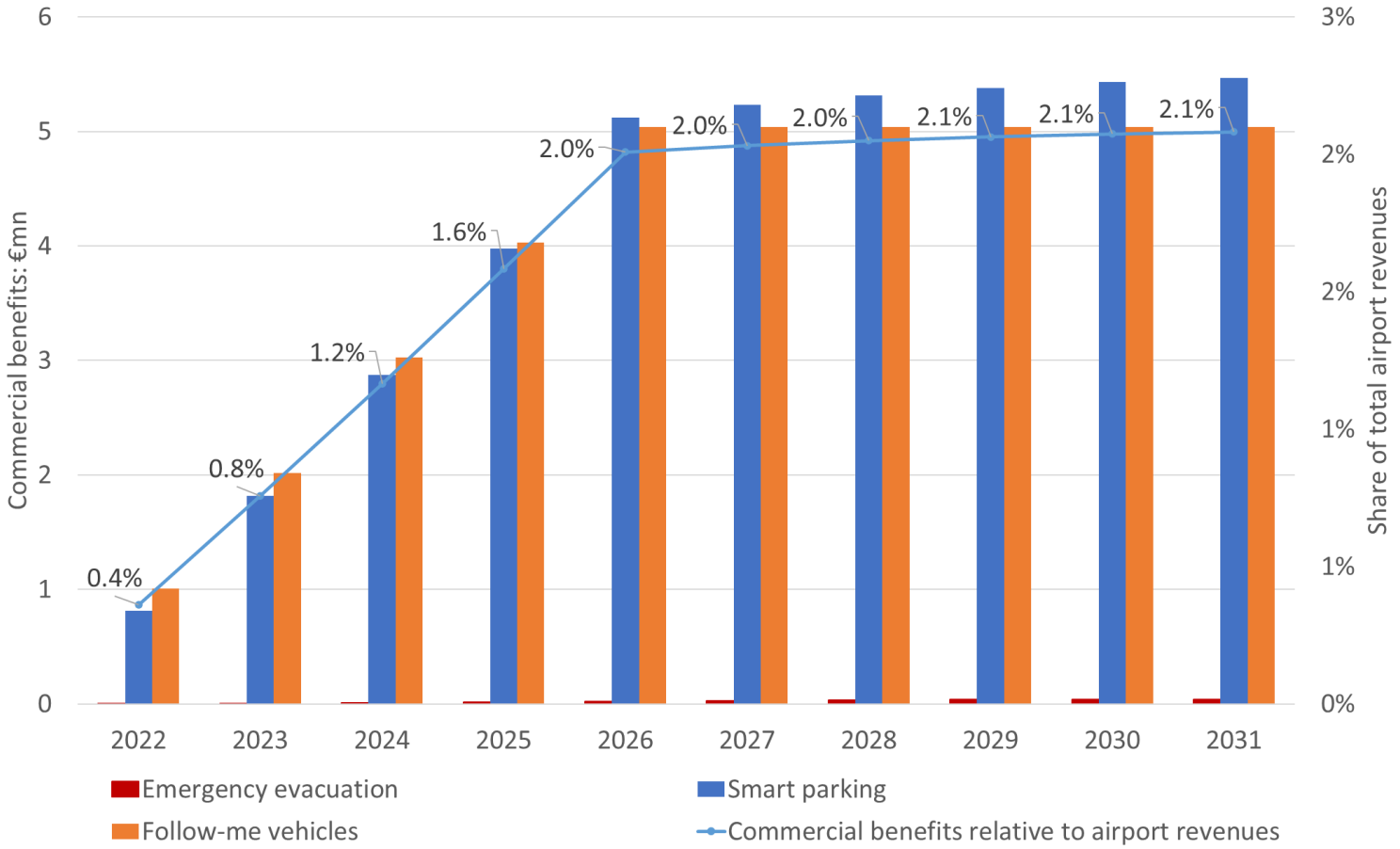


Illustration of potential commercial benefits for example use cases using advanced wireless for Athens International Airport From 5G-TOURS, Deliverable D2.3

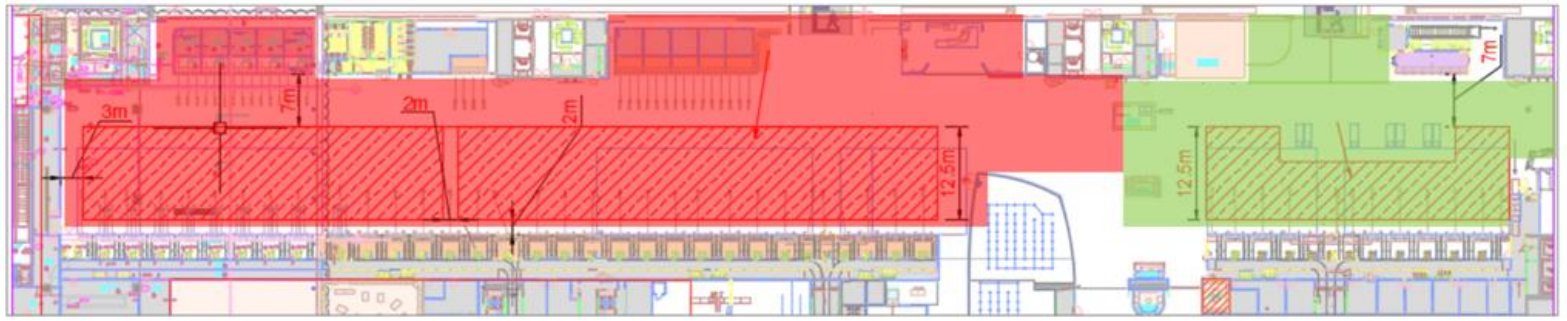
Deployment approaches – wireless technology options

Wireless technology	Spectrum	Mobility supported?	Reliability	Easy to deploy?	Device availability	Costs	Network responsibility
Wi-Fi	Readily available – no licence needed	Limited support for mobility	Limited reliability as licence exempt spectrum	Quick	Readily available	Low to mid range cost of equipment relative to mobile network options	Likely ownership and network maintenance sits with airport
Service agreement from existing mobile service provider (MSP)	MSP's existing licences or private network spectrum	Supports mobility	Reliability likely to be consumer grade rather than industrial and focused on public areas	Depends on MSPs existing network and if upgrades required	Readily available	Likely high OPEX profile May encourage investment in public mobile	Responsibility for spectrum, network build, maintenance and upgrade sits with MSP Limited by MSPs service offerings and new service roadmap
"Slice" agreement with an existing MSP with specific service level agreement	MSP's existing licences or private network spectrum	Supports mobility Potential roaming between public and private networks	Reliability as per service level agreement	Depends on MSPs existing network – likely additional infrastructure required	Readily available if using mainstream mobile spectrum May be limited if using localised private network spectrum	Likely high OPEX profile May encourage investment in public mobile	Responsibility for spectrum, network build, maintenance and upgrade sits with MSP Limited by MSPs service offerings and new service roadmap
Private network deployed and run by airport or third party	Localised spectrum for private networks in some countries only	Supports mobility	Bespoke levels of reliability and service levels	Specify, design and build a mobile network from scratch But can design and upgrade network to fit your services and roadmap of new services	May be limited if using localised private network spectrum	High CAPEX and OPEX profile But neutral host partners available to help with affordability depending on desired OPEX vs CAPEX profile	Responsibility for spectrum, network build, maintenance and upgrade sits with airport or their third party partner

Deployment approaches – implementation options

North Check-in Hall

South Check-in Hall



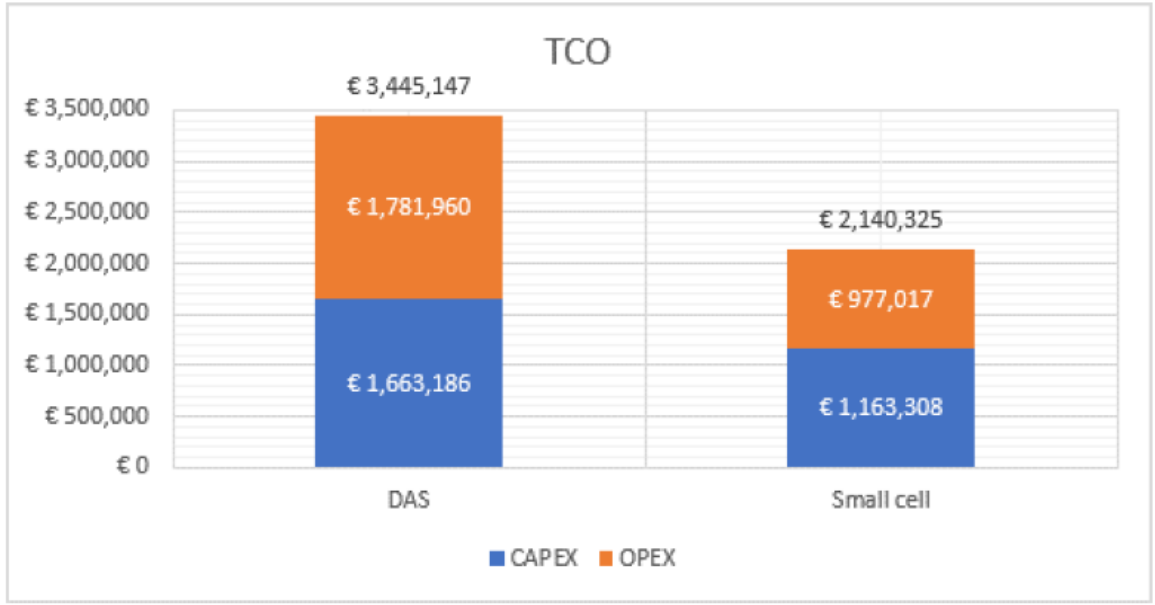
View of some of the areas in Athens's airport, zones size and peak populations

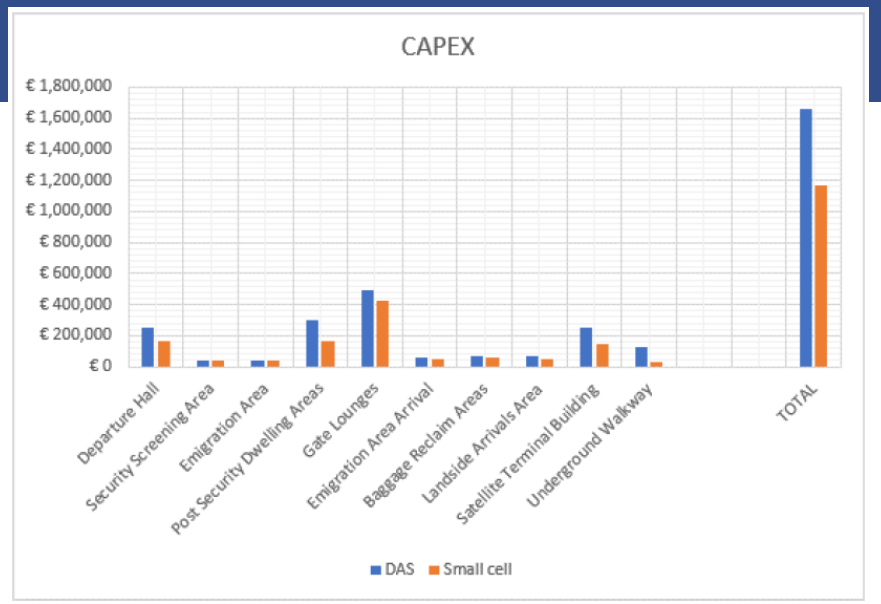
	Size of zones	Peak population
Departure Hall	14,050 sq. m	2,040
Security Screening Area	900 sq. m	450
Emigration Area	765 sq. m	383
Post Security Dwelling Areas	14,946 sq. m	2,218
Gate Lounges	15,122 sq. m	5,800
Emigration Area Arrival	1,600 sq. m	650
Baggage Reclaim Areas	2,337 sq. m	780
Landside Arrivals Area	3,150 sq. m	626
Satellite Terminal Building	12,500 sq. m	1,875
Underground Walkway	3,200 sq. m	320

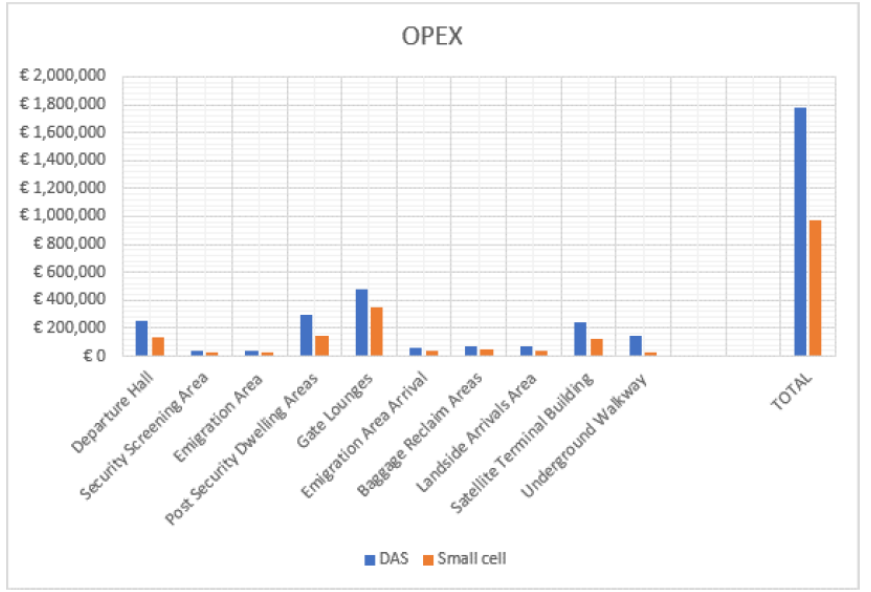
- Having chosen a technology, next need to assess the best way to implement it in your environment
- Need to understand the area to be served, number of users and existing infrastructure

Deployment approaches – implementation options

- Network dimensioning and cost modelling can then be done for candidate options to compare:
  - Total cost of ownership over network lifetime
  - Network cost profile over time



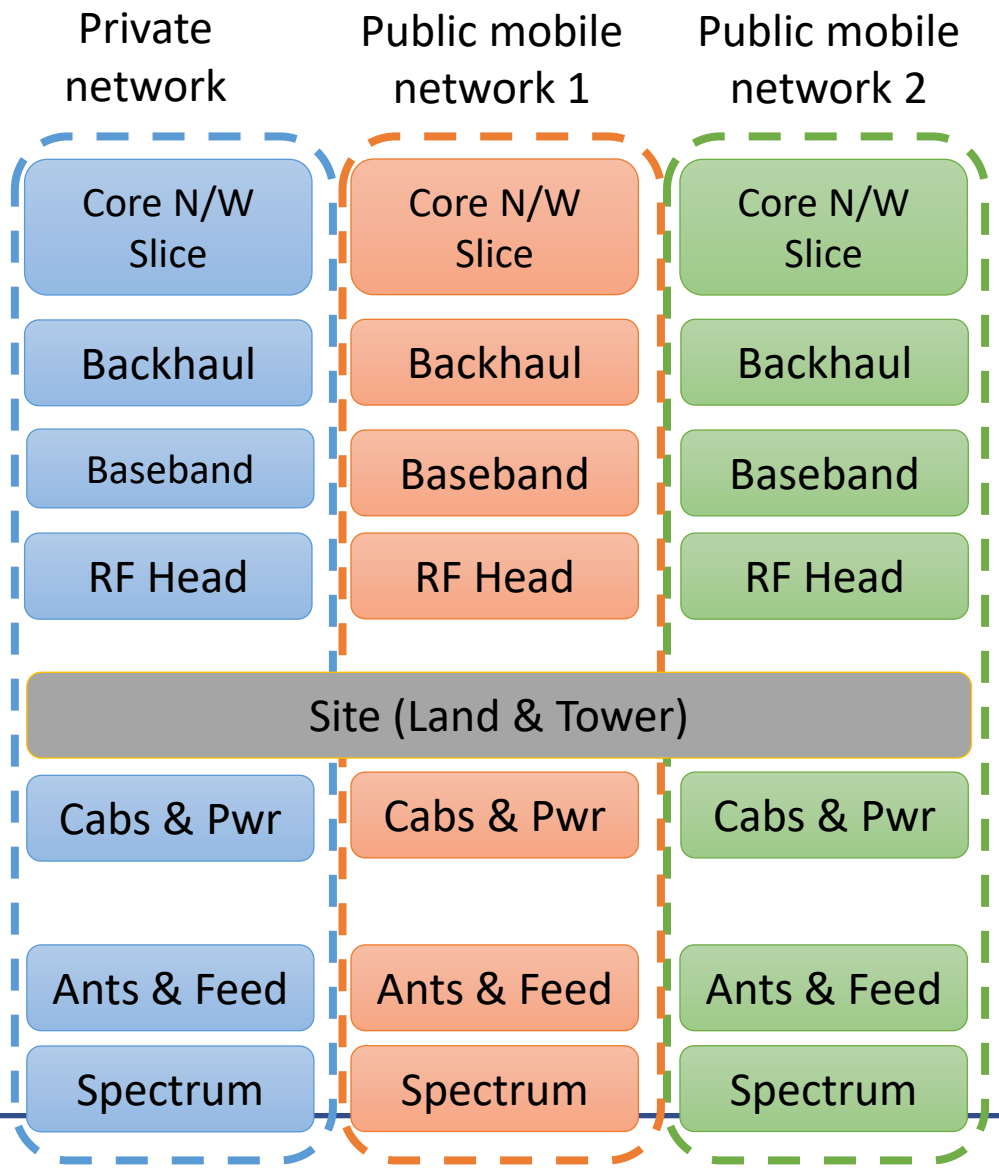




Figures from [5G-TOURS, Deliverable 8.3]

Deployment approaches – infrastructure sharing and ownership

Siloed deployment of infrastructure



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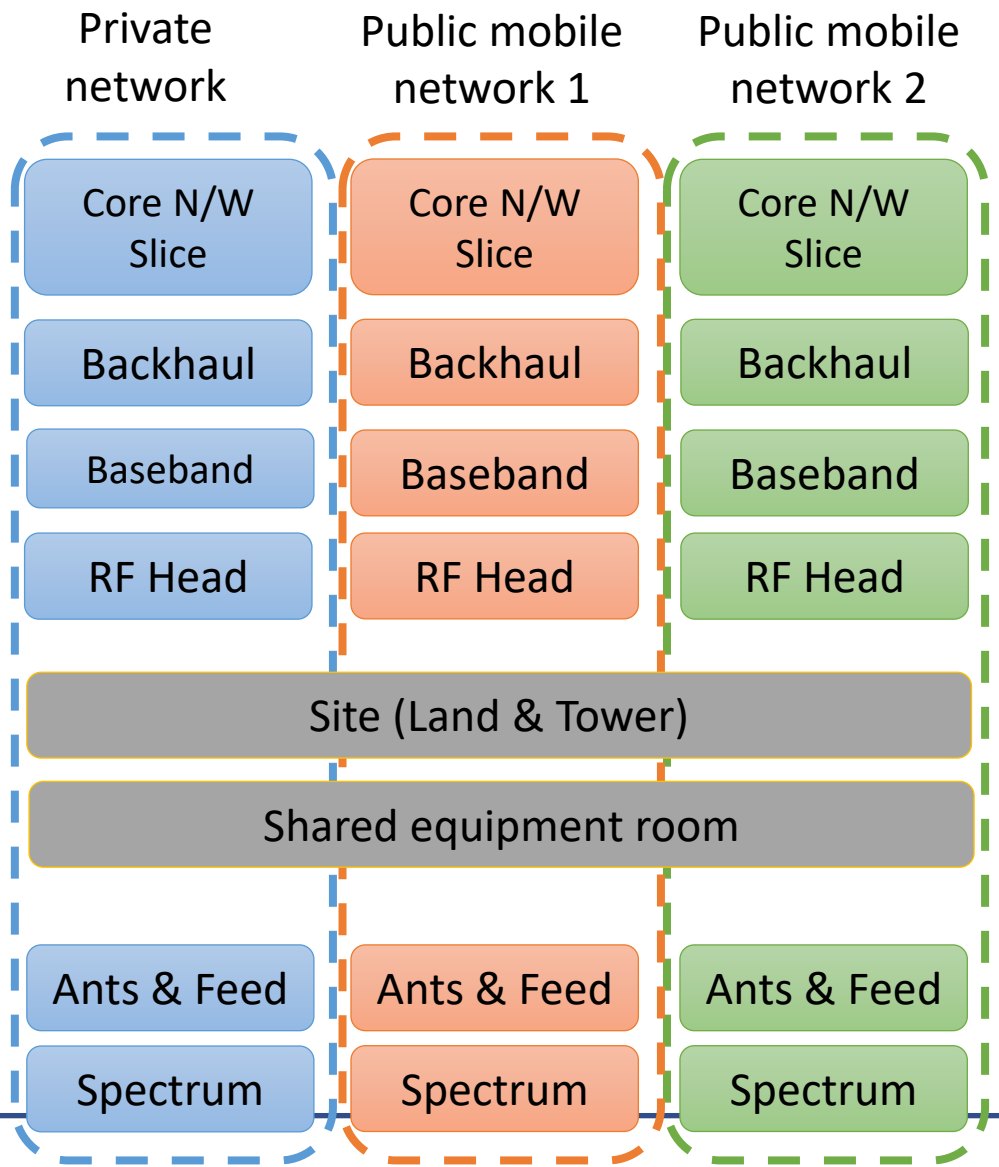
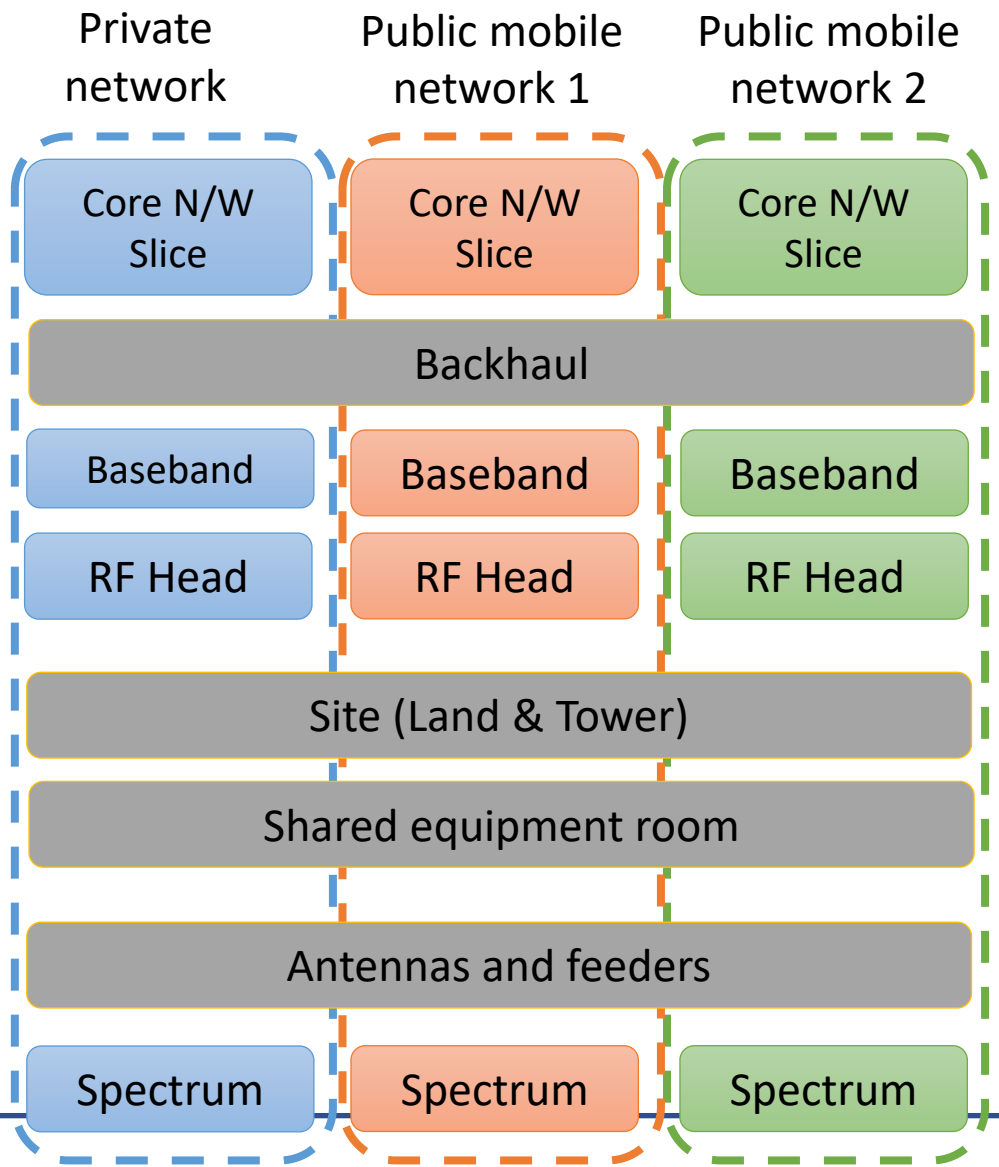
Deployment approaches – infrastructure sharing and ownership

Shared sites and equipment room



Deployment approaches – infrastructure sharing and ownership

Infrastructure as a service from neutral host but independent spectrum

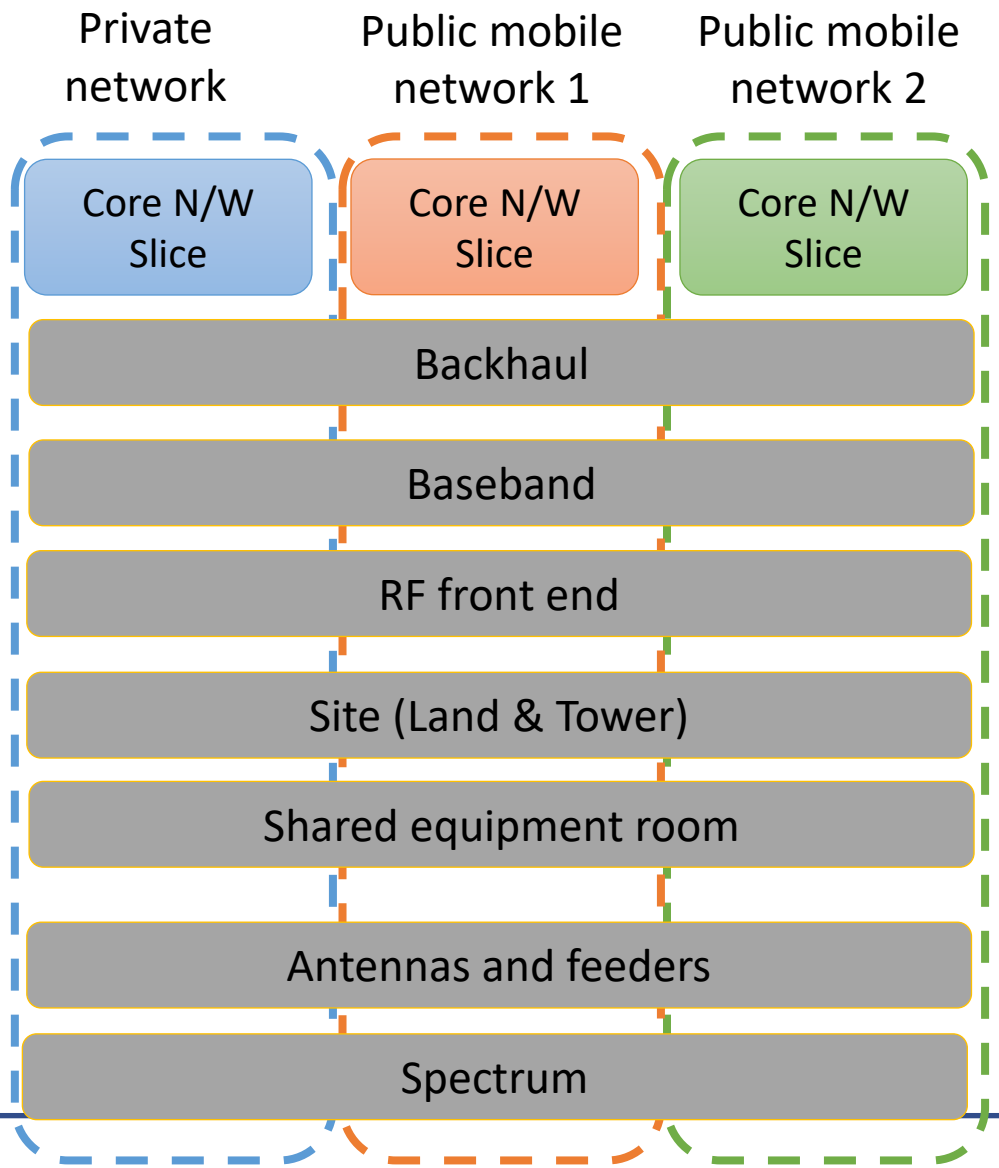


Key:

- Owned and managed by private network vendor
- Owned and managed by public mobile network operator 1
- Owned and managed by public mobile network operator 2
- Shared infrastructure, owned and managed by a neutral host with permission of the airport

Deployment approaches – infrastructure sharing and ownership

Fully shared infrastructure and spectrum delivered by neutral host



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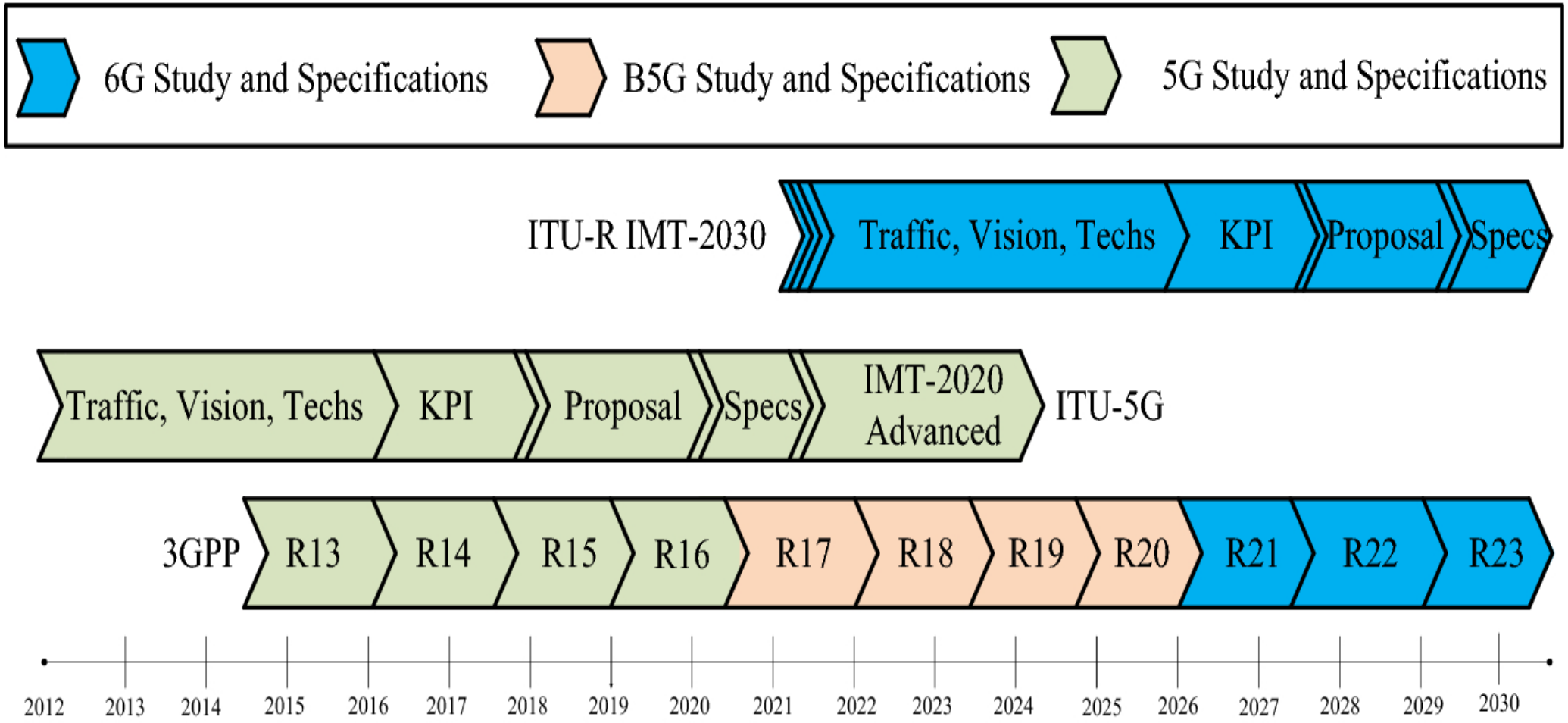
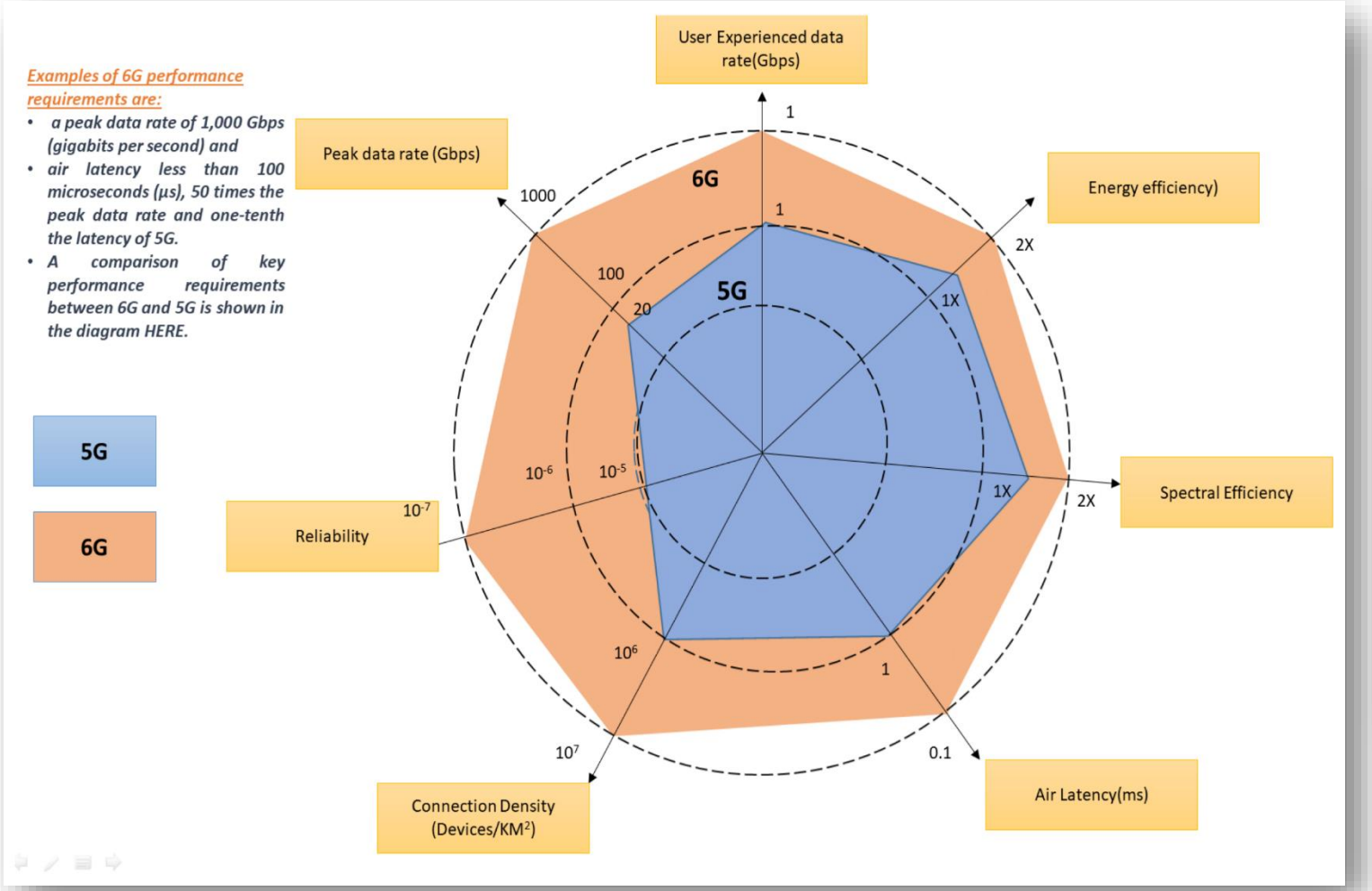
Roadmap for the transition from 5G to B5G to 6G

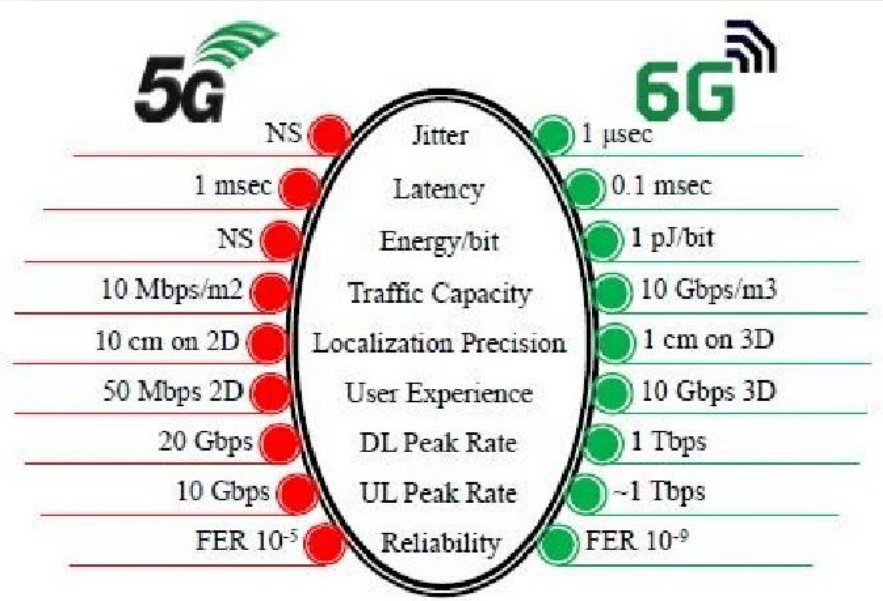


Performance characteristics comparison of 6G vs 5G

Examples of 6G performance requirements are:

- *a peak data rate of 1,000 Gbps (gigabits per second) and*
- *air latency less than 100 microseconds (µs), 50 times the peak data rate and one-tenth the latency of 5G.*
- *A comparison of key performance requirements between 6G and 5G is shown in the diagram HERE.*





https://www.mdpi.com/sustainability/sustainability-14-06356/article_deploy/html/images/sustainability-14-06356-g001.png

6G Use Cases for Athens International Airport

- Proactive Public Infrastructure Assets
- Autonomous APRON
- Service Robots for Enhanced Passenger's Experience

Proactive Public Infrastructure Assets Management – High level concept

On-site view of the building blueprints with AR

- Bidirectional communications with workers and remote video instructions
- Walkthroughs of designs prior to breaking ground
- Identify any issues before they even exist
- Improve Safety and Training

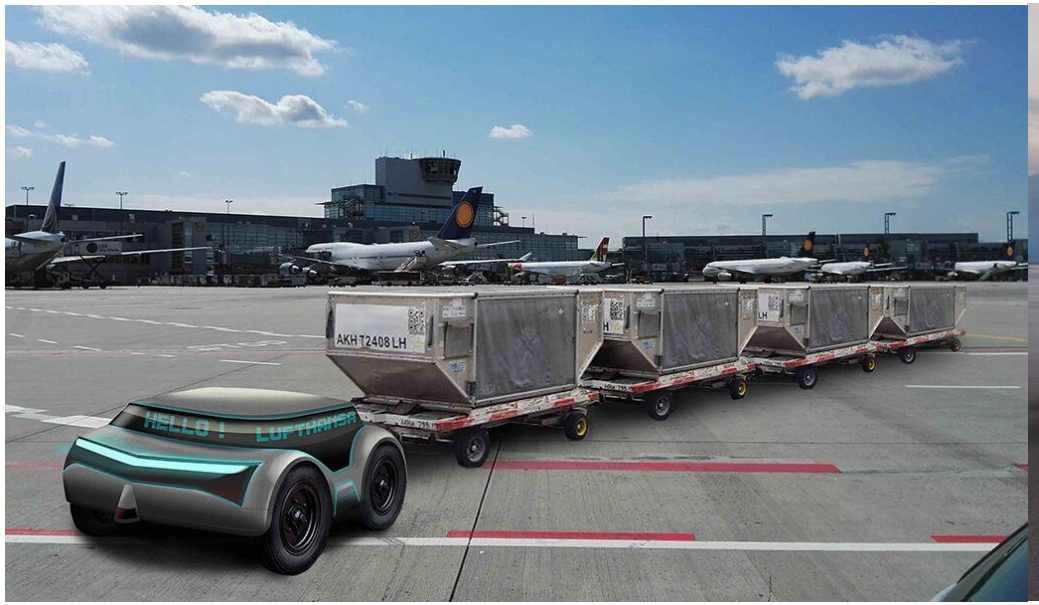
Security cameras & Drones (inside the terminal)

- Wireless monitoring of indoor construction sites
- Remote inspection to keep safety officials safely on the ground

Remotely-controlled or unmanned building machinery and vehicles

Autonomous construction &
3D printing of complex structures
Risk reduction in the construction environment

Autonomous APRON – High level concept



Remotely controlled or unmanned vehicles – Cobots

- Autonomous Apron Operations (catering, fuel aircrafts, baggage transport and cargo, clear debris etc.)
- Continuous monitoring of vehicles, cobots, and relevant resources

Data from the **vehicles** moving in the apron and the **robots** utilising capabilities from available sensors and B5G/6G (e.g., LIDAR sensors, GPS location data) and images and video coming from **security cameras**

Digital Twins of the apron which by **VR headsets** to ensure safer, incident-free operations. Whatever is happening in the physical world will be reflected inside the virtual one in real time.

AI techniques

- Predictions predictions and improved operations
- Alerts/suggestions for issues before they occur
- Insight about mitigation measures to support decision making and suggest action to return to normal operation
- Detect network anomalies and predict/prevent failures and security breaches

Service Robots for Enhanced Passenger's Experience – High level concept

Baggage flow

People flow

Transfer and stay time

Resource tracking

Service robots

Volumetric hologram

Personalized Services throughout the Journey

- Wayfinding
- Flight info
- Boarding alerts
- Dining
- Shopping
- Smart scheduling for service booking
- Passengers Q&A with AI

Use cases for airports supported by future mobile networks

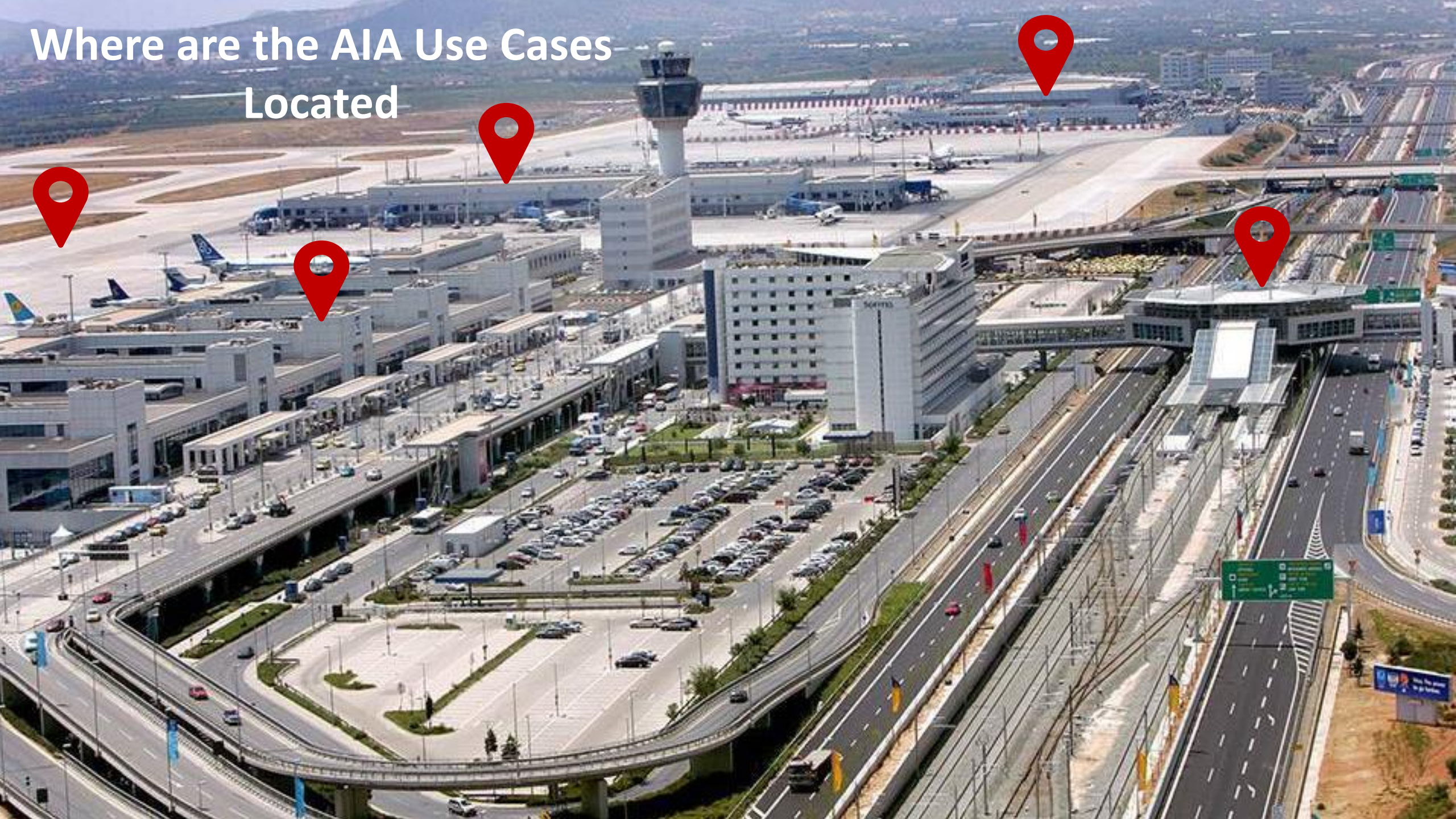
- High volumes and low latency Seamless/Contactless/ Frictionless services for passenger processing
- Passenger experience and entertainment such as location based and wayfinding services, content delivery services such as Netflix, Spotify, Apple music etc., online gaming etc.

Use cases for airports supported by future mobile networks

- Airport operational communication systems, such as PMRs, video & data capable transmitting handheld devices supported by AR/VR capabilities for line maintenance and operations staff etc.
- Safety and security utilizing large numbers of enhanced IoT sensors and high-definition CCTV cameras in close and remote areas of the airport e.g. perimeter fencing, vast and busy terminal areas, apron etc.
- Airport concessionaires' marketing and retail services
- Airport Asset Tracking
- Environmental and energy management controls
- Automated real-time Baggage Tracking

Image sources: dlr.de, visualize.com

Where are the AIA Use Cases Located



Conclusions

Reliable, real time connectivity is an essential component of the digitisation of airport operations.

Innovations in wireless technology mean that, with the right strategy and investment, wireless connectivity can meet the high reliability and real time requirements of airports.

With so many stakeholders involved at airports, there is risk of multiple disparate wireless systems covering public services to passengers and more private operational services being deployed.

5G and beyond architectures provide the opportunity to share infrastructure and build in flexibility.

Airport operators need to take an active role in developing a connectivity strategy and deciding how wireless will be deployed in their settings to ensure their best interests are met.

TrialsNet

realwireless.
independent wireless experts

Thank you

For more information please visit: www.trialsnet.eu

or contact directly :

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TrialsNet project has received funding from the European Union's Horizon-JU-SNS-2022 Research and Innovation Programme under Grant Agreement No. 101095871