

# A NETWORK OPERATORS VIEW ON CURRENT NTN POSSIBILITIES AND AREAS FOR FUTURE RESEARCH

Dr.-Ing. Markus Breitbach  
Senior Expert Group Technology  
Deutsche Telekom



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# A Network Operator's View on Current NTN Possibilities and Areas for Future Research

Dr. Markus Breitbach  
Group Technology, Deutsche Telekom AG



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# Towards a sustainable communication ecosystem for the digital society

## 01

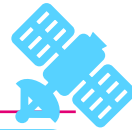
Providing human-centric experiences enriching everyone's lives.

## 03

Ensuring data sovereignty, privacy and trust for private and business digital lives of humans.

## 02

Offering communication & digital services globally for everybody and everything, anywhere and anytime.



## 04

Running carbon-neutral and maintaining high overall resource efficiency.



# Deutsche Telekom's services for the space industry



## Galileo

Galileo MPLS Data Distribution Network and IT services to manage Galileo core systems since 2010.

## Copernicus

Design and operation of the infrastructure systems for Copernicus since 2012.

New contract for Copernicus Data Space using Open Telekom Cloud signed in Dec. 2022.

## European Aviation Network

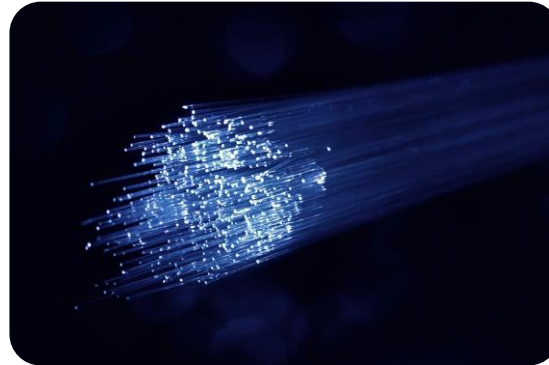
Construction of the LTE-based complementary ground network for EAN in 2018, which is fully integrated with Inmarsat's S-band satellite to deliver a truly seamless service.

## IRIS<sup>2</sup>

Core team member & essential subcontractor of SpaceRISE Consortium.



# Connectivity services for business and private customers



## Satellite IoT Connectivity

Low-rate messaging connectivity via satellite for infrastructure monitoring, agriculture, livestock tracking etc.

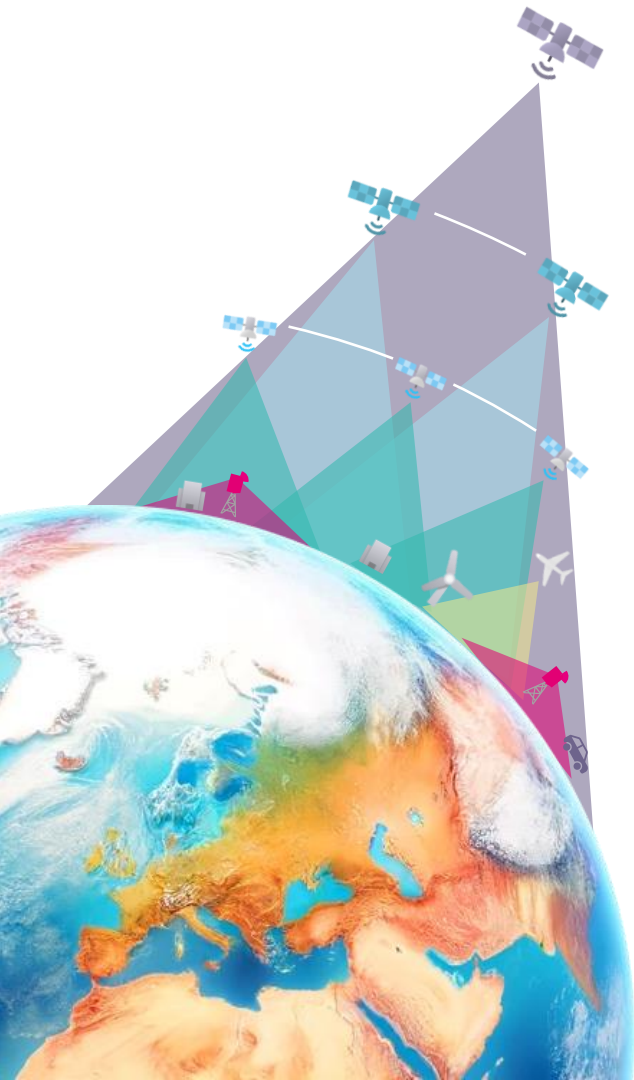
## Satellite Broadband

Fixed broadband access via satellite for fiber-substitution to remote premises and for resilience.

## Disaster Recovery

Successful test flights providing 5G connectivity from stratospheric plane with satellite backhaul

# 3D-Networks integrate base stations on different altitudes



	Altitude [km]	Latency [ms]	Max. DL datarate [Mbps]	Satellite lifetime [y]	Satellites to cover earth	Satellite terminal complexity
<b>Geo-Stationary Earth Orbit (GEO)</b>	35,786	> 500	Depends on antenna size	15	3-5	Low
<b>Medium Earth Orbit (MEO)</b>	5,000-12,000	100-200	Depends on antenna size	12	10-20	Medium
<b>Low Earth Orbit (LEO)</b>	300-1,500	≈ 30	~ 120 via broadband terminal	5-7	100-1,000	High
<b>High Altitude Platform (HAP)</b>	15-50	≈ 10	< 300 via 5G			
<b>Terrestrial</b>	<b>Mobile/ Cellular</b>	0	< 10	< 300 via 5G		
	<b>Fixed</b>	0	< 10	< 1.000 via fiber		

# European challenges on TN-NTN integration



- **Many neighboring countries with local market specifics and long borders**
- **Dense terrestrial cellular radio coverage with small, but many, uncovered areas**

# Managing European market differences

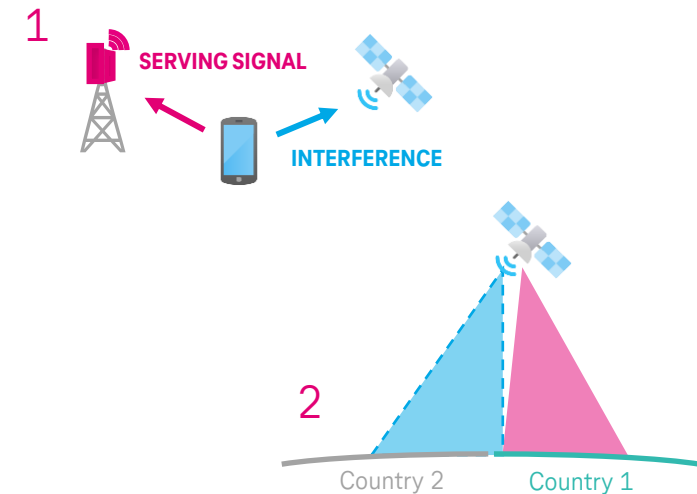
## Standardization and scale

- Flexibility to adapt solutions to different markets
- Enabling of cross-border communication
- Larger market enhances scalability for cost reduction of terminal devices
- Flexibility for customers to choose different service as needs change



## Europe-wide harmonization of satellite frequencies

- Cross-border coordination to avoid interference between TN and NTN





# Potential of aerial platforms might increase in future

## Technically feasible today:



- LTE eNB integrated to UAV platform
- continuous operation time of 6h+ per UAV
- Coverage area of over 5km diameter (20 km<sup>2</sup>) from 3 km altitude (B7 / 2600 MHz, B1 / 2100 MHz)
- Throughput performance in cell center achieving theoretical limits

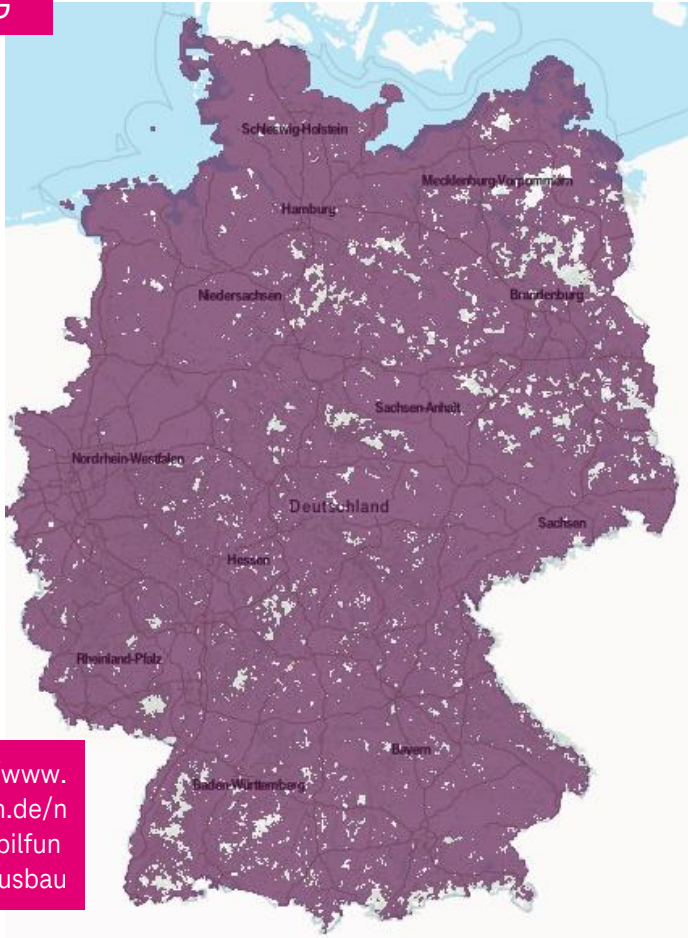
## Potential future evolution: “UAVs as flying antenna tower“

Longer flight duration without refuelling expected in future:

- Increasing efficiency of solar cells
  - Progress on stratospheric aircrafts technology
- HAPS could complement terrestrial cellular networks by providing similar service experience
- Better suited to nation-centric business and production environments of European MNOs:
- No need for global business model
  - Possibility for deeper network integration
  - Reduced interference problems at national borders

# Evolution of Direct-to-Handset technology

5G

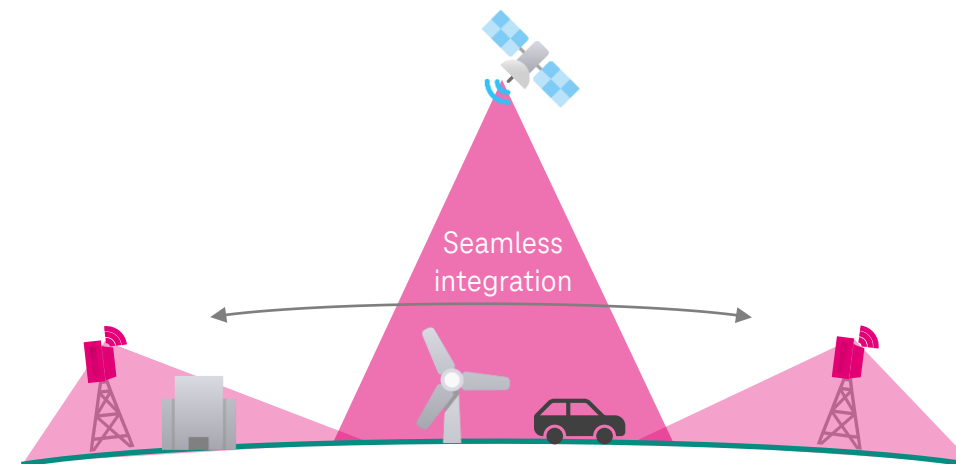


<https://www.telekom.de/netz/mobilfunk-netzausbau>

In Europe, terrestrially uncovered areas are small, but many  
→ Frequent TN – NTN resp. NTN – TN transitions

Seamless TN-NTN service continuity is essential for voice quality as expected by customers

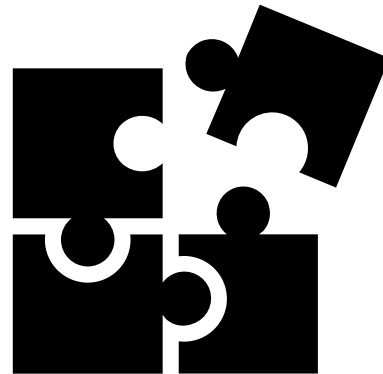
→ Need to evolve 3GPP standard



# Enablers for successful TN – NTN integration

**Seamless call continuity** allowing satellites to complement terrestrial networks effectively

**Future potential of HAPS** likely to increase with solar cell and airplane technologies



**Standardization** provides flexibility needed by differences in European societies

**Europe-wide regulation of satellite frequencies** to minimize interference along national borders



**LET'S MAKE NTN A REALITY TOGETHER**

**T...**

Test. Measure. Innovate

THANK YOU  
VERY MUCH

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