Frequency Sharing Topics of 5G Satellite Networks

ESA SPL 5G/6G

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ESA Strategic Programme Line for 5G/6G

Global Coverage & Connectivity

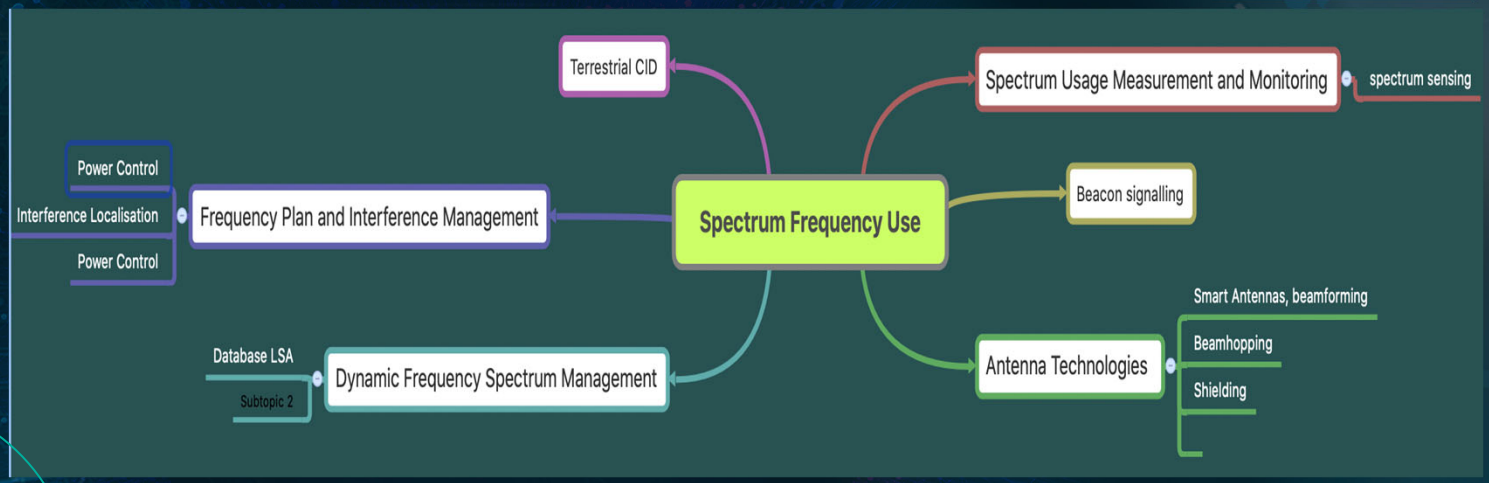
Resiliency

Broadcast Multicast

Global IoT/mMTC

- Inclusion of Non Terrestrial Networks (Satellites) in 3GPP ecosystem (5G Advanced) open up opportunities for development of globally competitive solutions for space-based infrastructure as complements to terrestrial systems
- 6G NTN become a unified part of ultra-flexible, highly dynamic 6G holistic system
- Satellite contributions to 6G ambitions:
  - Societal & environmental : development in un/under served areas, overall energy efficiency
  - Services: network resiliency, trustful and reliable transport of data, advanced features
  - Operational benefits: ease of use, plug and play (satellite in-6G Box solutions)
  - Cost benefits: overall cost efficiency and economical viability of solutions
- Frequency Spectrum Sharing

Importance of Frequency Spectrum Management



Short history: ESA and EU projects

2011-2012

ACROSS

Feasibility and possible scenarios/use cases. Identification of possible techniques

2013-2015

FREESTONE

Framework for application of databases and LA

2018-2020

SCENT

Build a LSA testbed for integrated satellite terrestrial 5G networks in 5G pioneer bands

VTT AIRBUS Fairspectrum KATOTEK

2020 - ...

- Spectrum Mission Feasibility Assessment
- Collaborative and Dynamic Approaches to Increasing Spectrum Utilization

2012-2015

CoRSat

2015 - 2018

SANSA

Shared Access Terrestrial-Satellite Backhaul Network enabled by Smart Antennas

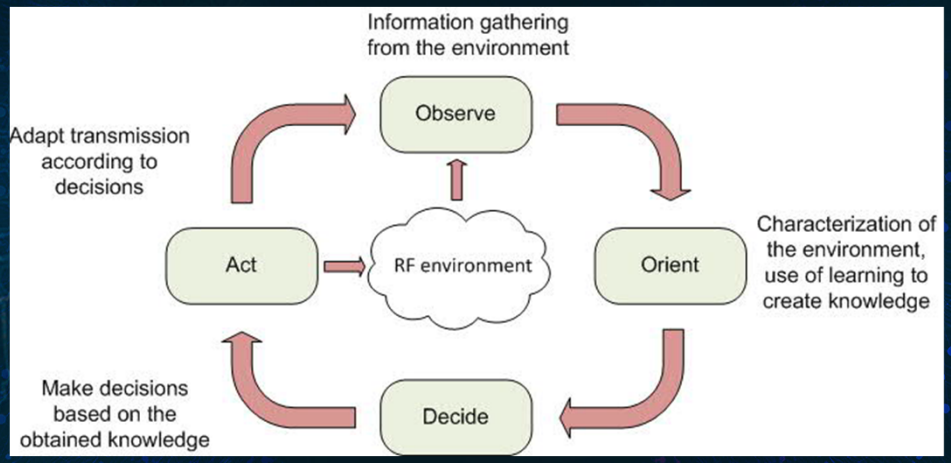
Focus on backhaul and smart antennas

2020 - 2023

DYNASAT

Spectrum Sharing

Simultaneous use of a specific radio frequency band in a specific geographical areas by a number of independent entities, leveraged through mechanisms other than traditional multiple- and random access techniques



Courtesy VTT

ASCENT Use Cases

Use case 1

C-band sharing between satellite and cellular

Space-to-Earth

Use case 2

Ka-band sharing between fixed satellite and cellular

Earth-to-space

ASCENT use cases

Use case 3

Ka-band sharing between satellite and cellular

Space-to-Earth

Use case 4 UHF-band

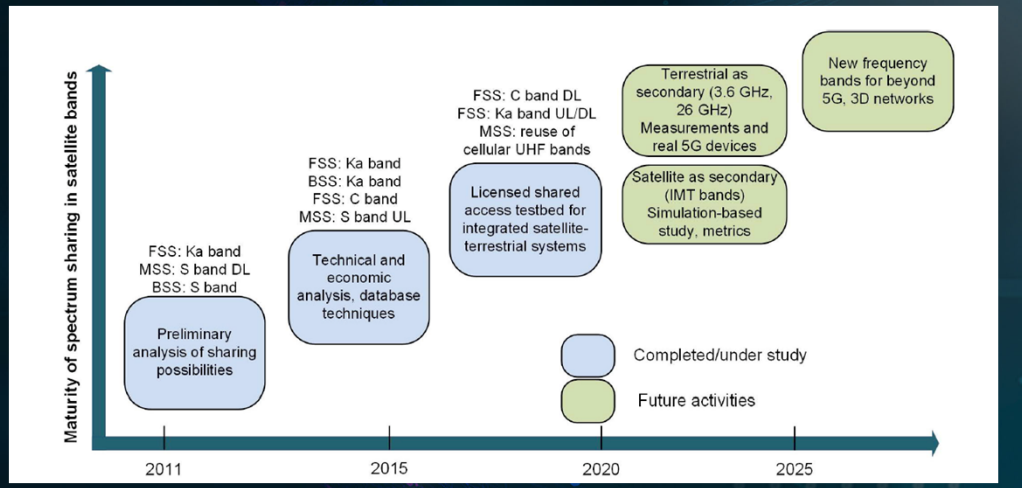
Secondary use of cellular band by satellites

Maritime and aviation

Courtesy ASCENT

ASCENT - LSA technology roadmap

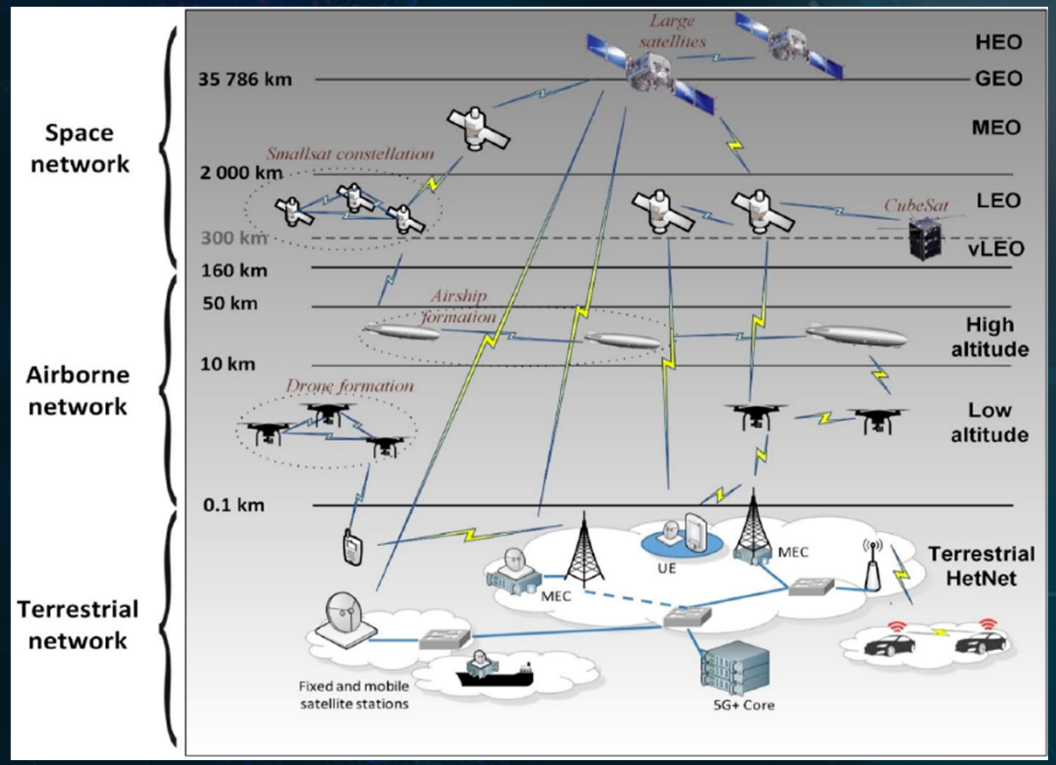
- Space segment: (UC 4) Satellites to support cellular frequency bands; beams/coverage optimized to provide service outside cellular coverage with harmful interference with cellular networks – Analysis both for GSO and NGSO
- Ground segment: LSA system itself and development of messaging protocols towards satellite systems – use of other techniques in conjunction with LSA i.e., power control, multi-beam antennas, … use of GNSS in VSATs
- Regulatory Analysis: new metrics
- Use of spectrum for 5G Private Networks



Courtesy ASCENT

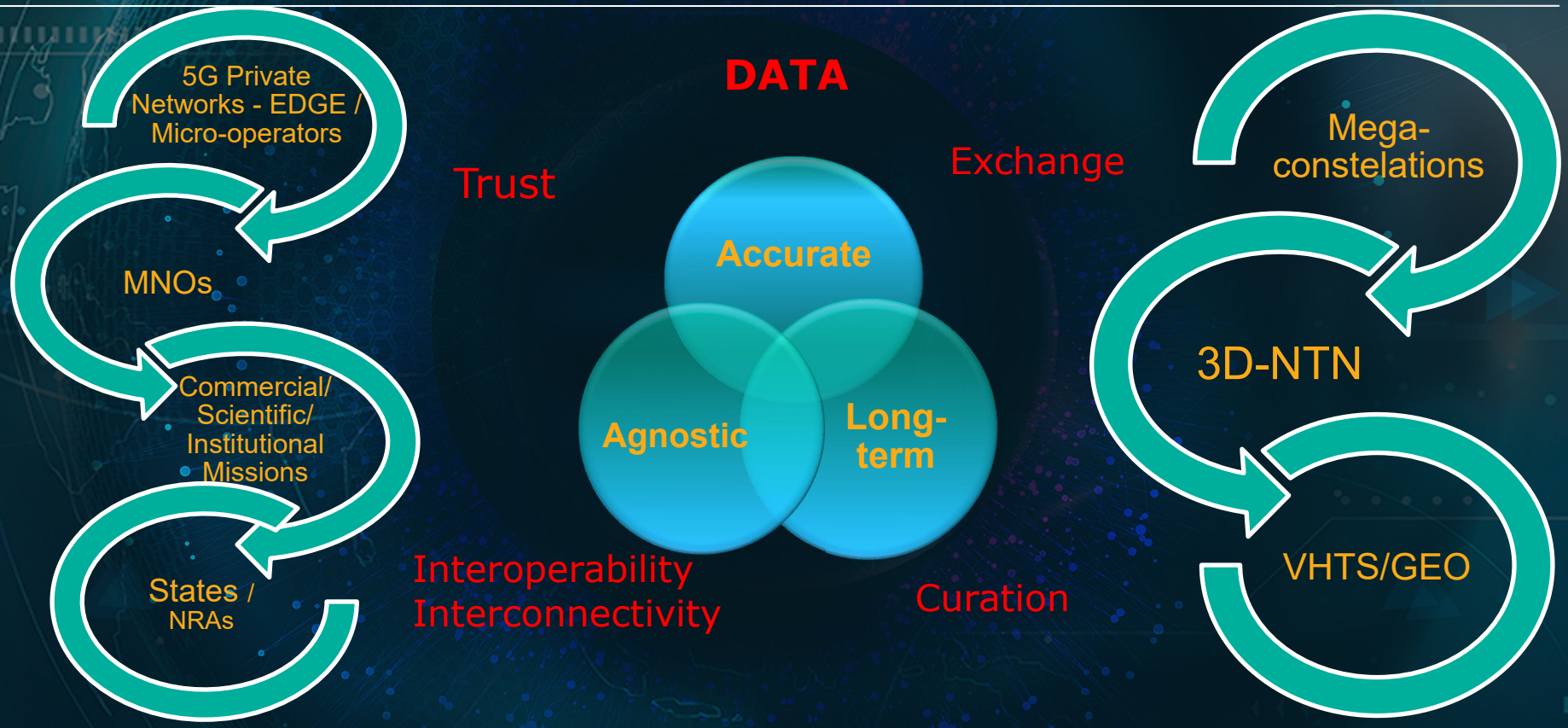
3D NTN – Layered architecture of 5G and beyond / 6G

- 3D-NTN: Clear need to continue spectrum studies:
  - What frequencies used in different links
  - Where spectrum sharing is possible and where dedicated frequencies are needed
- Ground segment – Space Segment
- Regulatory Analysis: new metrics



Courtesy VTT

Life and systems design after Covid-19



EXPAND 5G/6G SPACE

Our world in 5G and beyond / 6G: Intelligently and seamlessly connecting

A unified connectivity fabric this decade

Next technology leap for new capabilities and efficiencies

5G → Rel-15 -16 eMBB focus → Rel-17 -18 (5G Advanced) Expanding to new industries, 5G private networks, IoT, (3D) NTN, → Rel 20 +++ 6G 3D NTN space networks **6G**

WRC 23

WRC 27

Strong 5G momentum sets the stage for the global expansion, 3D networks and global seamless connectivity