ETSI Conference on
Non-Terrestrial Networks,
A Native Component of 6G

Free Space Optical and Radio Communications as 6G Building Blocks

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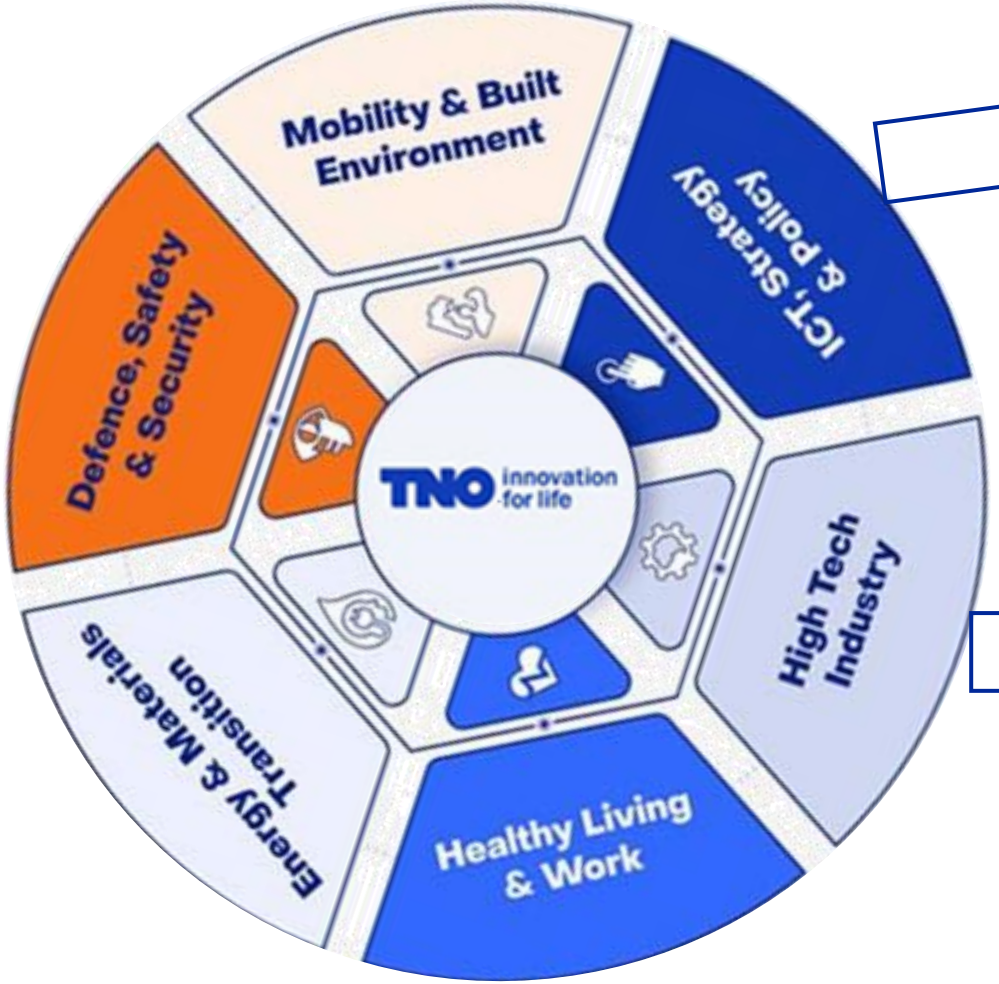
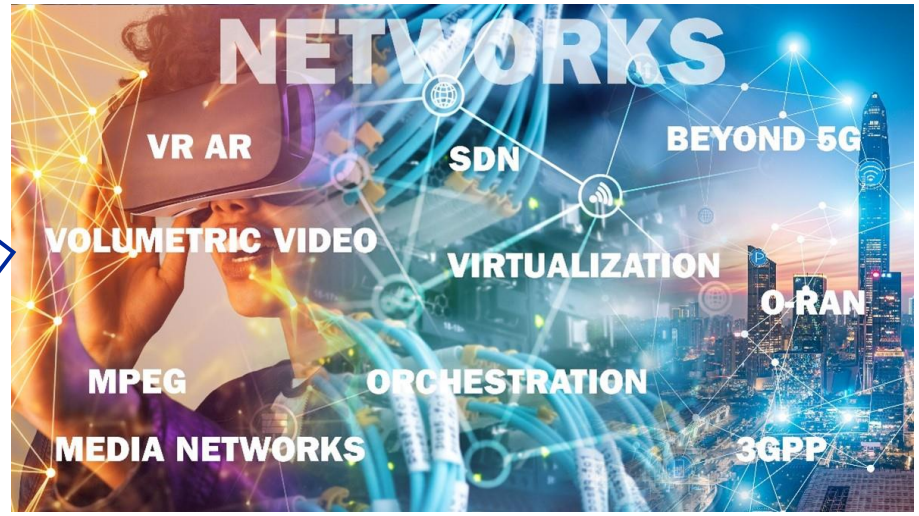
TNO - Netherlands Organization for Applied Scientific Research

- **Independent research organisation** established 1932
- 4000+ employees, 63 nationalities,
- 600M€ revenue, 1000 public-private partnerships, …





3GPP A GLOBAL INITIATIVE

ETSI

ngmn the engine of broadband wireless innovation

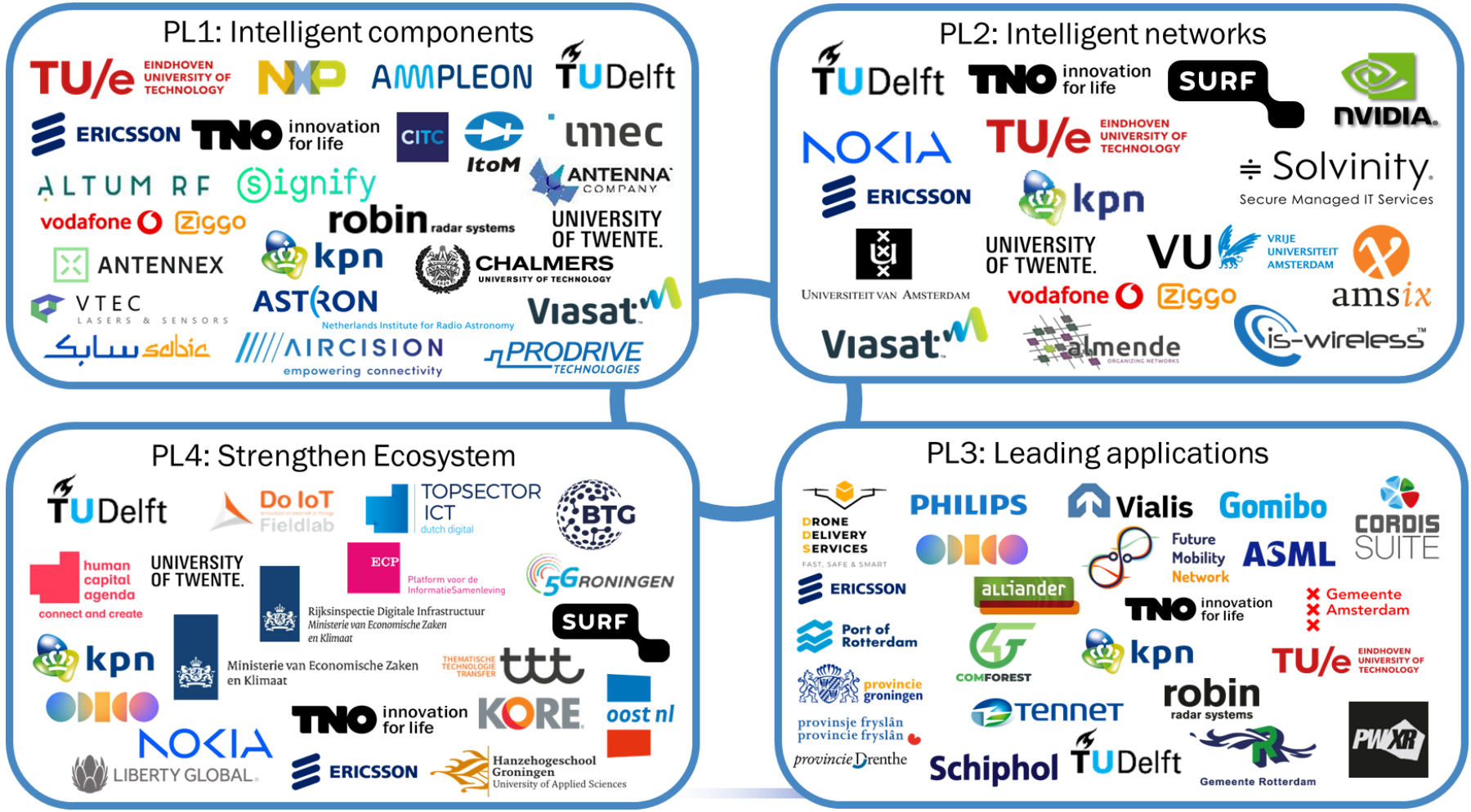
5GAA Automotive Association

O-RAN ALLIANCE

NATIONAL 6G PROGRAM – FUTURE NETWORK SERVICES (FNS)

FNS - building a strategic knowledge position for the Netherlands (and Europe) in the development and application of next-generation communication networks (6G)

- National Growth Fund (NGF) program
- Duration 2024-2030
- 60 partners
- TNO as program coordinator



6G FUTURE NETWORK SERVICES

www.futurenetworkservices.nl

NXTGEN HIGHTECH – FSO (LASER) COMMUNICATION

NXTGEN Hightech program develops a new generation of high-tech equipment focused on sustainability, digitalisation, health and technology sovereignty.

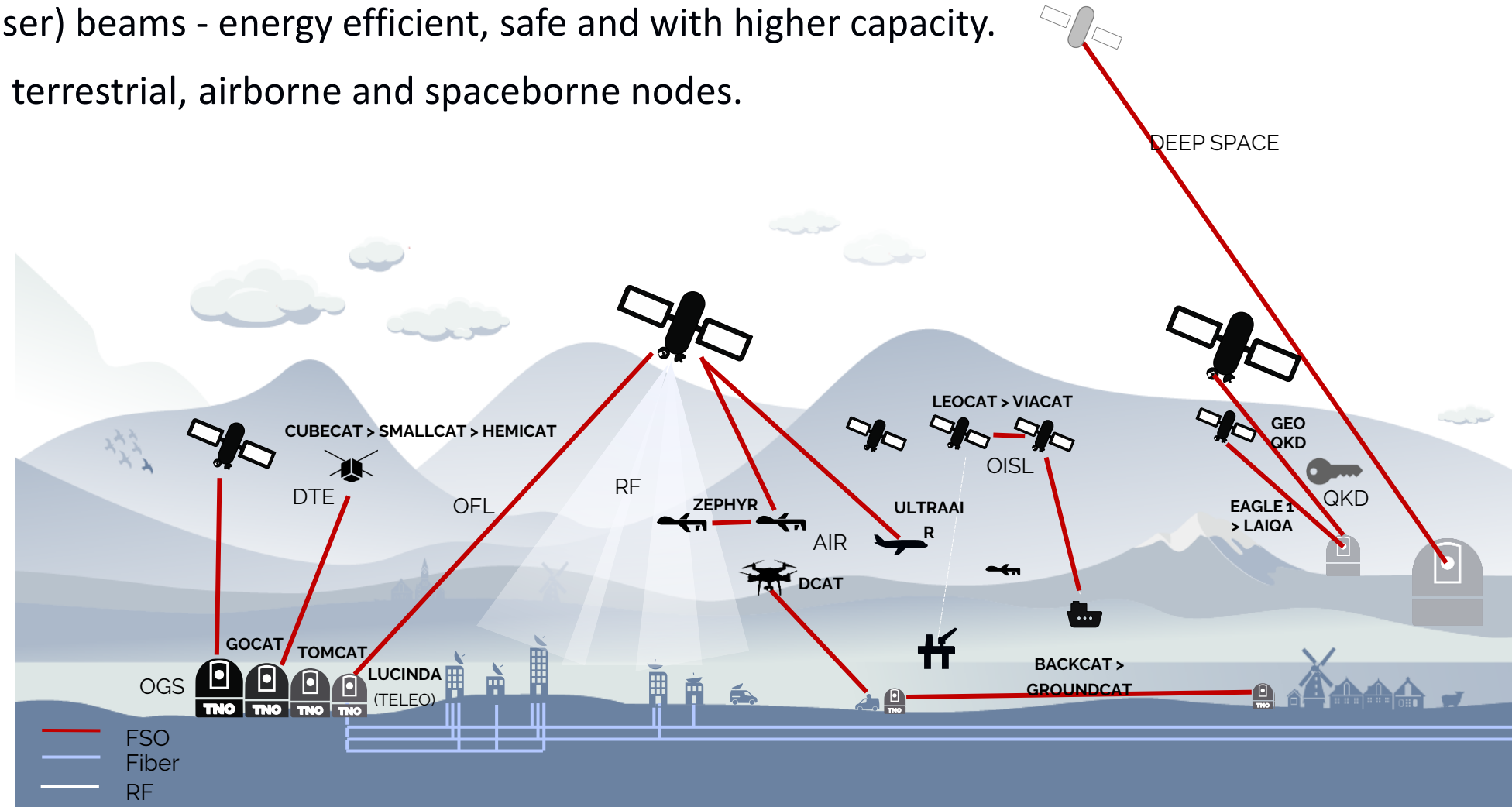
FSO (Laser) communication program line – development of equipment for data communication through Free Space Optical FSO (laser) beams - energy efficient, safe and with higher capacity.

FSO connectivity between terrestrial, airborne and spaceborne nodes.

- NGF program
- Duration 2023-2029
- TNO - program coordinator

NXT GEN hightech

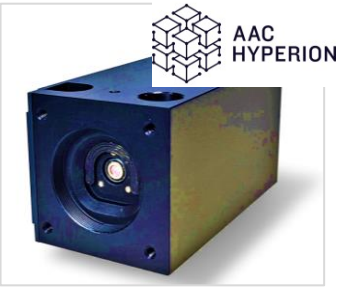
www.nxtgenhightech.nl

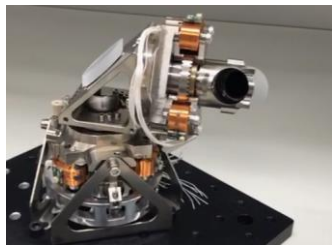


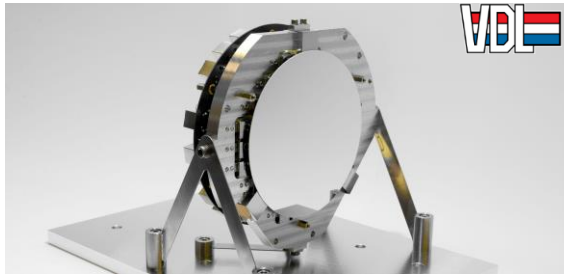
LASER COMMUNICATION PROGRAM: PARTNERS

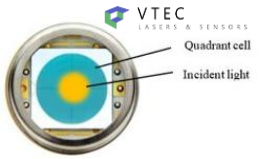
Development/production of:

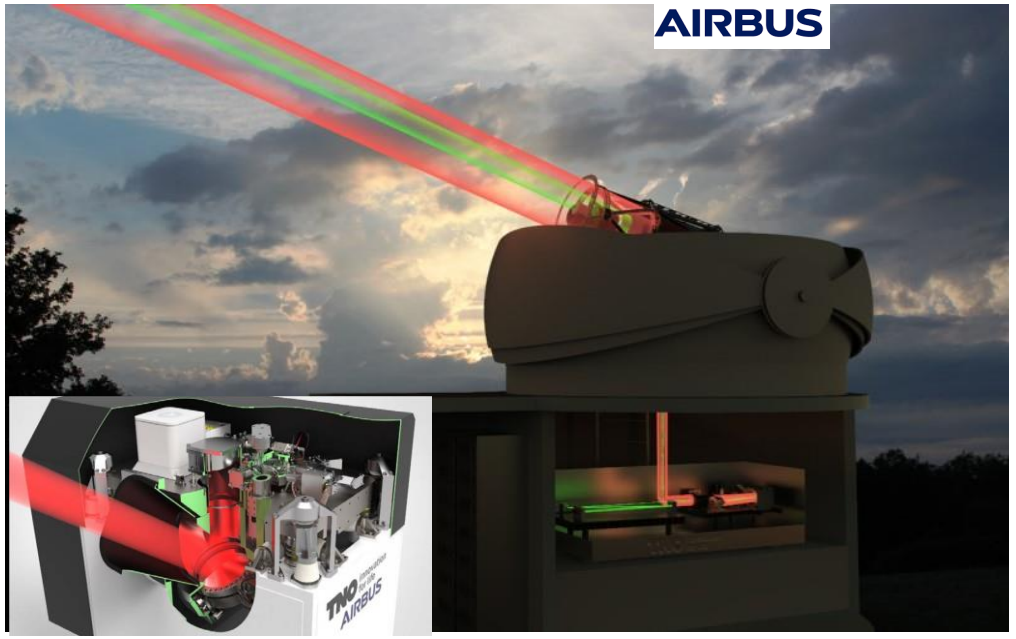
- Optical terminals
- High precision pointing mechanism
- Mirrors
- Photonics components

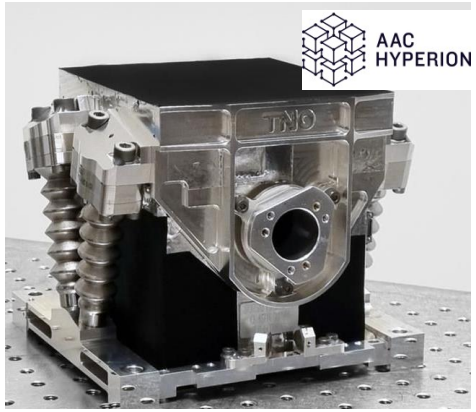






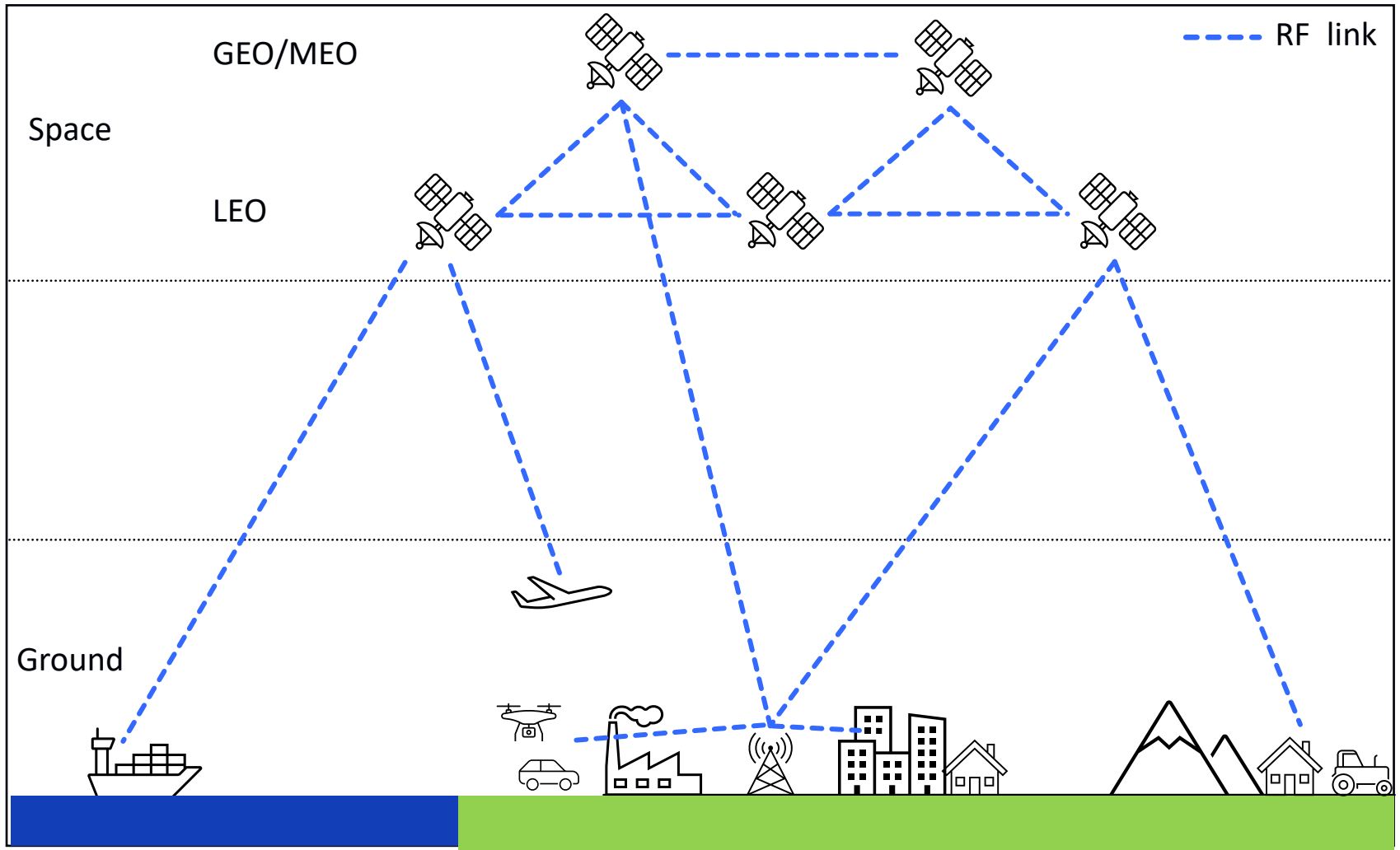






5G TN-NTN INTEGRATION

- 5G NTN (Rel-17, Rel-18) transparent satellites
- B5G NTN (Rel-19, Rel-20) – introduction of satellites with regenerative payload
- Dominance of RF communications



TOWARDS 6G TN-NTN UNIFICATION

6G towards:

- 100x improvement of target KPIs compared to 5G
- Multilayer (terrestrial, airborne, spaceborne) networking
- Global coverage

KPI	Foreseen 6G target
Experienced DR	~ x10Gpbs
Peak DR	~ x100Gbps
Connection density	~10^8/km

Eternal challenge - spectral scarcity!

Way forward

Radio access network

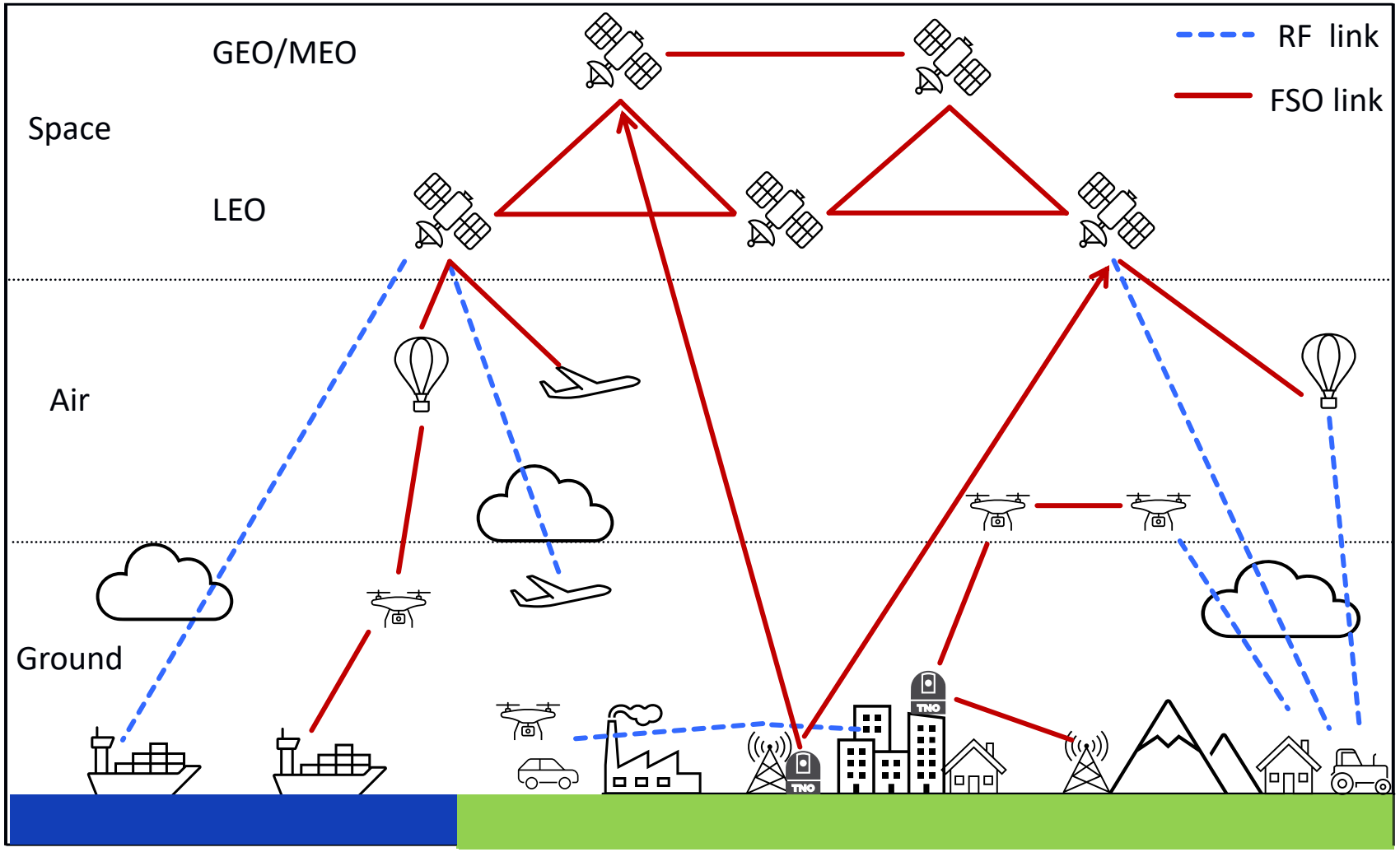
+

FSO back-, mid-, front-haul

Action Required

- Standardization of FSO communication

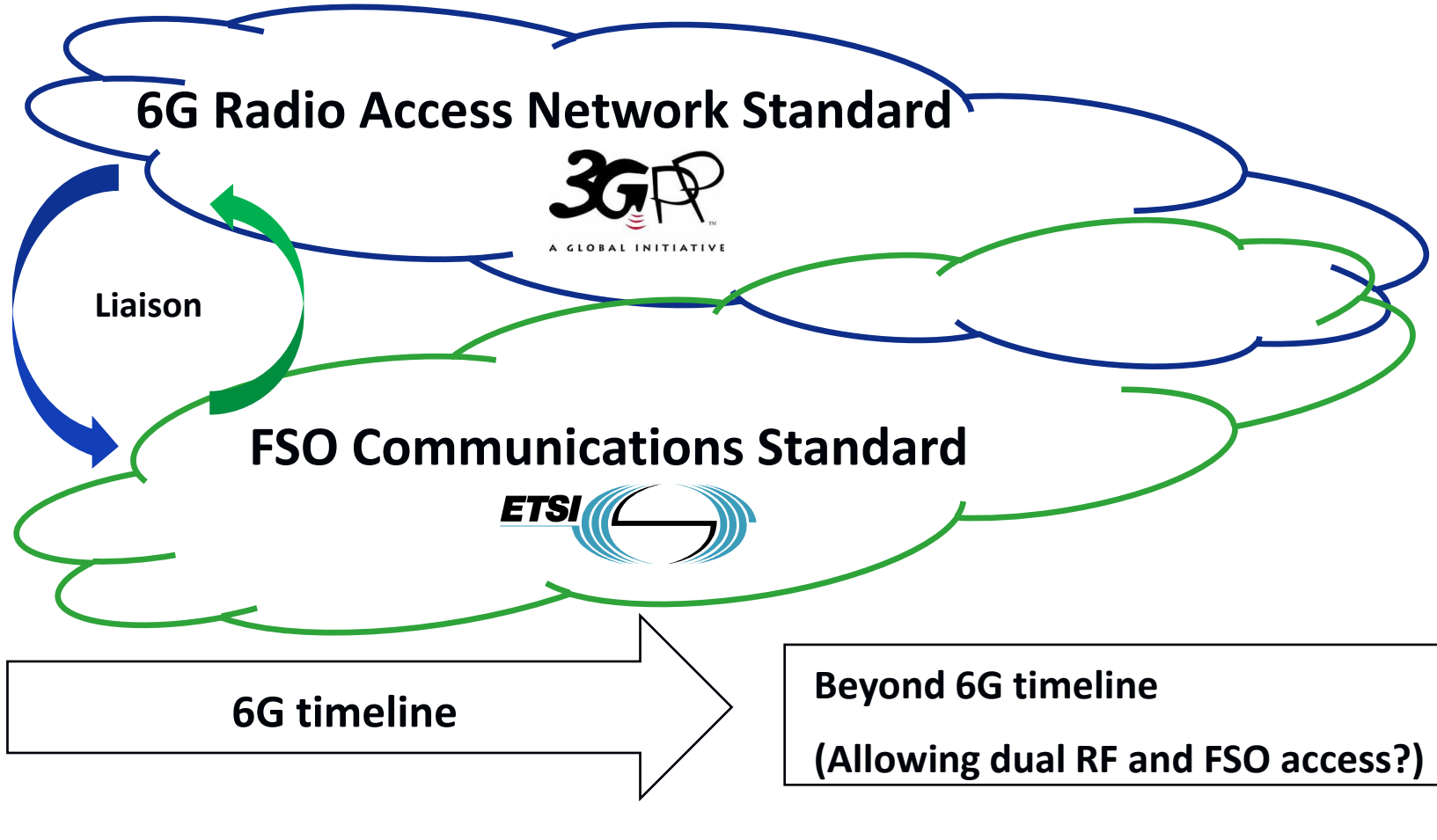
- FSO – 3GPP standard interoperability



FSO AND RADIO COMMUNICATIONS AS 6G BUILDING BLOCKS

Proposed way forward

- 6G radio access → standardization within 3GPP
- FSO communications → standardization within ETSI
- FSO standard must meet: 6G requirements (e.g. data rates, jitter, reliability, mobility) and be compatible with 3GPP



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Dutch National Growth Fund programs:
FUTURE NETWORK SERVICES
NXTGEN HIGHTEC – Lasercom

TNO innovation for life