The need for reliable, ubiquitous connectivity:

- Insufficient coverage for mobile connectivity:
  - Coverage of (terrestrial) white spots
  - Automotive: Autonomous driving
  - Maritime: Cruise ships, offshore platforms
  - Aerospace: Passenger aircraft
- Temporarily / locally insufficient capacity:
  - Agriculture
  - Construction areas
  - Cultural and sports events
  - Disaster recovery
**Unified 3D Networks**

**Unified processing platforms for network functions on different heights**

**SPACE SEGMENT**
- Multi-orbit satellites

**AIR SEGMENT**
- HAPS: Stratospheric airplanes, balloons
- LAPS: Drones

**GROUND SEGMENT**
- Terrestrial sites
- User equipment
- Customer premises equipment

**3D Networks**

Different properties with respect to:
- Performance: Coverage, capacity, data rate / link budget, latency, processing capabilities
- Geography / economics: Global business model needed for LEOs, local business model sufficient for HAPS
- Flexibility, mobility: Dynamically deploy or recall nodes, dynamically adjust coverage areas

**4G & Before**
Design optimized independently and exclusively for terrestrial networks

**5G & B5G**
Design optimized for terrestrial network component. Minimum impact to support integration of satellite for coverage and availability extension

**6G & Beyond**
Design optimized for both terrestrial and space components against a set of common goals

**Key challenges:**
- Nodes can join/leave network dynamically
- Security requirement: authentication of joining nodes
- Connectivity management for air interface and backhaul
- Dynamic reallocation of network functions
- Steerable high-gain antenna systems
- Reconfigurable hardware/microelectronics

**Novel Network Architecture:**
- 3D: Ground, LAPS, HAPS, LEO, GEO
- Organic behaviour

**Key Technologies:**
- Dynamic connectivity management and allocation of network functions
- AI-driven automatic operation

**Key Components:**
- Innovative antennas and processing platforms

**The infrastructures of 3D Networks will be moving**

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**Unified design 2030**

**Terrestrial networks**

**Satellite networks**

**Airborne networks**

**Integrated design**

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