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ITU-R: Direct to Device at the ITU-R Study Groups and WRC-27

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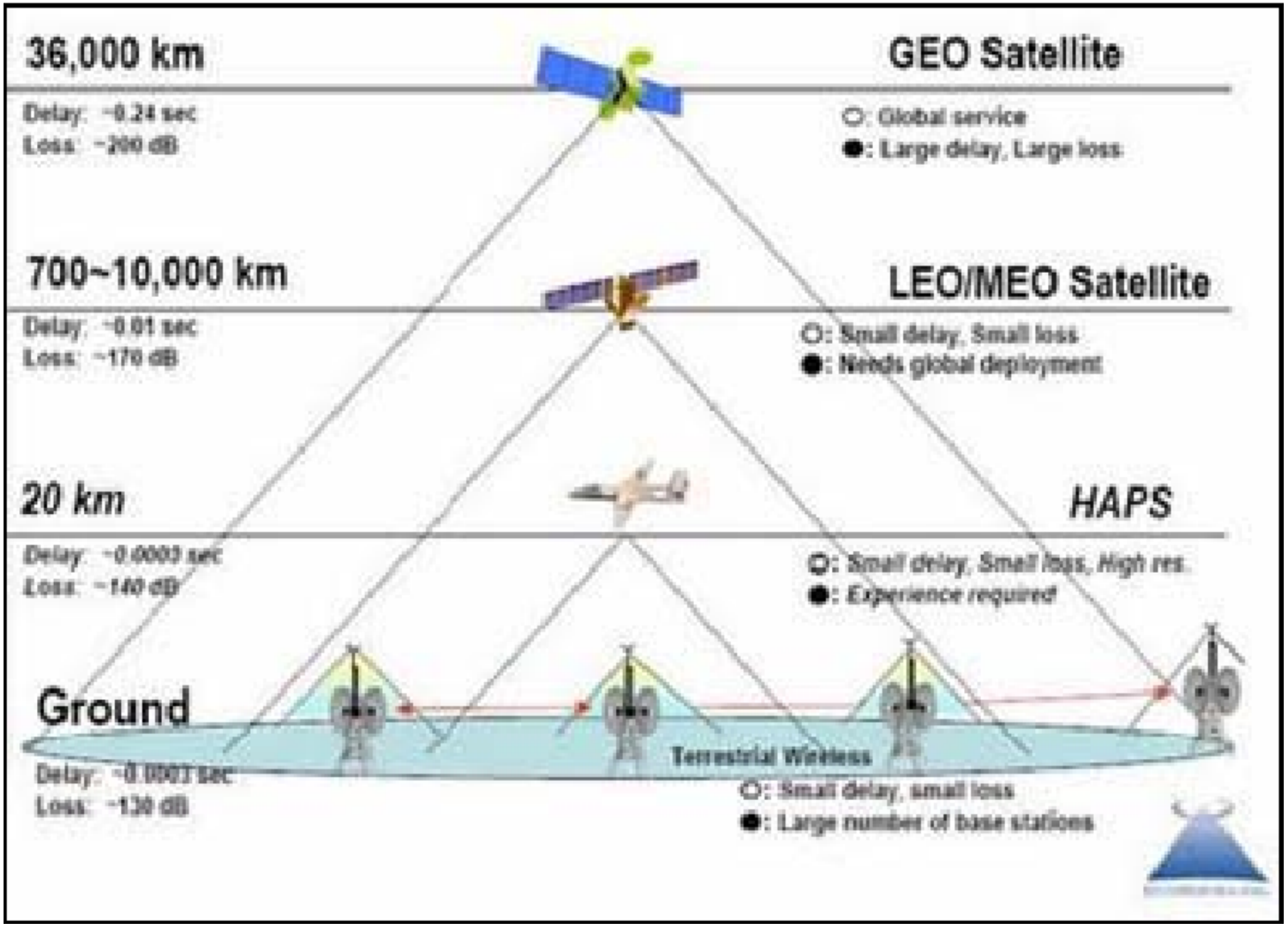
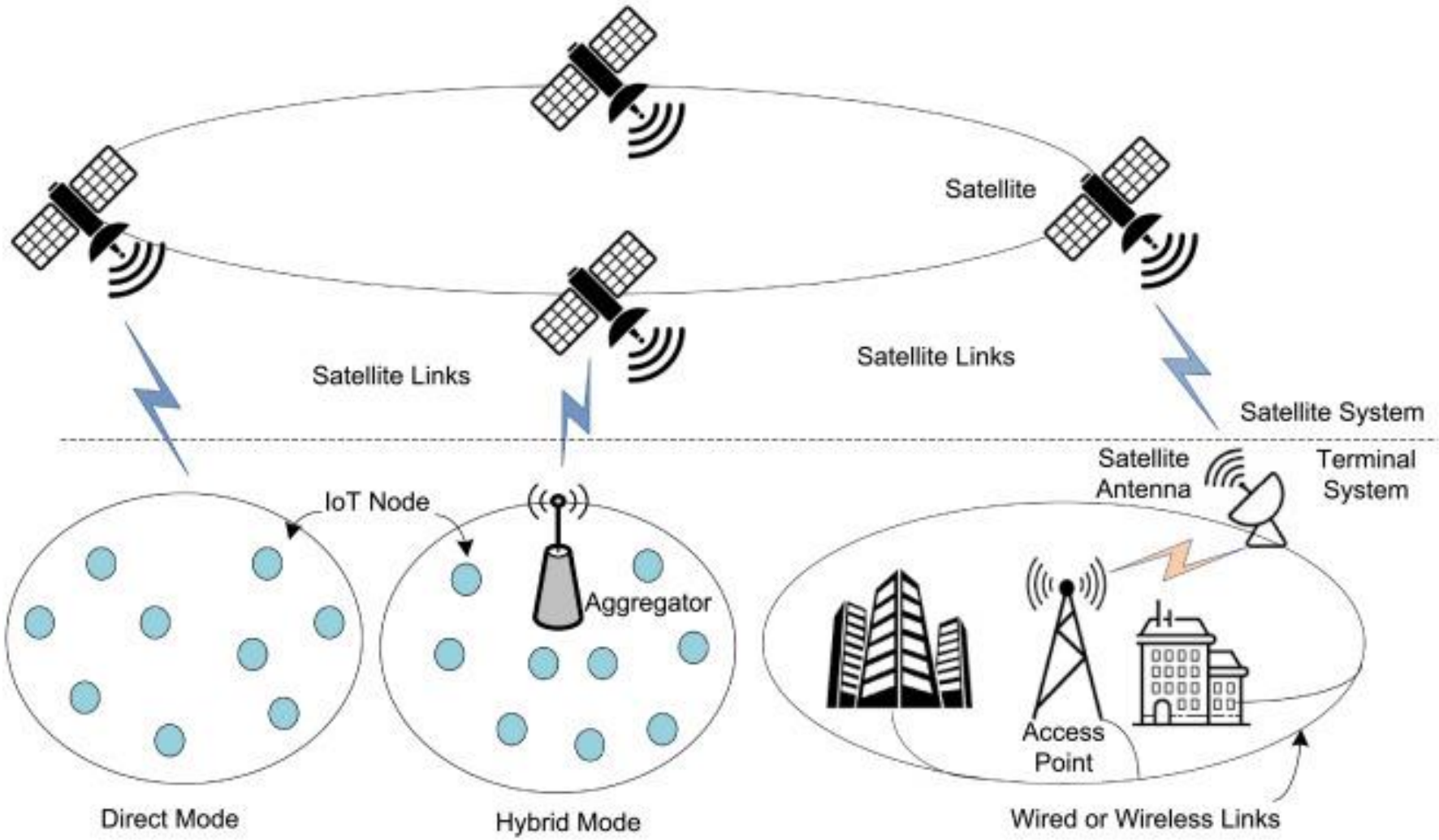
Broadband Access



Satellite and Terrestrial Integration



Direct Mode: already exists

- **Broadcasting** (DTH)
- **Fixed**:
  - ***GSO***: VSAT, USAT
  - ***NGSO:*** Smart antennas (plug and play)
- **Mobile**:
  - Narrowband
  - Broadband

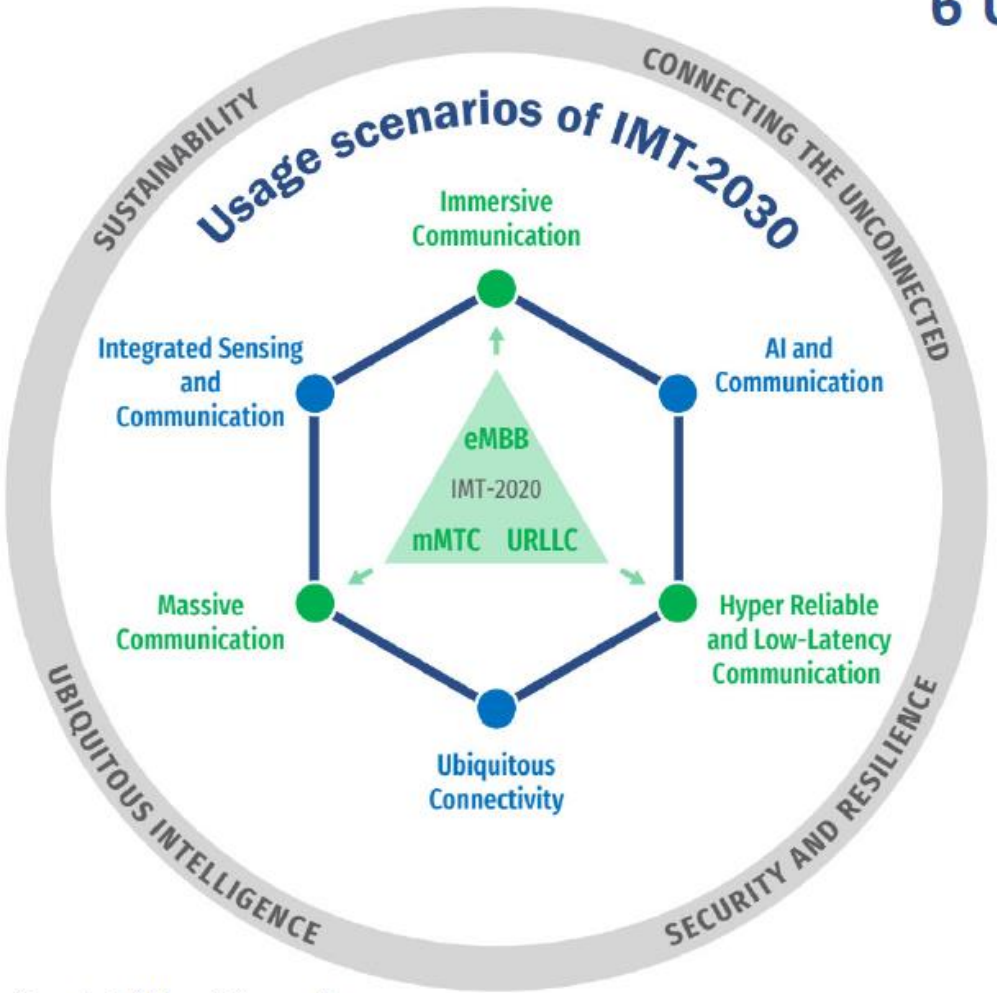
All above user terminals only operating for satellite links (**non compatible with terrestrial networks**)

Direct to Device:

- seamless connection : from Terrestrial to Space Networks (in direct mode)
- **with a unique terminal**

IMT-2030 (aka 6G)

Usage scenarios



So called "Wheel diagram"

6 Usage scenarios

Extension from IMT-2020 (5G)

- eMBB ➡ Immersive Communication
- mMTC ➡ Massive Communication
- URLLC ➡ HRLLC (Hyper Reliable & Low-Latency Communication)

New

- Ubiquitous Connectivity
- AI and Communication
- Integrated Sensing and Communication

4 Overarching aspects:

act as design principles commonly applicable to all usage scenarios

Sustainability, Connecting the unconnected,
Ubiquitous intelligence, Security/resilience

Core components of ubiquitous connectivity

1. **Terrestrial-Non-Terrestrial Network (TN-NTN) integration**: IMT-2030 will combine land-based networks with non-terrestrial networks from the sky and space, including **satellites**, High Altitude Platform Stations (**HAPS**), and Unmanned Aerial Vehicles (**UAVs**). This will deliver consistent service across land, sea, air, and remote areas that are difficult or uneconomical to serve with traditional mobile networks.

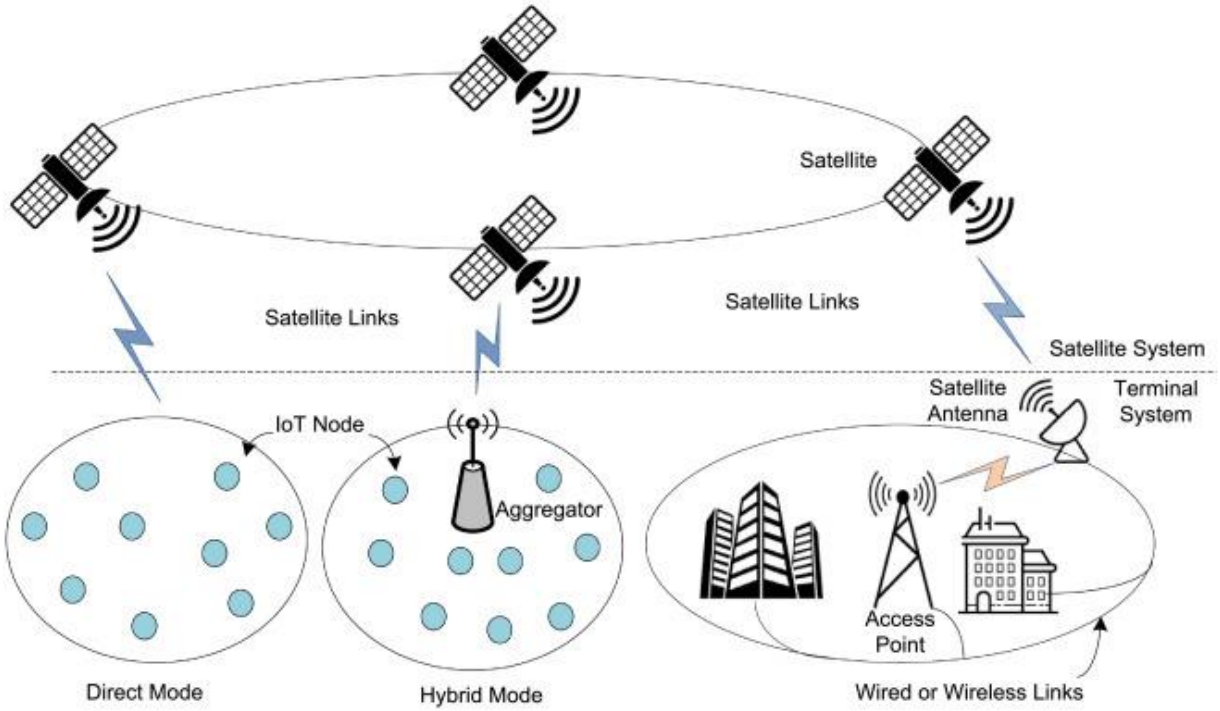
2. **Access to underserved areas:** The **primary goal** of this integrated network is to **connect currently unserved and underserved communities**, improving connectivity in rural and sparsely populated regions. This promotes digital inclusion and provides affordable access to essential services like education, healthcare, and business opportunities.

3. **Seamless handovers**: The network will be designed to allow for smooth transitions between different access points, such as **moving from a terrestrial cell tower to a satellite connection**. This ensures uninterrupted mobility and a high quality of service for users.

4. **New frequency bands**: To support the vision of global coverage and ultra-fast data rates, IMT-2030 will use a wide range of frequency bands, from **sub-1 GHz** up to **sub-THz** frequencies (100 GHz to 10 THz). These higher frequencies offer greater speeds, though they present new propagation challenges that the network must overcome.

5. **Integration with other access systems**: IMT-2030 is designed to interwork with other technologies like **satellite communication systems**, wireless local area networks (RLAN), and broadcast systems to offer users a comprehensive connectivity experience.

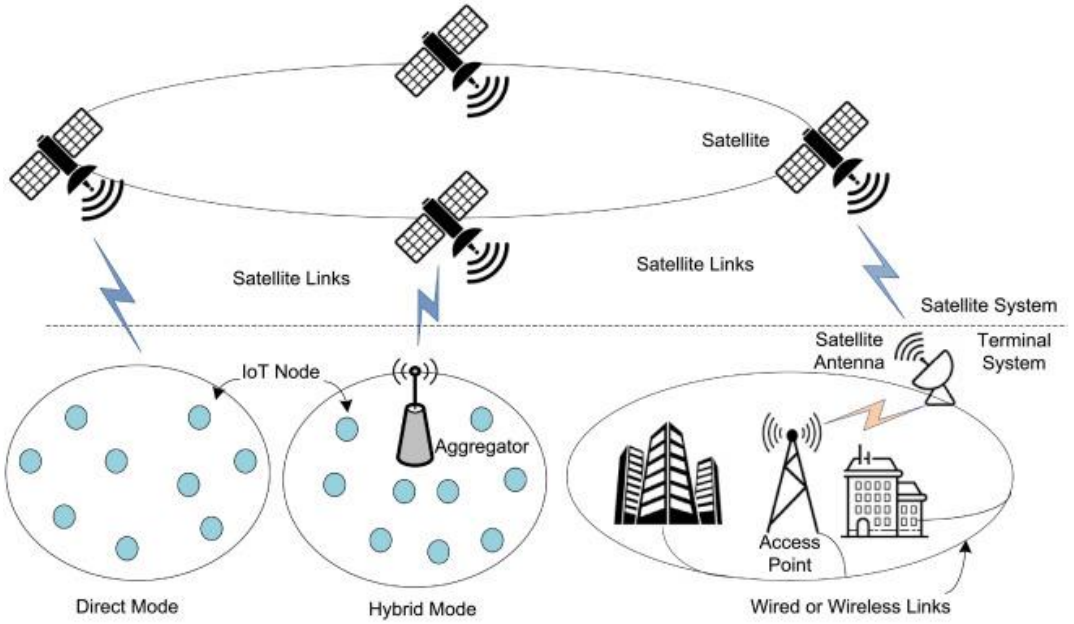
D2D: What is the Users Profile?



Mobile Network (Terrestrial) Users:

- They **already have the service** (within the Mobile Network coverage Area)
- They have high itinerancy: frequently traveling: Terretrial → Hybrid → Direct Mode
- Key Questions:
  - **What % of Mobile Users?**
  - **What % of time?**
  - **Business case: B2B?** High cost? (terminal, service)
  - **Excellent for Emergency Communications**

D2D: What is the Users Profile?



Non-served (Terrestrial) Users:

- They **don't have yet the service** (out of Mobile Network coverage Area)
- They live on those remote/rural and large scattered areas : ~~**Terrestrial ; Hybrid**~~; **Direct Mode**
  - **A. Satellite service: Fixed + Mobile**
    - Their connectivity needs are firstly fulfilled with a Fixed Terminal (**Domestic Hybrid Mode**)
    - % time they **also need** a mobile access? (**out of coverage of their Domestic Hybrid cell)**
  - **B. Satellite service: Only Mobile**
    - A Domestic Hybrid cell can be implemented trough a D2D? **Propagation challenges** (line of sight link)

Main challenge: : Why don't they have yet a Satellite service? **-→ Low income**

ITU-R SG 4: Space Services
D2D publications (before WRC-23)

- **Report ITU-R M.2077-0**: shortfall of spectrum available for the satellite component of IMT and systems beyond IMT-2000 :
  - >144 MHz (space-to-Earth)
  - >19 MHz (Earth-to-space)
- **Report ITU-R M.2218-0:** spectrum requirement in 4-16 GHz for MSS broadband applications: 240 MHz to 355 MHz
- **Report ITU-R M.2514-0:** vision, requirements and evaluation guidelines for satellite radio interfaces of IMT-2020. Minimum technical requirements for satellite systems which can be part of the IMT-2020 ecosystem, including bandwidth requirements
- **Report ITU-R M.2041-0:** sharing and adjacent band compatibility in the 2.5 GHz band between the terrestrial and satellite components of IMT-2000

ITU-R SG 4: Space Services
D2D publications (before WRC-23)

- **Recommendation ITU-R M.1182-1** integration of terrestrial and satellite mobile communication systems

- **Recommendation ITU-R M.1036-6:** frequency arrangements for the implementation of the terrestrial component of IMT in the bands identified for IMT in the Radio Regulations

- **Recommendation ITU-R M.1808-1:** also applies for the studies of frequency bands alocated for the mobile service below 960 MHz;

WRC-27

a.i. 1.13 to consider studies on possible new allocations to the mobile-satellite service for direct connectivity between space stations and International Mobile Telecommunications (IMT) user equipment to complement terrestrial IMT network coverage, in accordance with Resolution 253 (WRC-23);

WRC-23 Res 253: Studies on possible new allocations to the mobile-satellite service for direct connectivity between space stations and International Mobile Telecommunications (IMT) user equipment to complement terrestrial IMT network coverage

THANKS ☺
GRACIAS ☺

Further info:

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