

Thoughts on LEO scenarios and requirements

IETF 123

Geely

Overview of GEESATCOM Networks

72

Phase I includes 72 satellites to provide **global real-time data communication services**

72

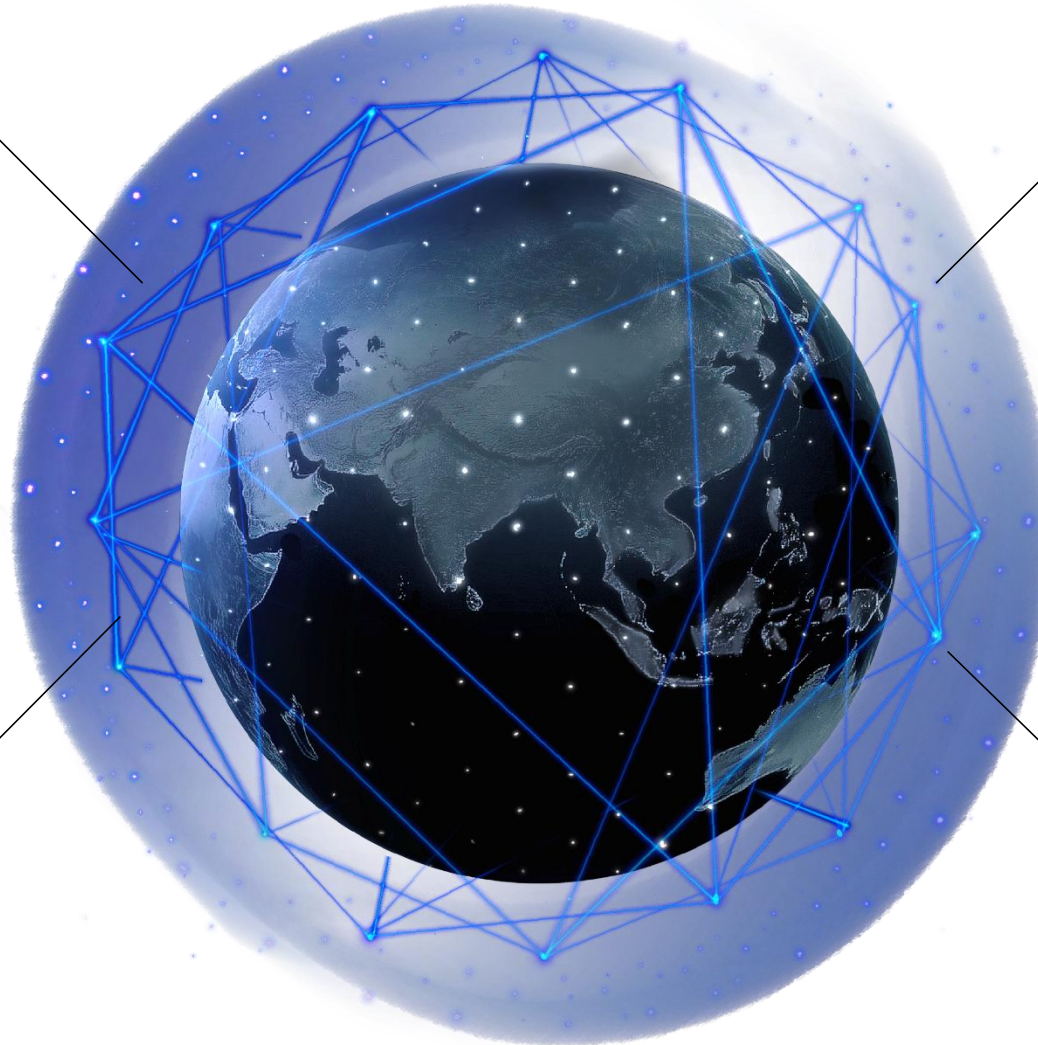
Phase II includes 72 satellites to provide global IoT NTN communication and voice call services

30

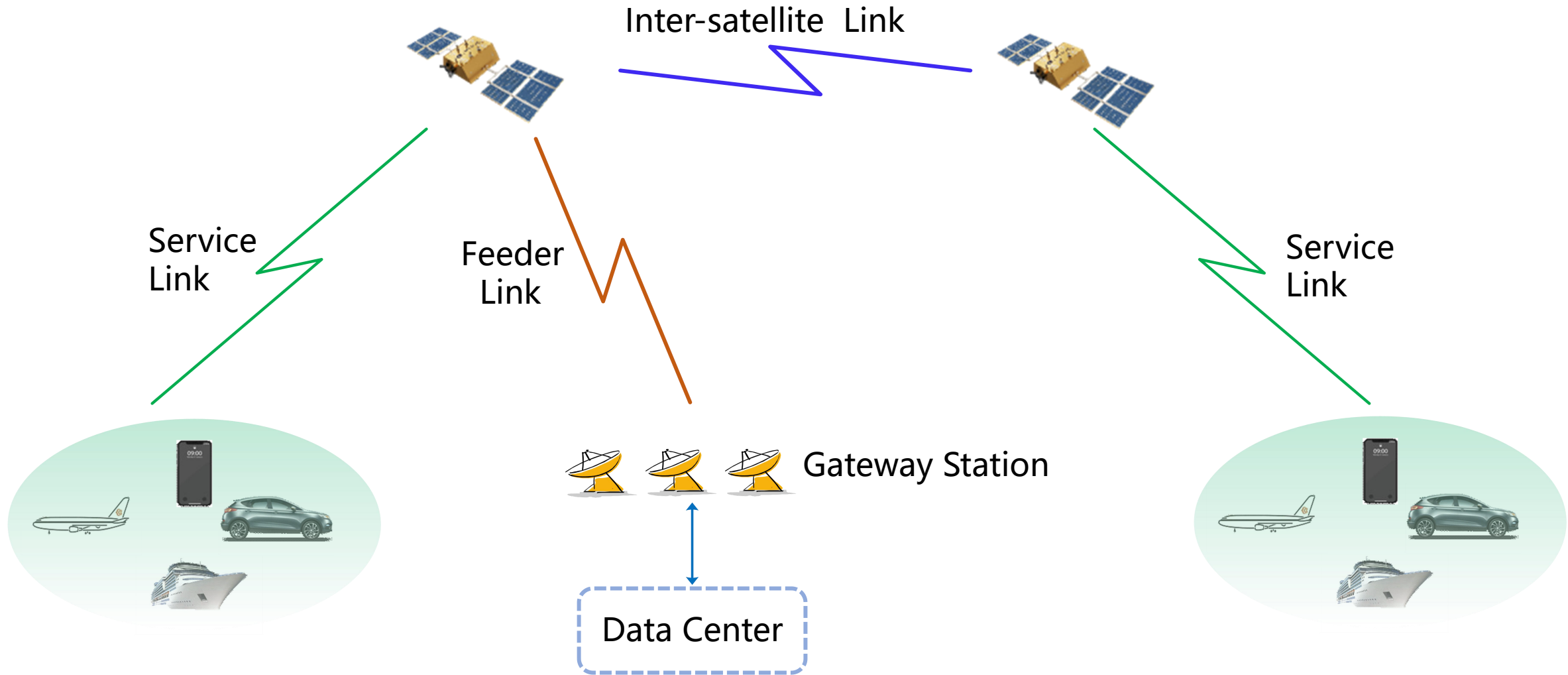
Three orbital planes were deployed
The only company in China to construct constellation with orbital plane level deployment

264

Phase III includes 264 satellites to provide direct-to-cellphone communication services



Typical Application Scenarios



IoT Data Backhaul, Data Distribution and End-to-End Communication Services are provided by GEESATCOM Networks.

Key Technical Challenges

- **High Mobility:** Frequent satellite/beam handovers (every XX seconds) causing connectivity interruptions.
- **Dynamic Network Topology:** Changing satellite constellations lead to high variation in RTT, loss rate and out-of-order packets delivery.
- **Dynamic Bandwidth:** Impact of weather conditions (rain, snow), occlusion by buildings and trees on signal quality.
- **Long Latency:** Coexistence with terrestrial networks cause long control loop of TCP.

Core Requirements for LEO Systems

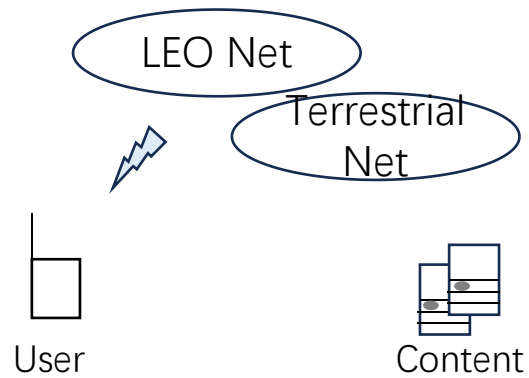
- **Low tail latency:** Improve head of line block for real-time applications.
- **High throughput:** Supporting multi-Gbps data rates per beam.
- **Reliability:** Minimizing packet loss and service disruptions during satellite/beam handovers.
- **Scalability:** Handling increasing numbers of users and devices.
- **Fairness:** Flows with different RTT are treated equally
- **Security:** Protecting data transmission against cyber threats.

Many solutions on different area

- **Solutions (not exhausted)**
 - **Reduce control loop time**
 - Multi-segment TCP
 - **Increase throughput**
 - Multi-path/session TCP
 - **0-RTT, decouple address, FEC**
 - QUIC
 - **Congestion control**
 - Westwood/BBR - bandwidth based
 - Vegas/Illinois – RTT based
- **Gaps:**
 - Lack of standardized on overall solution.
 - Heavy retransmission cause long tail RTT
 - Available bandwidth is not filled up

Focused scenarios

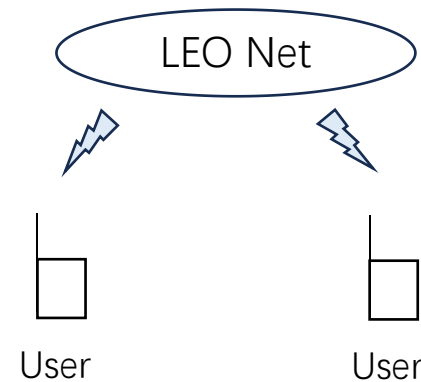
Satellite for 1 end



User connects to LEO satellite network, content service is located in terrestrial network

Priority 1

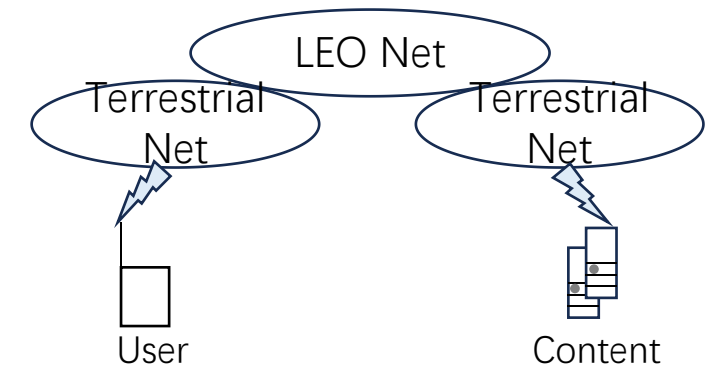
Satellite for 2 ends



Both end of users are directly connected by LEO satellite network

Priority 2

Satellite for relay



LEO satellite network provides relay service for terrestrial network

Priority 3

Conclusion and Call for Collaboration

- **Conclusion:** LEO satellite networks hold great potential but face significant challenges that require innovative solutions.
- **Call for Collaboration:** We aim to drive consensus on LEO requirements within standardization bodies like IETF. Join us in researching and developing solutions to unlock the full potential of LEO scenarios.

Q&A