

6G & Goal-Oriented NTN

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FRESHDATA

Network Differently. Send Less. Know More.



ODTÜ
METU

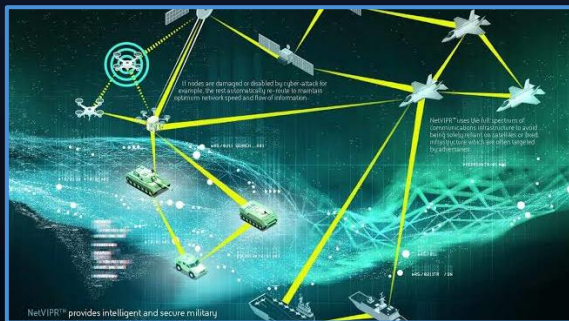
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6G Networks - true game changer

Distributed intelligence with local decisions under uncertainty.



Paradigm SHIFT

From centralized reaction to distributed **value-aware** agency

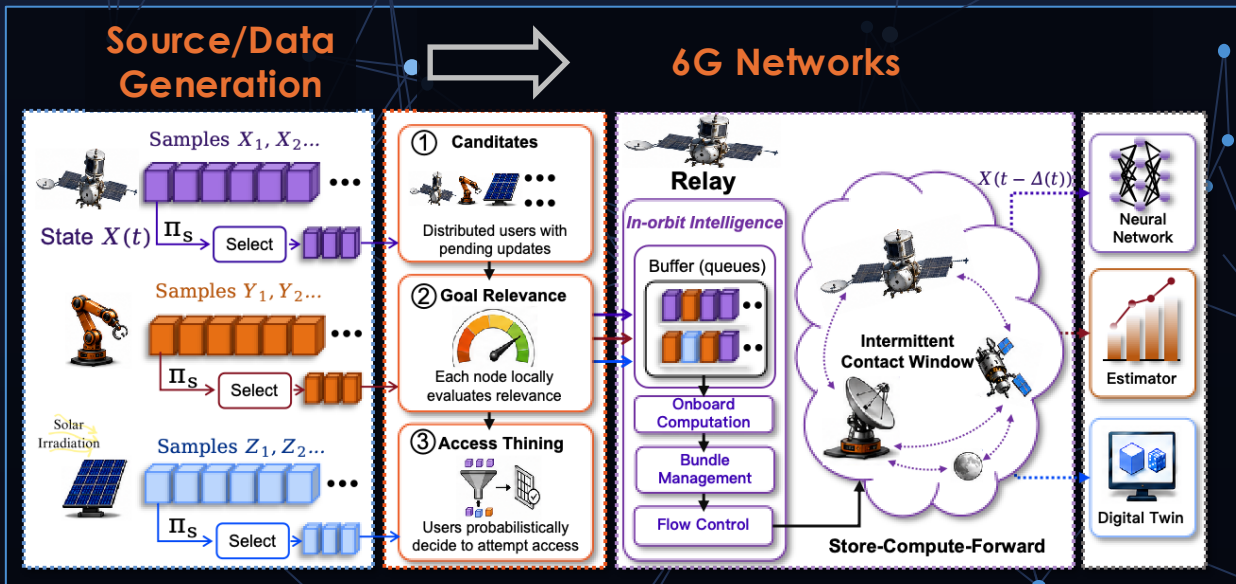
Local decision-making under uncertainty

- No always-on control plane
- Learning the value of information
- **Silence** as an action

Proactively orchestrate resources rather than only predict failures.

Decide when action is **valuable** and when **silence** is better.

AI-Native: The network can start at the point of data generation



The Network Decides

- when to transmit?
- what to sample?
- what to drop?

AI-aware control outperforms traffic prediction

Academic research and standards need to catch up to what is possible by AI- but **energy-efficient AI**.

AI-native 6G needs **SUSTAINABLE** information selection, not unlimited data movement.

NTN-Native 6G Architecture



Sustainability and worldwide connectivity

- Store and forward
- AoI-optimal routing differs from terrestrial
- Handover: group, cell edge, handover free regions

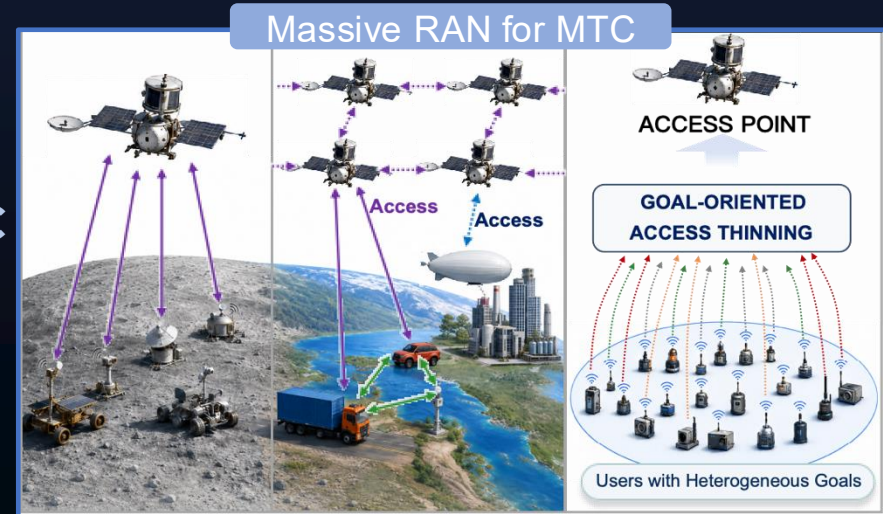
Massive RAN solutions are needed for MTC

S&F:

- When connectivity is unavailable, how do we carry information forward?

GO-NTN answers:

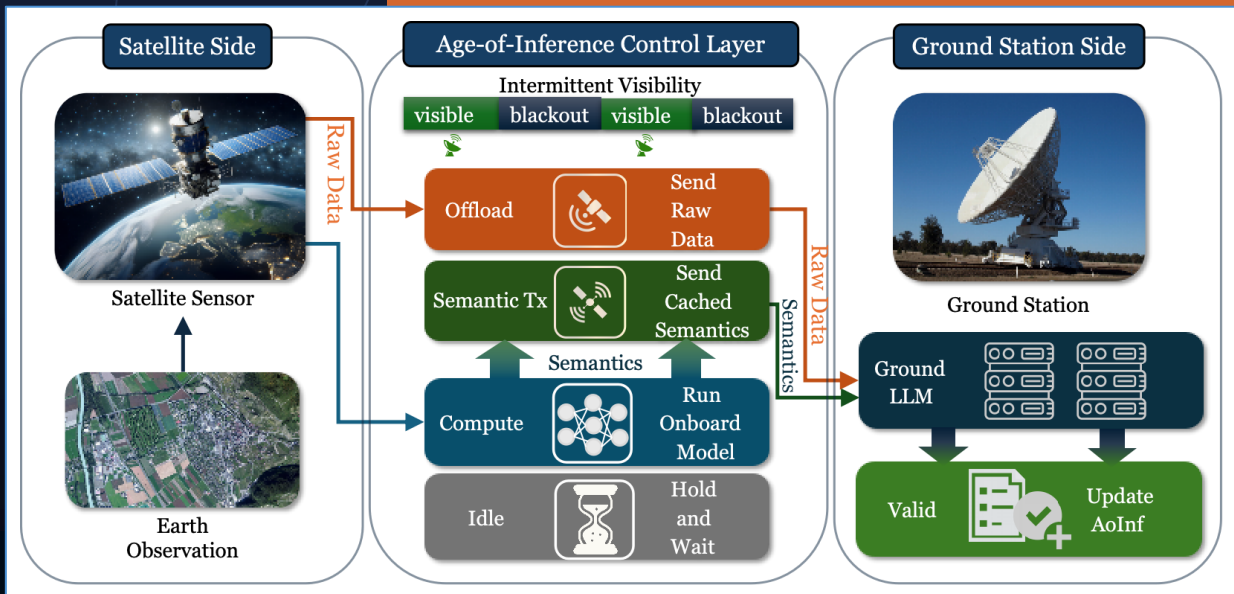
- When the next opportunity arrives, what information is worth carrying?



Edge for Timely Decisions, **Not Raw Data**

Local computation followed by a fresh decision update.

Raw data → **Features** → **Decisions**



Communications and Computation co-design is important:

- Compute where AoI reduction is maximal
- Digital twins need information freshness, not volume
- Satellite edge can act as a decision node
- Compute-in-orbit

6G = Goal-Oriented Connectivity

Freshness as a Service

Service contracts defined by AoI and decision staleness.

SLAs move from **throughput** to **freshness** guarantees.

- Buy timeliness, not bandwidth
- AoI-defined service tiers:
 - e.g. Peak AoI ≤ 500 ms
- Pricing linked to decision quality
- Natural fits to **IoT** and **NTN**

From Mbps to freshness guarantees



Operator commitment to NTN

European NTN Market with small constellations

Sateliot: 3GPP-based LEO IoT deployment

Celeste: Smart 5G gNB on satellite

OQ Technology — NB-IoT/5G NTN constellation

Skylo — commercial Release-17 NTN

Lacuna Space — constrained satellite-pass (50 B packets 6 times a day per user)