NEOSPACE CHALLENGE 2026 · NEXT-GEN DOWNSTREAM

Lynq NTN-Pulse

Every signal, the right path.

A 112-satellite polar 5G constellation and the cloud-to-edge software that runs it: every alarm anywhere on Earth in under 100 ms, with satellites, gateways and AI-enabled IoT devices updated from one place.

Team **Lynq** · Challenge: **OQ Technology: AnyPoint-NTN**

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NEO SPACE EUROPE

TECHNOLOGY

THE PROBLEM

Today's satellite IoT is neither global nor easy to run.

Who has it

Offshore energy, vessels, pipelines and remote infrastructure are hit hardest.

Operations

A regenerative network is a distributed computer: a gNB on every satellite, dozens of gateways, hundreds of thousands of devices. Links come and go every few minutes. Updating software or AI models by hand does not scale.

112 satellites

Coverage: truly global 5G IoT takes 112 satellites in 7 polar planes, the cheapest design that covers 100% of Earth every minute with alarms under 100 ms (p99). That is the network we propose.

Over open ocean no gateway is in reach. Without inter-satellite links, those places stay dark. However, many satellites fly,

Search over constellation candidates, NSGA-II over 3,064 designs, confirmed at 24 h, 2,000 points (07-constellation-optimization)

TECHNOLOGY

OUR SOLUTION

A complete, operable global NTN: the constellation, the routing brain and the orchestration layer, delivered with software support for OQ.

7×16 polar constellation

112 satellites at 700 km, Ka-band RF crosslinks. **100% of Earth, every minute, alarm p99 98 ms.**

NTN-Pulse policy engine + digital twin

Picks the path for every message: deliver now, relay over ISL, or store and forward. Lands data only at allowed gateways.

KubeEdge orchestration

One control plane from cloud → gateways → satellites → devices. Push updates in minutes, and nodes keep running when the link drops.

AI-enabled IoT devices

Models run on the terminal and on satellites, so they send only the alarms and summaries that matter.

TECHNOLOGY

HOW IT WORKS

1 · Sense

An AI-enabled device detects an anomaly locally, e.g. vibration or a pressure spike, and sends a 200-byte alarm instead of raw data.

2 · Decide

The onboard gNB classes it as **critical**. The policy engine picks the fastest **allowed** path.

3 · Route

It hops over RF crosslinks to a satellite above an authorised gateway, then to the 5G Core and cloud: **~72 ms typical**.

4 · Update

Operators push a new model, policy or gNB patch through KubeEdge. It rolls out canary-first, plane by plane, during contact windows.

Service tiers

Critical <100 ms (p99) worldwide · **Regular telemetry** by store-and-forward **≤90 min**

In scope

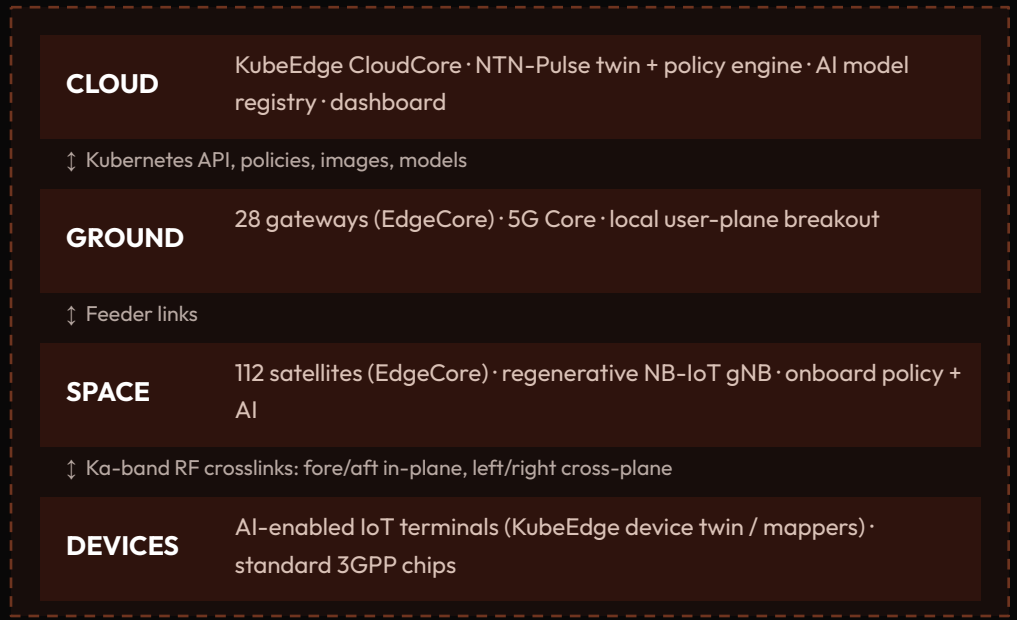
Global LEO service, uplink IoT and alarms, satellite + gateway + device software lifecycle

Out of scope

Broadband to phones (a different satellite class), and the downlink path (it mirrors the uplink graph)

TECHNOLOGY

TECHNICAL ARCHITECTURE



Key subsystems

- **Space segment:** 7 planes × 16, 700 km, 87° Walker star. 16U, 30 kg, 100 W. gNB + 4 RF crosslink terminals
- **Ground segment:** 28 gateways worldwide, 5G Core, sovereign local breakout
- **Software platform:** KubeEdge: CloudCore in the cloud, EdgeCore on gateways and satellites. Edge AI with KubeEdge Sedna

What is new

A satellite is managed like a cloud node. Policies, gNB software and AI models ship as containers. Edge autonomy keeps every satellite serving through link outages and syncs it when contact returns.

TECHNOLOGY

FEASIBILITY AND MATURITY



TRL today: **3** (proof of concept in simulation, filled) · Target: **TRL 5 by Q4 2027** (outlined)

Already done · proves TRL 3 today

- **Global optimiser:** NSGA-II over 3,064 designs on MeluXina. 7×16 is the cheapest design with 100% coverage and p99 <100 ms
- **Re-simulated design:** 24 h at 60 s steps over 2,000 points. Coverage 100%, p50 72 ms, p99 98 ms, survives a failed gateway with no loss
- **Policy engine in the North Sea twin:** with a gateway offline, alarms stay at ~100 ms over the ISL mesh (vs 30–35 s without it). 100% routing compliance
- **Reference systems:** Iridium (66-sat RF crosslink mesh since the 1990s), KubeEdge (CNCF graduated), 3GPP Rel-17/19 NTN

Planned · to reach TRL 5

- **KubeEdge testbed:** CloudCore + EdgeCore on flight-like boards, with simulated link outages
- **Hardware-in-the-loop** with OQ's 5G Satellite Test Lab (Leudelange)
- **AI-enabled terminal pilot** with one offshore operator

Details in the R&D roadmap →

TECHNOLOGY

PRIOR ART (IP) AND BENCHMARK

Criterion	Lynq on OQ (7×16)	Sateliot	Starlink D2C	Iridium
Architecture	Regenerative gNB, RF mesh, KubeEdge-managed	Rel-17 NB-IoT, bent-pipe + S&F	Broadband D2C, laser mesh	Proprietary, RF mesh
Alarm latency	**p99 98 ms, 100% Earth**	Minutes (store-and-forward)	~25–60 ms (broadband)	Global, not published
Cost	**€134M capex** (€0.83M/sat), €348M / 10 yrs	Not disclosed	Billions, ~11,100 sats	High, 66 sats
Maturity (TRL)	3 (design + software)	9	9	9
Operability	Cloud-native updates, standard 3GPP chips	Standard 3GPP	Own ecosystem	Own terminals
Edge AI on devices	**Yes, orchestrated**	No	No	No
IP position	Own know-how on open source (Apache-2.0)	Patented S&F roaming	Proprietary	Proprietary

Sources: USPTO grants to OQ (SpaceNews; SpaceWatch.Global, Dec 2022), Espacenet, company websites. See References.

Key patents

OQ holds 12 patents (2018 priority) plus a **pending ISL patent for cellular constellations**. Sateliot holds a patent on S&F roaming.

We differ by doing **policy routing and orchestration on top** of the link, not the link itself.

Freedom to operate

To check. KubeEdge is Apache-2.0. Our policy engine, satellite operators and edge-AI models are our own know-how.

BUSINESS MODEL

MARKET AND CUSTOMERS

$2.3–3.1B

Total market

Satellite IoT in 2026, growing **14–23%/yr**

Commercial research houses; see References

~290k

Market you can reach

Global network breaks even at **~290k assets × €120/yr**, or **~35k sovereign endpoints × €1,000+/yr**

≈ €35M/yr average 10-year TCO

2 layers

First customers

OQ Technology: buys the constellation design, NTN-Pulse, KubeEdge orchestration and support

OQ's end customers: offshore energy and maritime first (e.g. Equinor, Ørsted, Eni), then defence/sovereign

Alternatives today

VSAT, Iridium, Sateliot / Skylo, in-house ops tools. **Main limit:** no global low-latency coverage, no data-residency control, slow manual operations

BUSINESS MODEL

VALUE AND REVENUE

Why customers choose us

- **Global alarms in <100 ms (p99)**, with no dark oceans
- **Updates in minutes, not missions:** gNB, policies and AI models rolled out from one control plane
- **AI at the edge:** devices send insight, not raw data, which suits a narrowband network and lowers cost per asset

How we make money

Who pays	For what	Price model
OQ Technology	NTN-Pulse + KubeEdge platform licence	Per satellite / gateway node per year
OQ Technology	Software support, updates, SRE	Annual support contract
OQ / device makers	AI-enabled device agent + model updates	Per device per year
End customers (via OQ)	Priority asset monitoring	€120/asset/yr (OQ's tariff)

Offer: *"We sell OQ a cloud-to-edge platform and support to run its 112-satellite network, licensed per node and per AI-enabled device."*

REGULATION AND STANDARDS

Requirement	Source	How we comply	Status
Debris mitigation	IADC guidelines, 5-year deorbit trend	At 700 km natural decay is too slow, so a deorbit burn is budgeted (Δv 207 m/s, electric propulsion)	Planned
Spectrum use	ITU RR Art. 9 coordination, Art. 22 EPFD	OQ's priority ITU filings via Luxembourg. €1M budgeted for the Ka-band crosslink filing	In progress
Operation licence	Luxembourg space law (2020), ILR/LSA	Extend OQ's Nov-2025 concession to ISL + regenerative ops	**Open**
Data residency + lawful intercept	GDPR, national LI rules	Onboard policy routing, local breakout, the MNO keeps LI. 100% compliance in simulation	Done (sim)
Cybersecurity	NIS2 (space is a critical sector), Cyber Resilience Act (IoT devices)	Signed container images, mTLS between CloudCore and EdgeCore, audited rollouts, device update path	Planned
Export control	EU dual-use, ITAR/EAR	European crosslink suppliers, no US-origin parts	Planned

Sovereignty and security are built into the software: routing rules and signed updates are enforced by the platform. **Open point:** extending OQ's Luxembourg concession to ISL and regenerative operations, our first regulatory step.

Engagement order: Luxembourg ILR/LSA → ITU BR → international waters (no landing rights) → MNO partner countries → EC/CEPT spectrum

BUSINESS MODEL

COSTS & ECONOMICS

Costs and assumptions

- **Network (OQ side):** €134.2M capex · €348.2M over 10 years (satellites ×2 generations €185.9M, launch + transfer vehicles €82.5M, 28 gateways €36.4M, ops €43.4M)
- **Lynq side, main costs:** engineering team, cloud and testbed hardware, security certification
- **Key assumptions:** €10k per node/yr licence · support contract · €2 per AI device/yr

Economics

Lynq	Year 1	Year 2	Year 3
Revenue (€)	0.3M (pilot + integration)	1.2M (licence for 112 sats + support)	2.5M (+ AI devices)
Costs (€)	0.6M	1.0M	1.6M
Result (€)	−0.3M	+0.2M	+0.9M

The software layer is **~3–7%** of the network's 10-year cost (€12–25M), but it decides how fast OQ can operate and earn.

BUSINESS MODEL

FUNDING REQUEST & USE

Funding needed

€450k

Goal: reach TRL 5 in 12 months

Use of funds:
R&D (KubeEdge satellite operators, policy engine, edge AI) **45%**
Testing (testbed, HIL) **25%**
Team **25%**
Other (cloud, security audit, IP) **5%**

Funding routes

- ESA OSIP
- ESRIC Startup Support Programme
- Luxembourg national grants
- Paid software contract with OQ

IMPLEMENTATION PLAN

R&D ROADMAP

Oct 2026

7×16 design + policy engine in twin (done)

TRL 2 → 3

100% coverage, p99 <100 ms, 100% routing compliance in simulation

Q2 2027

KubeEdge testbed: cloud + gateway + satellite boards

TRL 3 → 4

Update reaches all nodes with simulated outages. Nodes keep serving offline. Failed canary rolls back automatically

Q4 2027

HIL at OQ's 5G Test Lab + first AI-enabled terminal

TRL 4 → 5

Correct priority/path in ≥99% of cases. Device model updated over the air

2028

Pilot on OQ's fleet with an offshore operator

TRL 5 → 6

≥95% of alarms delivered on tier over 3 months, zero non-compliant landings

Facilities and partners needed: OQ 5G Satellite Test Lab (Leudelange), MeluXina HPC, OQ fleet access, one offshore operator

IMPLEMENTATION PLAN

TEAM, PARTNERS AND RISKS

Davoud Jokar
Systems and digital twin

Ines Bouissou
NTN modelling and constellation optimisation

Gambhir Sharma
Cloud, KubeEdge orchestration and deployment

Maryam Amini
TCO, pricing, regulation and first-buyer case

Key partners: OQ Technology (challenge company), MeluXina / LuxProvide (HPC), KubeEdge / CNCF community, Università di Roma Tor Vergata

Main risks

Risk	Mitigation
Technical: RF crosslinks have only 0.58 dB margin. A single satellite failure opens 4-min gaps. Onboard compute is tight (40 W payload)	Design for +3 dB per link. Fly 1 in-orbit spare per plane (7 sats, ~€7M). Lightweight EdgeCore, staged updates only in contact windows
Regulatory/market: concession not yet extended to ISL. Security certification (NIS2/CRA)	Luxembourg first. Signed images, audit logs and a security review built in from the start
Delivery/funding: launch cost per plane (dedicated launch raises 10-yr cost by ~50%)	Rideshare + transfer vehicles. The design ranking holds under that sensitivity

IMPLEMENTATION PLAN

NEXT STEPS

A KubeEdge testbed and HIL slot at OQ's 5G Satellite Test Lab, at €450k to reach TRL 5

Partner we are looking for

OQ as software customer, plus one offshore operator for an AI-enabled terminal pilot

Test facility or data

OQ gNB payload interface, flight-like onboard computer, fleet telemetry, continued MeluXina access

Mentoring

ITU filing for Ka-band crosslinks, NIS2/CRA security certification, MNO roaming

Since the start of the challenge: [feedback from OQ/mentors]. **Changes we made:** moved from a North Sea 30-satellite fleet to a **global 7×16 polar design** chosen by optimisation, and added **KubeEdge orchestration and edge AI** so OQ can run and update the network quickly.

THANK YOU

QUESTIONS ARE WELCOME

Lynq · NTN-Pulse: *Every signal, the right path.*

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FOR THE Q&A

BACKUP SLIDES

A · 7×16 polar design B · KubeEdge orchestration layer C · Cost per design alternative

References and sources. Full regulatory analysis:

01-research/05-REGULATORY-deep-dive.md. Show these only when the jury asks.

BACKUP A

7×16 POLAR DESIGN

Figure	Value
Orbit	7 planes × 16 = 112 sats, 700 km, 87°, Walker star, period 98.6 min
Coverage	100% of Earth, every minute, longest gap 0 min. 2.58 satellites in view on average
Alarm latency p50 / p95 / p99	72 / 91 / 98 ms
Crosslinks	Ka-band RF, 4 per satellite, ~1 Mbps, 186 of 208 links up on average
Satellite	16U, 30.1 kg, 100 W, €0.83M
Capex / 10-yr TCO	€134.2M / €348.2M
1 satellite fails	99.84% coverage, 4-min gap, p99 ~99 ms
Svalbard gateway down	No change (100%, p99 98 ms)

Why RF and not laser: RF is cheaper at every laser price tested (down to €0.02M/terminal). A laser 6×20 design costs **€125M more** for the same service.

BACKUP B

KUBEEDGE ORCHESTRATION LAYER

Layer	Component	Job
Cloud	CloudCore + Kubernetes API	Desired state for every node. Image and model registry
Gateways	EdgeCore	Runs 5G Core functions, local breakout, gateway-side policy
Satellites	EdgeCore (lightweight)	gNB apps, onboard policy engine, onboard AI. **Edge autonomy:** keeps running when the feeder link drops
Devices	Device twin + mappers (MQTT, Modbus)	Device state, config and model updates for AI-enabled terminals
AI	KubeEdge Sedna	Joint cloud–edge inference, incremental and federated learning

Rollout policy: signed image → 1 canary satellite per plane → health check over the next pass → plane by plane → automatic rollback on failure. Large images ship as layer deltas during gateway contact, not over 1 Mbps crosslinks.

BACKUP C

COST PER DESIGN ALTERNATIVE

Design	Sats	p99	10-yr cost
6×16 @ 800 km, in-plane RF only	96	110 ms	€256M
7×15 @ 700 km, RF in-plane + cross	105	99.5 ms	€333M (1-min gaps, 0.02 dB margin)
7×16 @ 700 km, RF in-plane + cross	**112**	**98 ms**	**€348M**
6×20 @ 800 km, laser	120	99.7 ms	€473M
17×18 @ 500 km, laser grid	306	84.8 ms	€1,211M

7×16 is the cheapest design with 100% coverage and p99 <100 ms.

BACKUP

REFERENCES AND SOURCES

1. Lynq, Constellation optimisation and 7×16 design sheet (07), Global coverage study (05), NTN-Pulse digital twin (04), 2026. github.com/gambhirsharma/Lynq
2. OQ Technology / NEOSPACE Europe, AnyPoint-NTN: Global gNB-Onboard LEO Constellation for Ubiquitous 5G NR-NTN, challenge brief, 2026
3. KubeEdge project documentation (kubeedge.io) and KubeEdge Sedna, CNCF [add access date]
4. Patents: USPTO grants to OQ Technology (SpaceNews; SpaceWatch.Global, Dec 2022); Sateliot S&F roaming patent. Search via Espacenet [add query + date]
5. Market: satellite IoT forecasts in 01-research/06-BUSINESS-CASE.md [name the publisher for the figure you quote]; LEO operator figures in 06-leo-constellations/README.md (as of 19 Oct 2026)
6. Regulation: ITU Radio Regulations Art. 9 and 22; Luxembourg Law on Space Activities (2020); OQ Luxembourg concession (SpaceWatch.Global, Nov 2025); IADC Space Debris Mitigation Guidelines; GDPR (EU 2016/679); NIS2 Directive (EU 2022/2555); Cyber Resilience Act (EU 2024/2847)