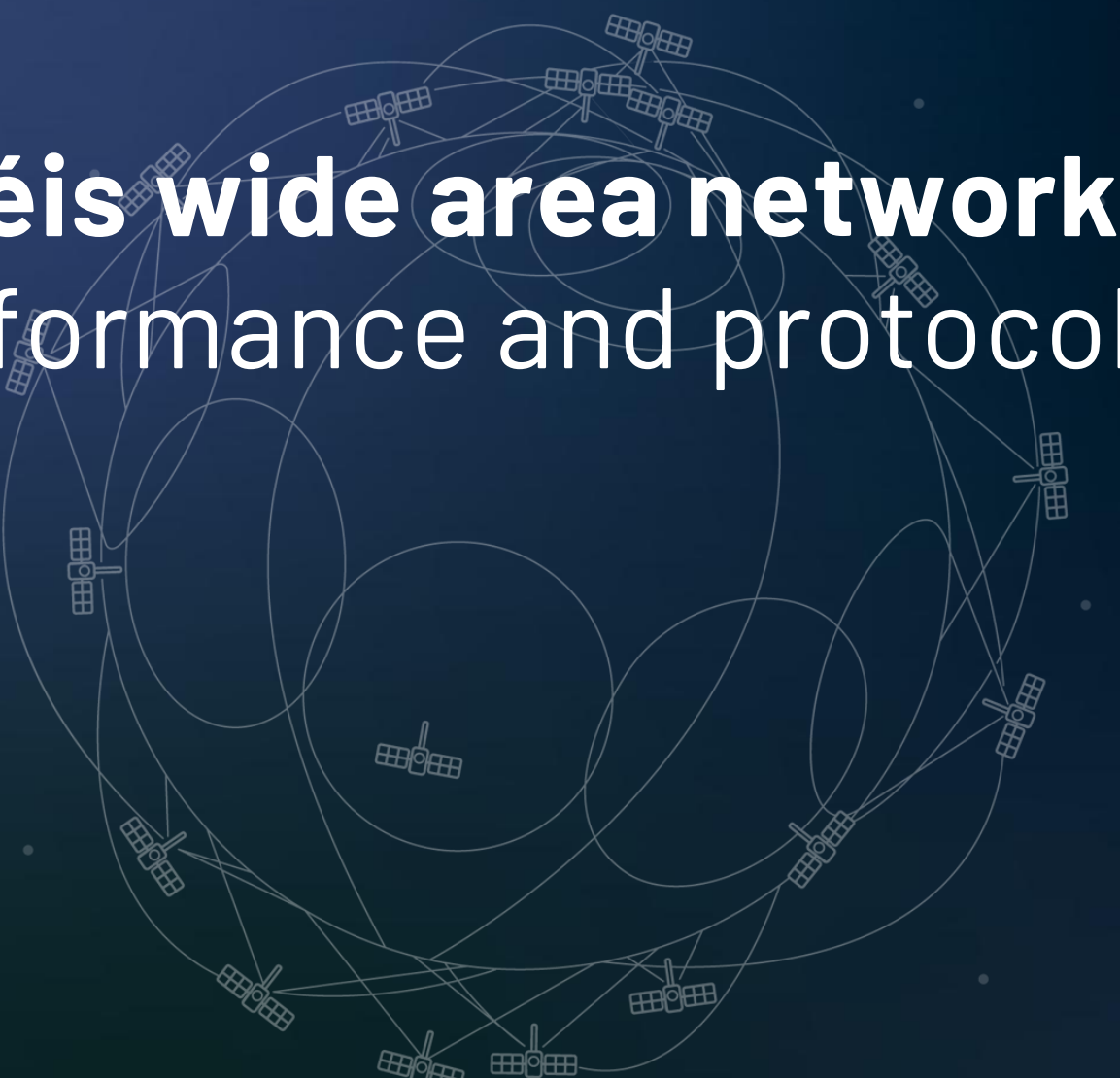




Kinéis wide area network for satellite IoT

Performance and protocol optimisation



NTN Days Conference – October 2026

Kinéis gen1 connect 100% of the planet

-  **25 satellites** (5x5 planes)
-  **20 ground stations**
-  **Global IoT Network**
-  **Kineis Wide Area Network**


kiWAN



Network Challenges for gen2 system design



Satellite Low End IoT is a complex optimization problem

- Use cases range from mobile tracking to fixed command & control
- Devices are half duplex, low cost, low power, small and often custom-built
- Satellites have limited spectrum, RF and processing power



Protocol and waveform drive performance

- Reliable transmission is hard with uplink only and discontinuous coverage
- Users want configurability while the operator must guarantee stability
- Use cases require downlink both for signaling and data, which becomes the real bottleneck



No existing standard covers all satellite IoT needs

- **NB-IoT** works, but is heavy and energy-hungry for payloads under 100 bytes
- **Pure random-access** protocols are non-standard and limited in configuration
- For the **low end IoT**, a **new protocol** must combine the best of both

NEXT

Building Kinéis gen2 System and Protocol


kiWAN r2
Low end IoT


NB-IoT
5G/6G IoT



Real-time connectivity
with guaranteed QoS



Massive random access,
higher downlink capacity



Cheaper modem and air-time
Easier integration and use

kiWAN r2 PHY layer: Optimal efficiency over the RA channel



Benchmark PHY candidates

Classical and novel PHY layers, evaluated on:

- **Energy efficiency**
- **Robustness** to jamming and coexistence with legacy signals
- Receiver **complexity**
- **Spectral efficiency** in multiple random access



Bring LoRa to satellite operator context

Adaptation of LoRa to licensed spectrum:

UHF

L & S band

Optimisation of waveform for **full duplex, licensed bands**



Optimize coded waveforms

Ultra-narrowband and spread spectrum for all IoT use cases:

UNB

FHSS

DSSS



Design advanced receivers

New receivers, designed for:

- Robust processing of coded GMSK signals
- Multi-user detection in UNB and DSSS contexts
- Co-channel interference mitigation

kiWAN r2: discipline between RA and DAMA

kiWAN r2 shall keep random access and adds network control, resiliency and flexibility

Free transmission

Devices transmit at will: light and cheap, but complexity forwarded to the users and network cannot manage load or interference.

Disciplined

Random access with higher resiliency (load, priority and interference control), and flexibility (link adaptation).

Connected

The network assigns resources to each device (DAMA): reliable, but heavy for small payloads. Limited network control

Free transmission

LoRaWAN, Argos

Disciplined

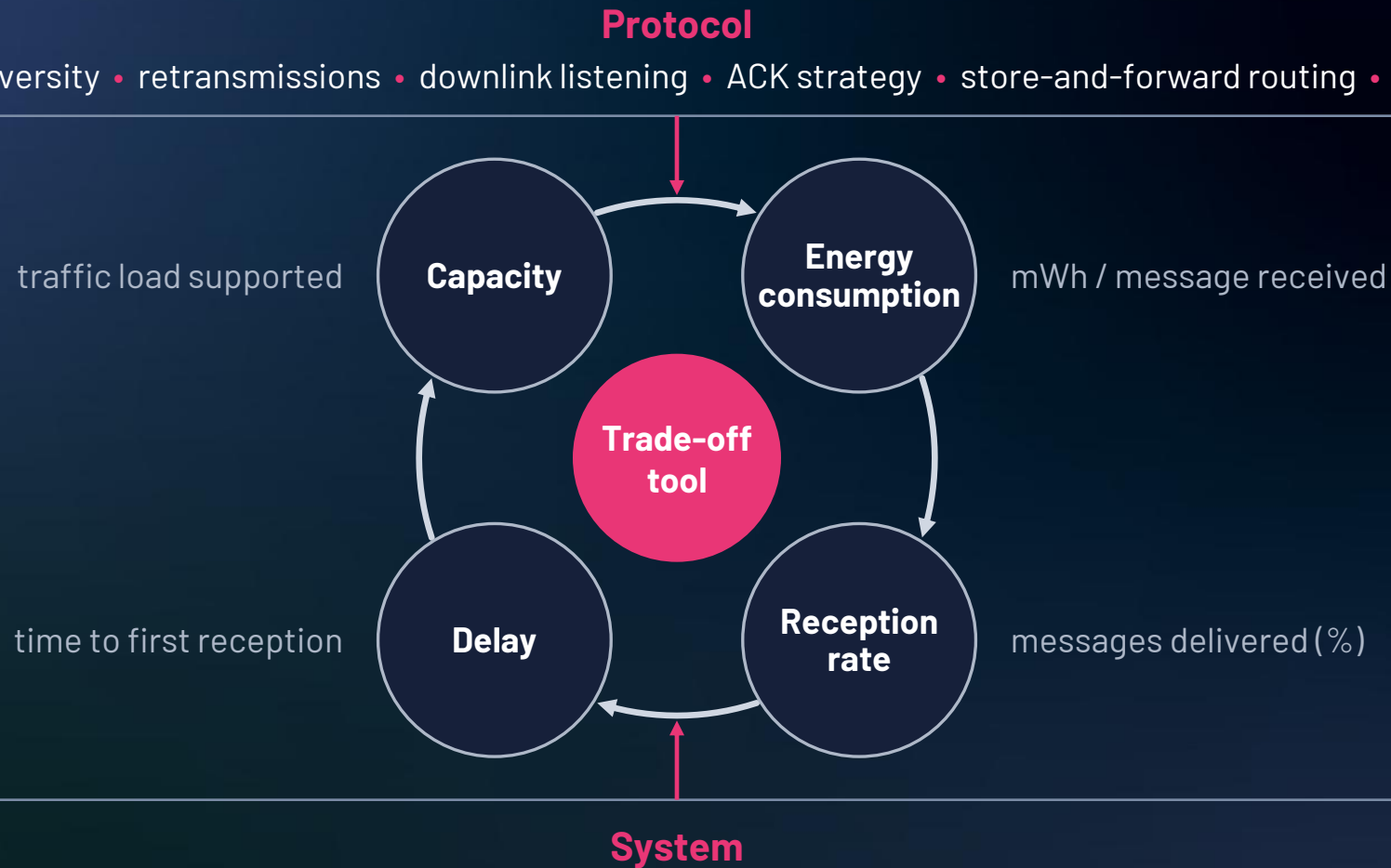
kiWAN

Connected

NB-IoT

Best efficiency	<100 bytes	<500 bytes	>500 bytes
Access scheme	Random access (RA)	Random access (RA)	Assigned (DAMA)
System duplex	Half duplex	Full duplex	Full duplex
Connection	None	None	Double handshake
Uplink ack	Optional	Optional	Mandatory
User configurability	Very open	Open, under control	None
Load control	No	Yes	No
Priority management	No	Yes	No
Link adaptation (ADR)	No	Yes	Yes
Interference management	No	Yes	No

Protocol and system trade-offs methodology



FLoRaSat now simulates KiWAN end to end

☒ Recent additions ☐ Base modules

Open-source discrete-event simulator (Inria) on OMNeT++ / INET / FLoRa, extended for KiWAN

Architecture: refactored, with end-to-end connectivity from device to ground station			
APP	Traffic generation: inter-packet law (uniform, exponential, custom), first-packet time, number of packets		
NET	Store-and-forward routing	ISL + routing solutions	
MAC	KiWAN UL: Blind, SatDetect, ACK + retransmissions	Modular downlink frame with periodic beacon	
PHY	Link budget validated on Kinéis measurements	Collisions from an ad hoc PHY receptor simulator validated on lab measurements	
Orbit & system	Kinéis constellation (real TLE) with antenna modelling	20 ground stations with measured terrain masks	Terminal fleets with field masks and antenna patterns
KPIs	Capacity traffic load supported	Energy consumption mWh / message received	Delay time to first reception
			Reception rate messages delivered (%)

A. Y. Choquenaira-Florez, B. Coeugnet, R. Ohs, J. A. Fraire, and H. Rivano, "FLoRaSat 2: Simulating cross-linked direct-to-satellite IoT LEO constellations with joint access and routing evaluation," Authorea, 2025, doi: 10.22541/au.175647870.00758886/v1.

Conclusion

CHALLENGE FOR GEN 2

Gen2 design must scale without losing simplicity

- Finding the right operating point between system/device **cost**, **complexity** and **performance**
- Guaranteeing **quality of service** is a must, not possible with Uplink only transmission
- Need for a **novel protocol** to overcome the challenge of low end IoT



DESIGN DRIVERS

Tailoring and Optimisation of the system & protocol

- **Real-time connectivity** with guaranteed QoS
- **Massive random access**, with novel waveforms suited to licensed bands
- **Downlink capacity** becomes a major challenge for signaling and data
- **Lower modem and air-time cost**, easier integration & use



kiWANr2

Random Access under network control & discipline

- Keeps **light random access**, adds network control of load and interference
- **Optimized performance** for each use case, while keeping it simple to use
- Evaluated end to end in **FLoRaSat**, validated on Kinéis measurements

Thanks!



kinéis

Satcom IoT Operator

DO YOU HAVE
ANY QUESTIONS?

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