MobiSpaces
new data spaces for green mobility

VesselEdge

Edge Computing Onboard of Moving Vessels

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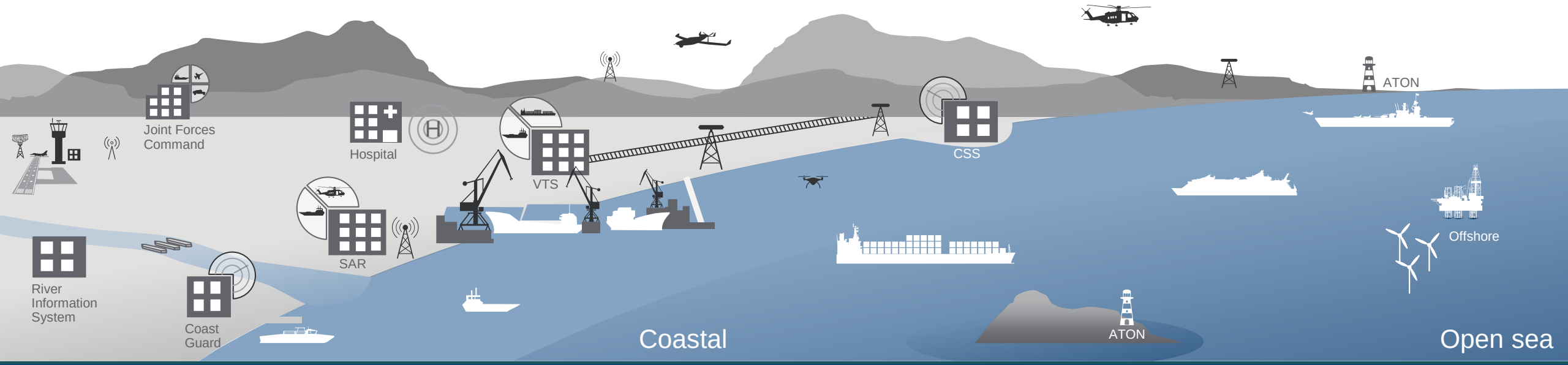
Architecture for increased flexibility, efficiency & safety



Frequentis MarTRX

Modularity on system level

Coastal Surveillance Systems

GMDSS, Search and Rescue

DSC | NAVTEX | SafetyNET | MSI/ CMB

Tracking and Tracing

Maritime Comms System

MF/HF VHF | Digital radio | Telephony

MCS 3020 IP

Vessel Traffic Management Solutions

Radar | AIS | CCTV | METEO

smartVTS

Integration and networking

Recording

DIVOS

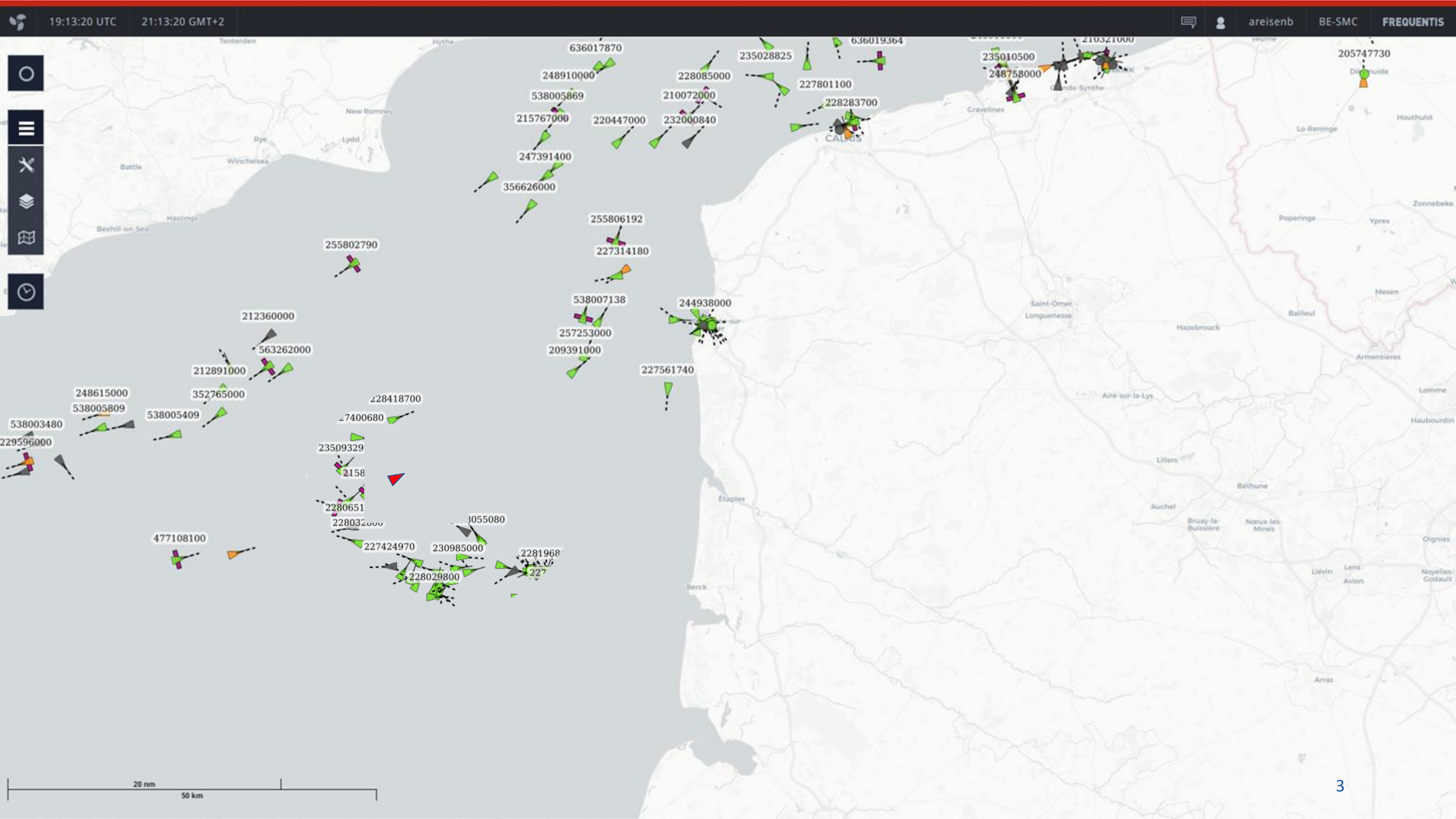
Incident and crisis management

Best-of-breed partners

Sensors | Port Mgmt. | SARIS | Others …

Maintenance and monitoring

Services and management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Lillers
Auchel
Arras
Hastings
Bexhill-on-Sea
Battle
Rye
Winchelsea
New Romney
Lydd
Tenterden
Hythe
20 nm
50 km

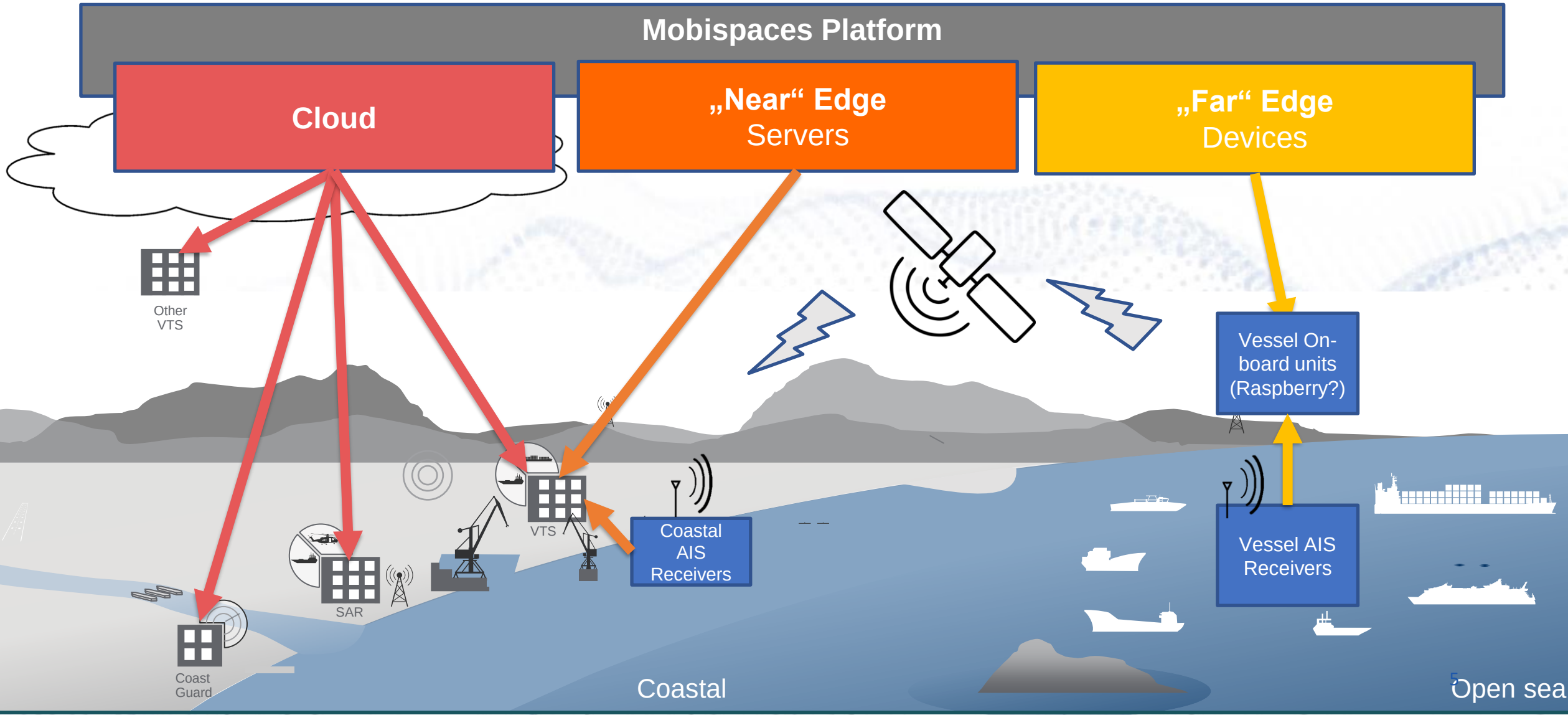
User-story

- Improve situational awareness for operators by deploying „mobile-sensors“ to overcome limitation (bandwidth, location, time, …)
  - -> real-time, stream processing

- Possible additional use-case
  - Data-sharing (learning) between different operating entities (control rooms from different organizations)
  - Enrich Model with other data (weather, tidal, hydrographic, …)
  - Provide Model for other applications

VesselEdge – Overview

relating to the MobiSpaces Reference Architecture



KPIs

- (a) successful deployment of a novel smart AIS system that pre-processes the raw AIS data stream and transmits the key information (local model) back to the control room (target: deployments on 3 ships, baseline: current vessel AIS systems are only used for on-board situation awareness)
- (b) extended AIS coverage beyond the reach of coastal AIS antennas (target: extend AIS coverage on-demand by linking sensors on-board of moving vessels, baseline: current terrestrial AIS coverage at the use case location)

KPI	Actual Value	Goal	Gain
Data Rate	38.4 kBit/s	3..32 kBit/s	5..10
Latency	3..4 h	< 5s	1000

Infrastructure & Communication Link Characteristics

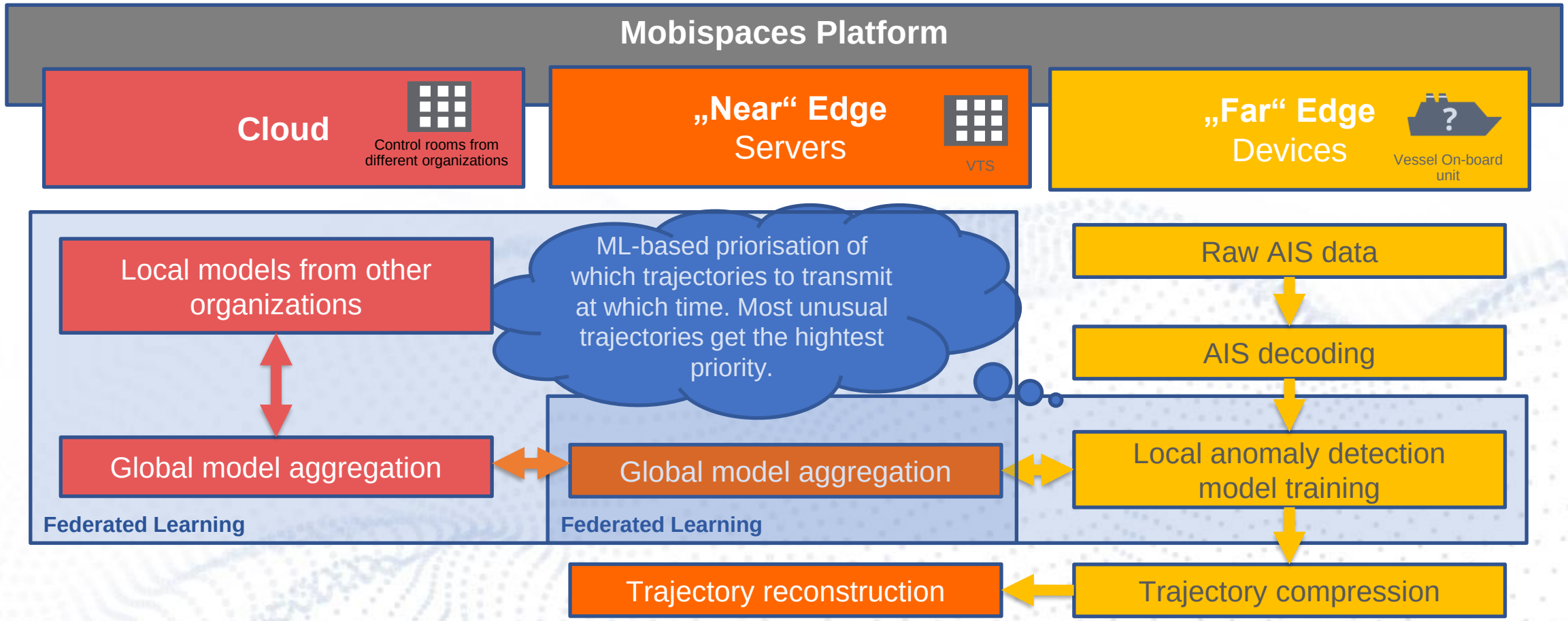
- Sensors: AIS Receiver
- Processing: Raspberry Pi 4 - Intel NUC (fanless, robust)
- Interface
  - NMEA serial interface for AIS Receiver (on vessel)
  - Processed/Decoded AIS Data
  - Data Link via Satellite, VDES, MF/HF data link – simulation
  - Propagation of trajectories and/or model

Data Link	Data Rate	Coverage
Satellite	32 … 128 kBit/s	globally
VDES	310 kBit/s	30 nmi
HF/MF data link	< 5 kBit/s	300 nmi

- Channel Simulation only
- More KPIs to come
  - error rate, availability/reliability, OPEX, latency, ….

VesselEdge – Federated Learning Architecture

Selective trajectory compression & transmission

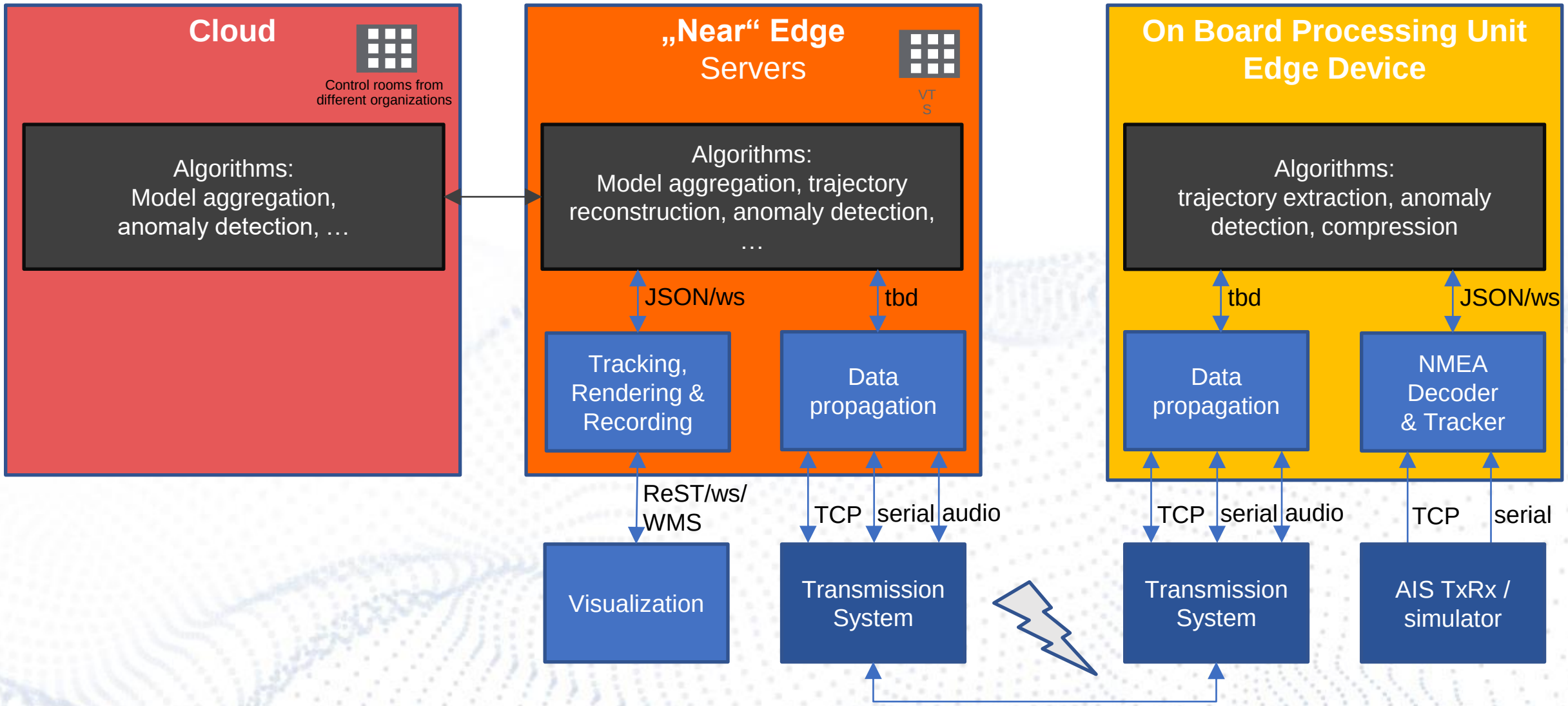


Onboard the vessels, the anomaly detection model is used to automatically determine which vessels behave unusually. These anomalous trajectories are transmitted back to the VTS with high priority.

Can potentially be combined and used together

VTS don‘t want to share raw AIS data with others. Therefore, every VTS trains their own local model. On the central server, multiple local models are aggregated to provide a global model that covers the combined areas of all participating VTS. This global model may also be shared with other organizations, such as the coast guard.

Deployment Diagram



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