OMNIACCESS

International Research Ship Operators

35th International Research Ship Operators Forum Vancouver, Canada 2024

Premium Maritime Digital Solutions

Comms updates and feedback

Cybersecurity updates

Possibility Framework

Complete, modular, and securely managed solutions portfolio

Bring the best internet and cloud to you, anywhere	Enable every device to connect	Boost productivity transformation through digital	Enhance operations, experience and efficiency	Ensure security in the digital world

Connectivity

Satellite
GEO
MEO
LEO

Terrestrial
Cellular
Wireless

Network

WAN Management
SD-WAN
Bandwidth Management

LAN Management
Managed detection & response
LAN design, deployment & management
Network access

Cloud & IT

IT Management
Assets monitoring
Standardisation & automation
IT modernisation

Hybrid Cloud Management
Migration & integration
Cloud usage optimisation
Business continuity & disaster recovery

(I) IoT & Applications

Real-time visibility & reporting
Performance optimisation
Sustainability enablement

Application Services
Welfare
Media
SaaS

Cyber Security

Assess / Protect
Advisor Services
Identity & access management
Infrastructure & data security

Defend
Managed detection & response
Digital risk protection
Vulnerability management

UNITY Platform

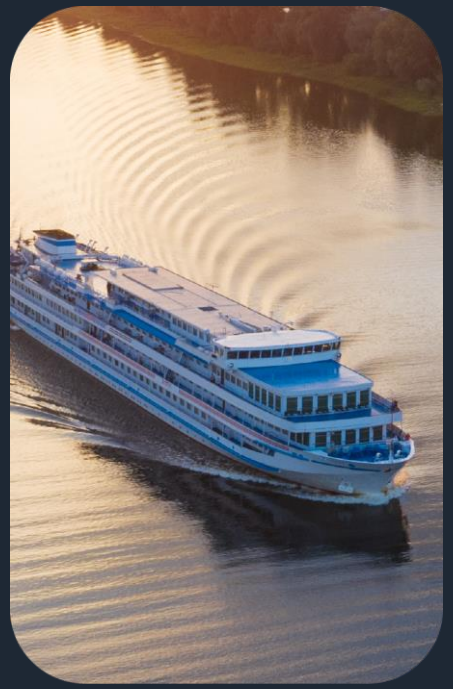
OMNIACCESS

OUR CUSTOMERS

Serving the most demanding

Super and
Mega Yachts

Ocean
Cruises



Luxury
River Cruises

Research and
Special Vessels

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Antarctic coverage – Use case

BAS Antarctic bases and RRS Sr. David Attenborough

British Antarctic Survey has selected OmniAccess to provide robust and reliable VSAT & LEO communications to five of its Antarctic Bases and their main research vessel RRS Sir David Attenborough.

OmniAccess has designed the communications system and installed all the satellite equipment on board the new RSS Sir David Attenborough, which has also been commissioned to OmniAccess' network. State of the art LEO communications technologies such as Starlink has also been integrated to always provide best-in-class connectivity to the Vessel, including a powerful fail-over strategy.

This project places **OmniAccess in the first row of players in Antarctic** and maritime research worldwide.

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Communications equipment on a Research Vessel

Above Deck Equipment (ADE)

GEO

LEO

eutelsat ONEWEB
eutelsat GROUP

STARLINK

4G/5G

Shore

Iridium/FBB

Below Deck Equipment (BDE)

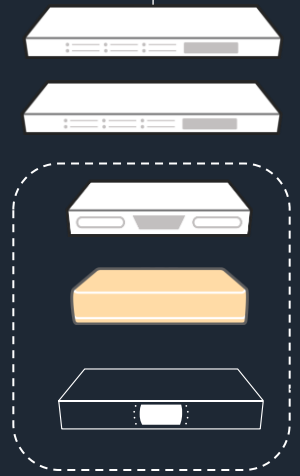
Arbitrator/Mediator
(Dual antenna only, depending on model)

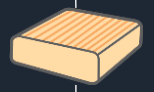
Antenna Control Unit

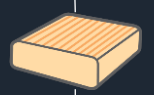
VSAT Modem

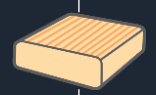
VSAT Router)

Security and Management









Modem(s)

Internal Network

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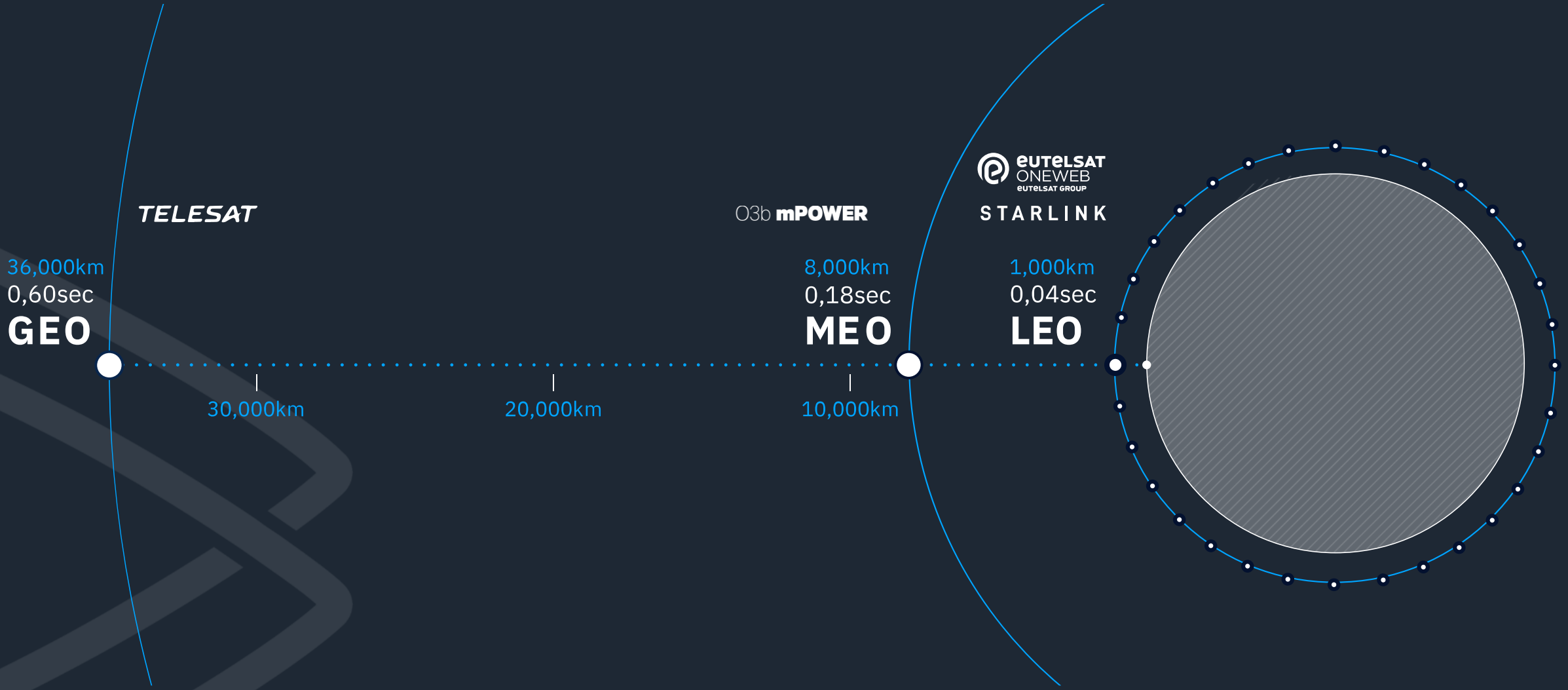
GEO / MEO / LEO



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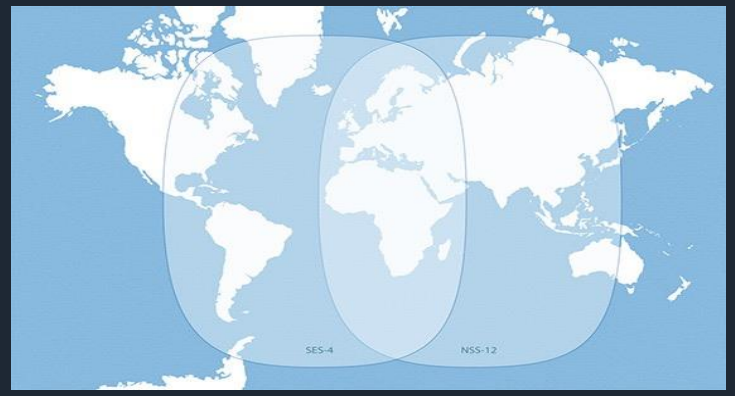
SATELLITE FREQUENCY BANDS

C-band

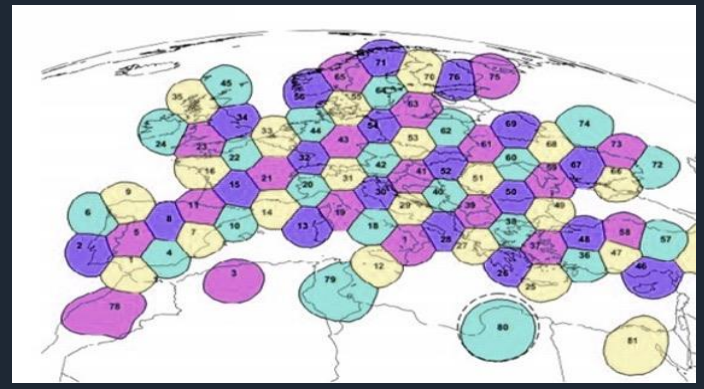


- ✓ Only used by VSAT GEO.
- ✓ Very Large footprints.
- ✓ Global coverage.
- ✓ Weather resistant.
- ✓ Large antennas (2.4m).
- ✓ 4 to 8 GHz range

Ku-band

- ✓ Used in VSAT GEO and LEO.
- ✓ Footprints: hundreds square km (LEO) / thousands sq km (GEO).
- ✓ Higher capacity than C-band
- ✓ Small to large parabolic antennas (45cm to 2,4m) OR flat antennas with LEO (Kymeta, Starlink, etc.).
- ✓ 12 to 18 GHz range
- ✓ Rain fades

Ka-band



- ✓ Used in VSAT GEO, MEO and LEO.
- ✓ Footprints: hundreds square Km.
- ✓ No true global footprint yet
- ✓ Medium to large parabolic antennas (1m to 2.4m)
- ✓ 26.5 to 40 GHz range
- ✓ Heavier rain fades

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LEO & MEO Map

2022 2023 2024 2025 2026 2027 2028 2029

STARLINK

- 7000 satellites
- Ku band service for UT
- 550 km above Earth
- Best Effort Only

eutelsat ONEWEB

eutelsat GROUP

- Up to 588 satellites in total
- Ku band service (holding priority)
- 1200 km above Earth
- MIR & CIR & SLAs

amazon Project Kuiper

- 3232 satellites
- Ka band service
- 590-630 km

TELESAT LIGHTSPEED™

- 300 Satellites
- Ka band service
- CIR & MIR – High-end

O3b mPOWER

- 6 out of 13 satellites in total
- Ka band service
- 8000 km above Earth
- Dedicated capacity

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Connectivity Options

Why choose... fuse them !

5G

Mobile data

EUTELSAT GROUP

INTELSAT

STARLINK

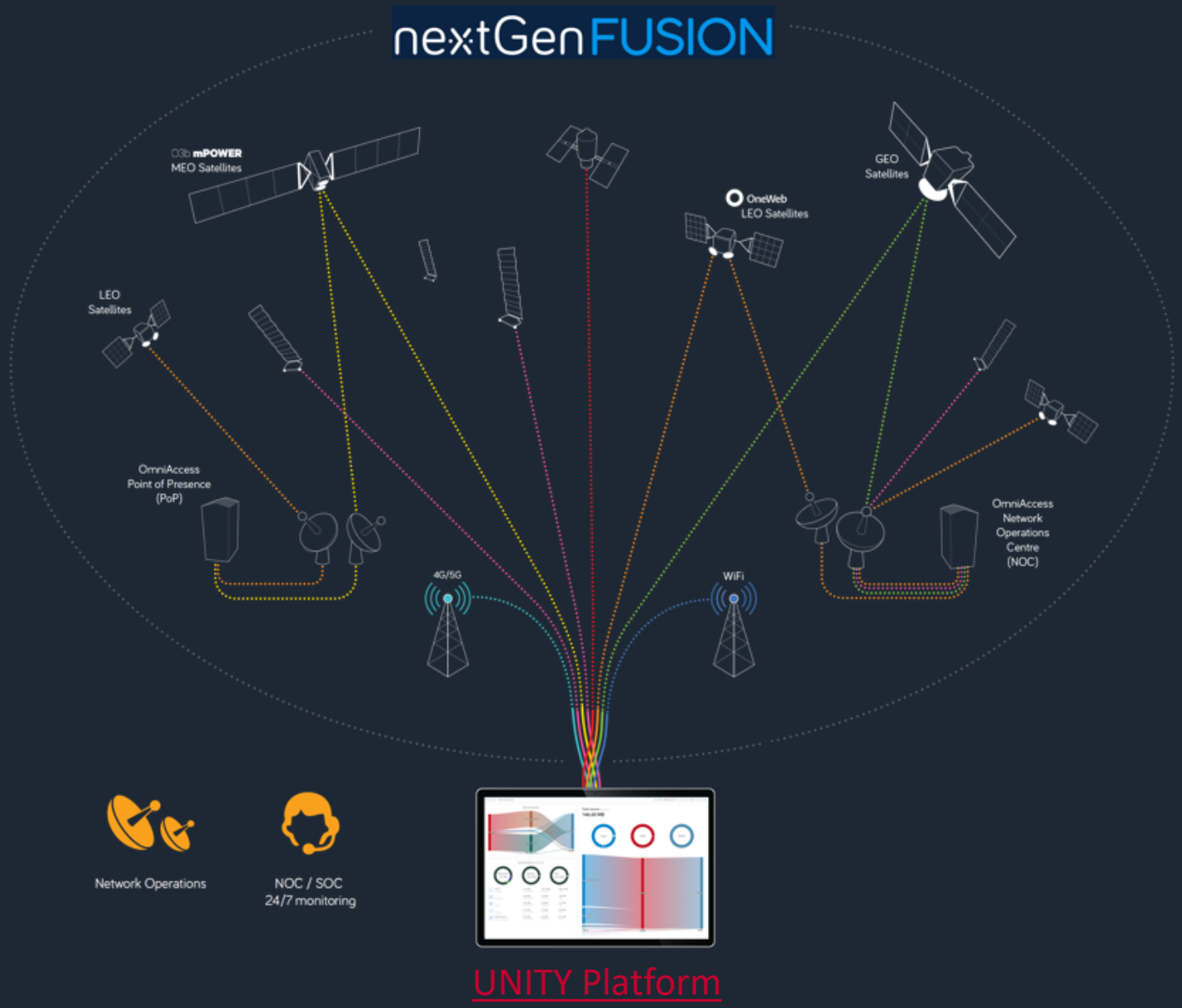
O3b mPOWER

EUTELSAT ONEWEB

EUTELSAT GROUP

TELESAT LIGHTSPEED™

amazon | project kuiper



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Starlink & the Marlink Group / OmniAccess

OMNIACCESS MARLINK

Jason Fritch:
VP of WW Enterprise Sales at Starlink

Erik Ceuppens:
CEO Marlink Group

Starlink Traction: OmniAccess / Marlink

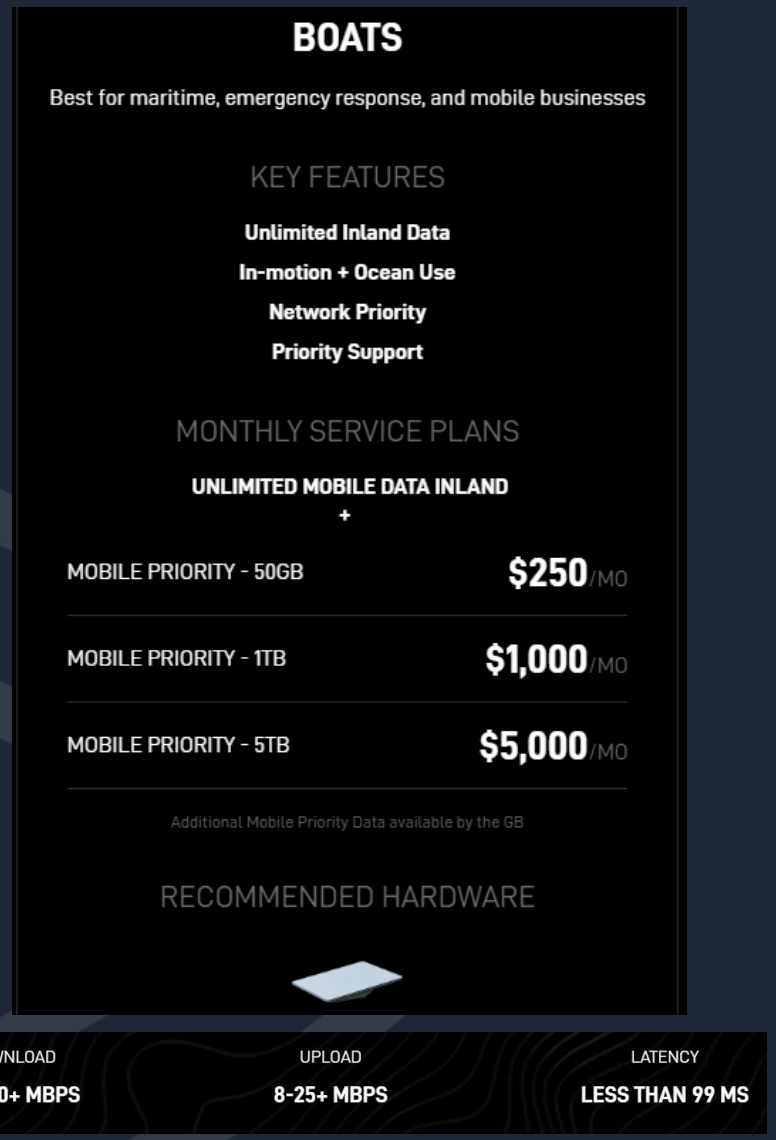
- **# 1 Integrator / Reseller globally**
- +5PB of data per month
- +3500 Starlink subscriptions
- Special agreement with Starlink
- Purchased capacity bulk
- Tailor own plans

STARLINK

Starlink Mobile Priority Plans

STARLINK

Current plans on Starlink official US page: 50GB, 1TB, 5TB



Starlink extended plans with OmniAccess:

50 GB → $250 /month

1 TB → $1,000 /month

5 TB → $5,000 /month

10 TB → $10,000 /month

15 TB → $15,000 /month

Unlimited → $28,000 /month

Note that these last 3 plans are not on the Website

EXCLUSIVE

Plans **can be used on (n) x antennas** connected to same UNITY onboard. (This cannot be done when going to Starlink direct)

Data pivoting between Starlink and 4G/5G (Europe zone). Meaning you can consume the monthly quota together over Starlink & 4G/5G seamlessly and at same $ rate. This provides resiliency, higher capacity and redundancy

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Additional Starlink Data plans that OmniAccess offers exclusively

EXCLUSIVE

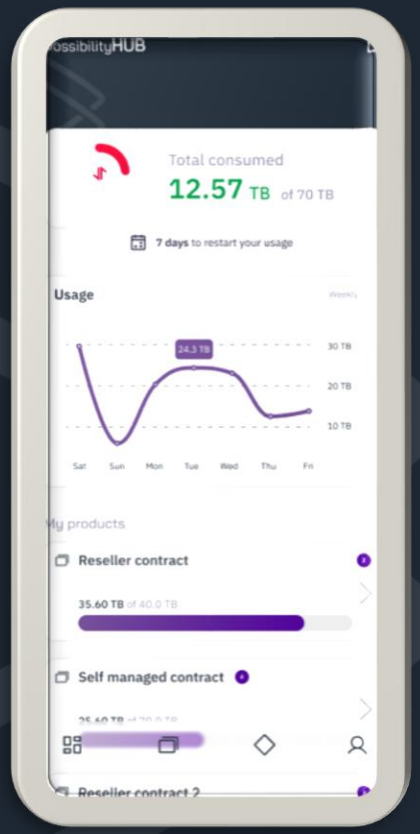
1TB Top-up

- Can be added at any time until the end of the month
- You can add several top ups (e.g. 3TB for $5,250) (i.e.: mid-month Top-up)

EXCLUSIVE

PAYG (Pay As You Go rate)

- Does not require a monthly plan (no commitment)
- Just activate and pay as you go
- This is Priority data
- Ideal for short term users
- i.e.: Activate one SL terminal just for a week



EXCLUSIVE

Starlink Data Pools

- Minimum size: 10TB per month
- Distributed between up to 20 vessels
- Larger monthly pools in increments of 1TB
- Top-ups and Overage options
- Data Pivoting in Europe
- Pools only work with Priority data
- Managed via new OmniAccess App
- Ideal for USV fleets

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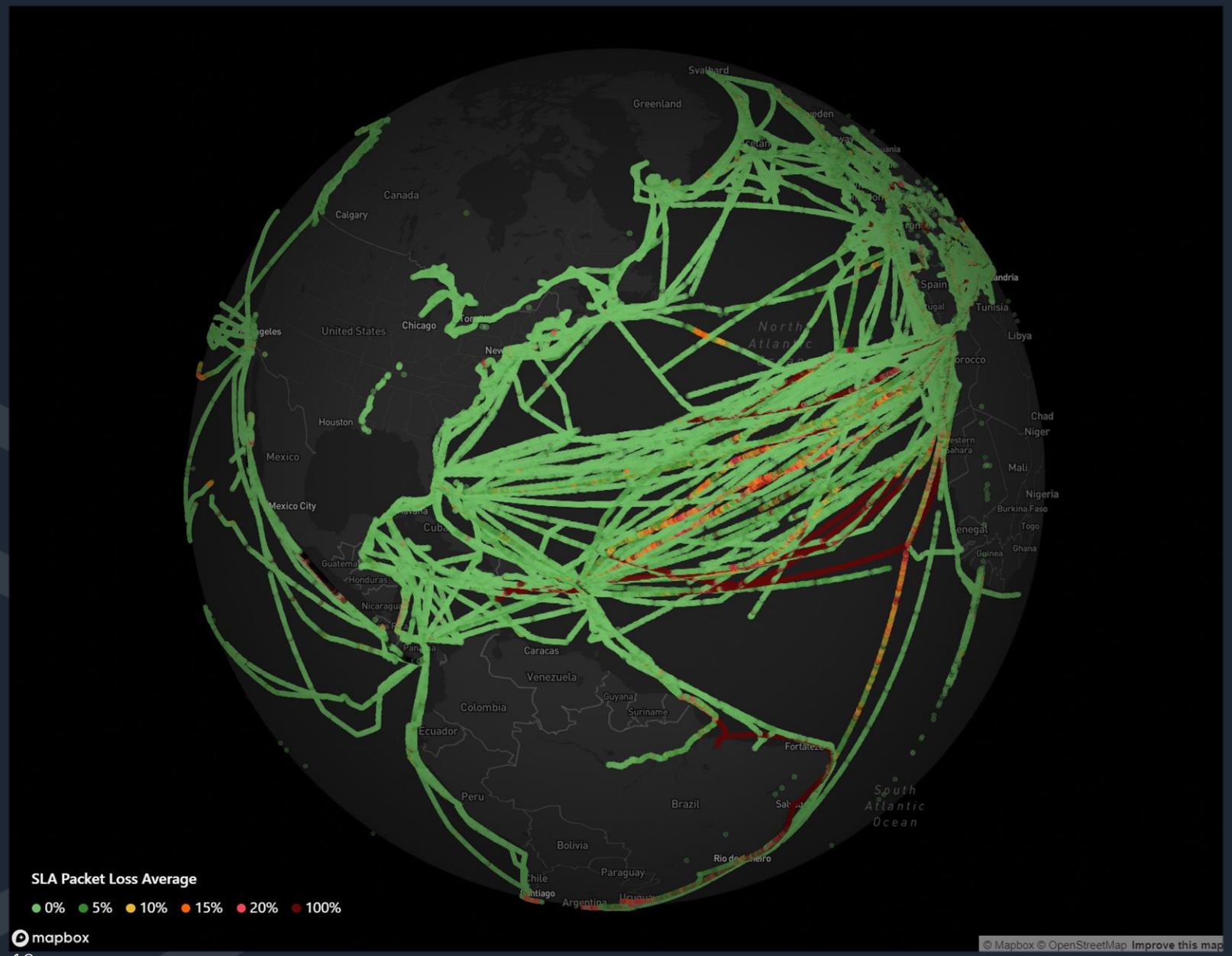
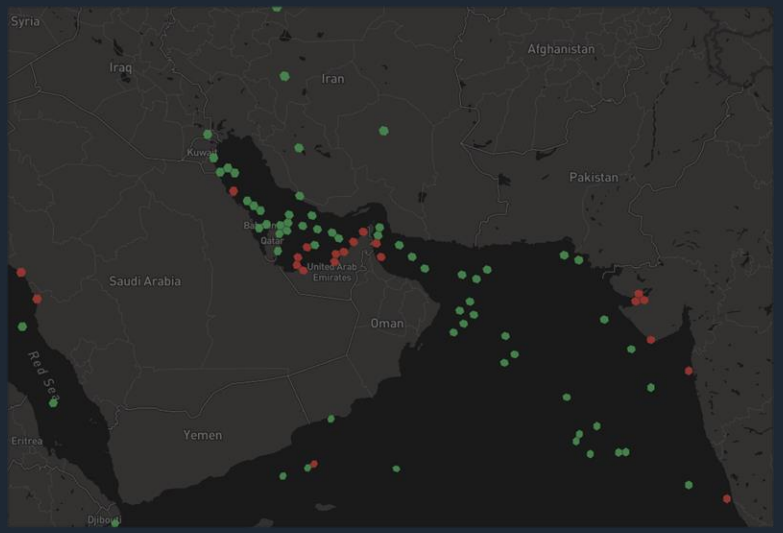
OmniAccess Starlink heatmaps





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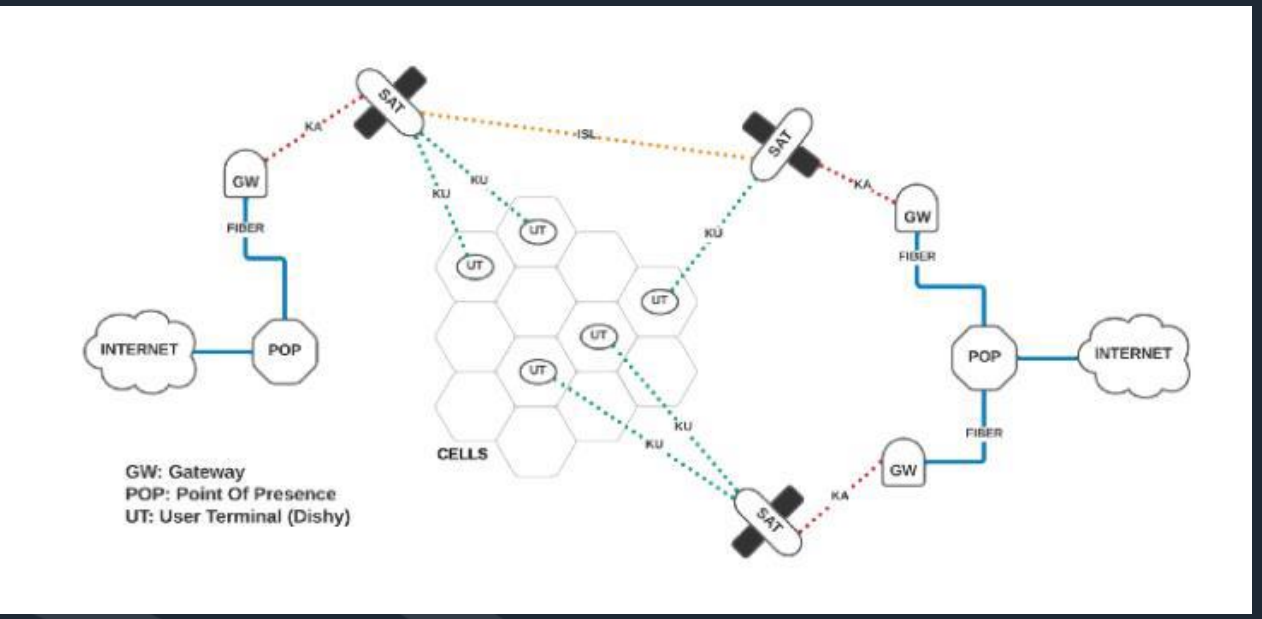
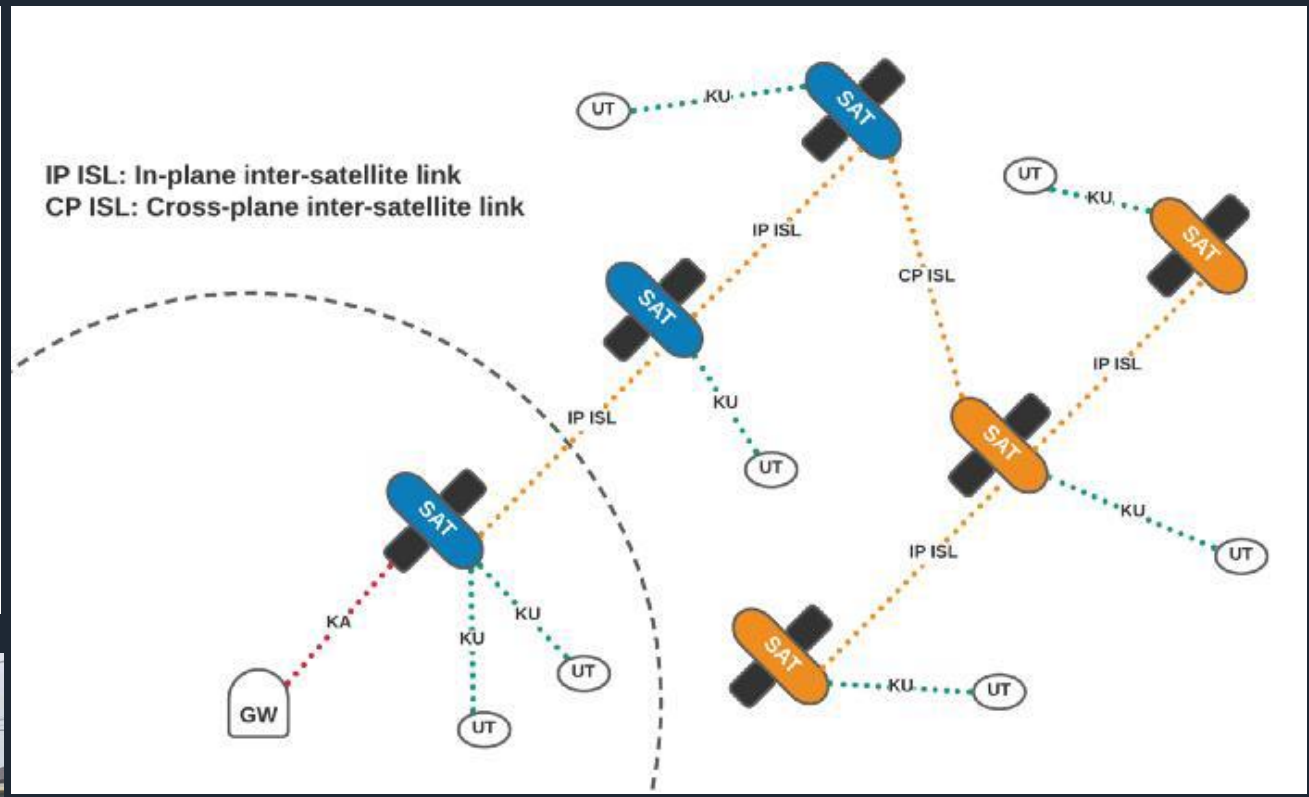
Starlink Network Overview

- Optical Inter-Satellite Links (ISL) used to communicate satellites in-plane and cross-plane
  - to ease the connectivity to the gateways from satellites without visibility.





- Each Gateway site typically features 9 antennas, in 3x3, 4-5, or 1x9 configuration.
- 8 Active antennas / 1 Standby.
- The gateways connect to Points of Presence (POPs) over high-capacity fiber.

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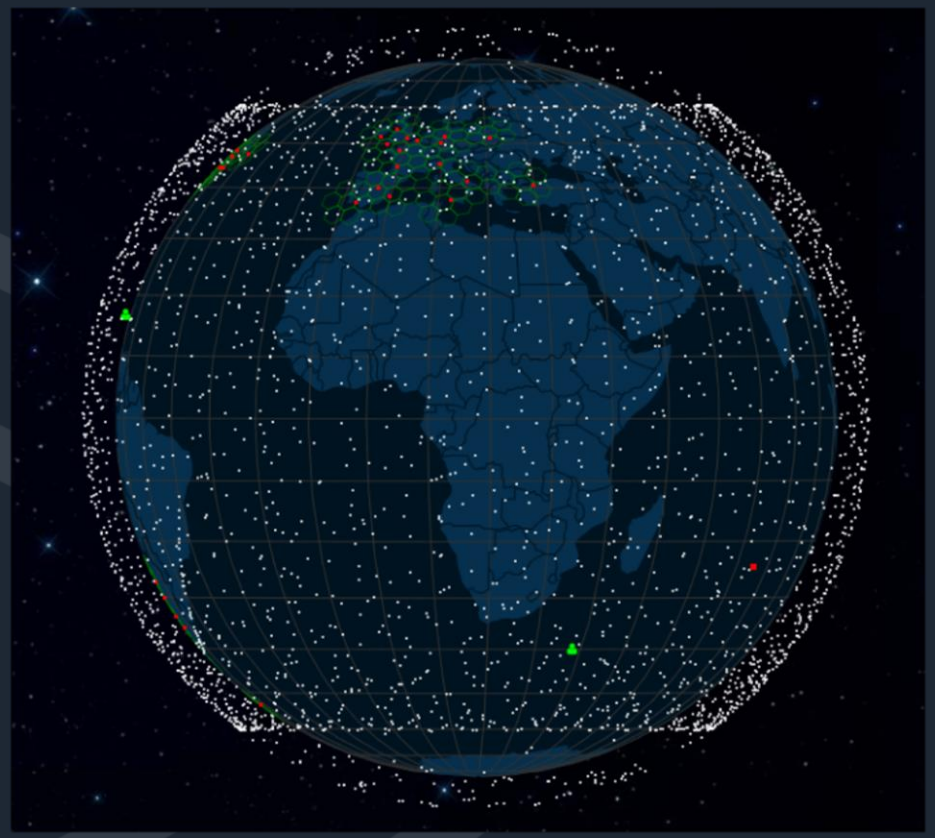
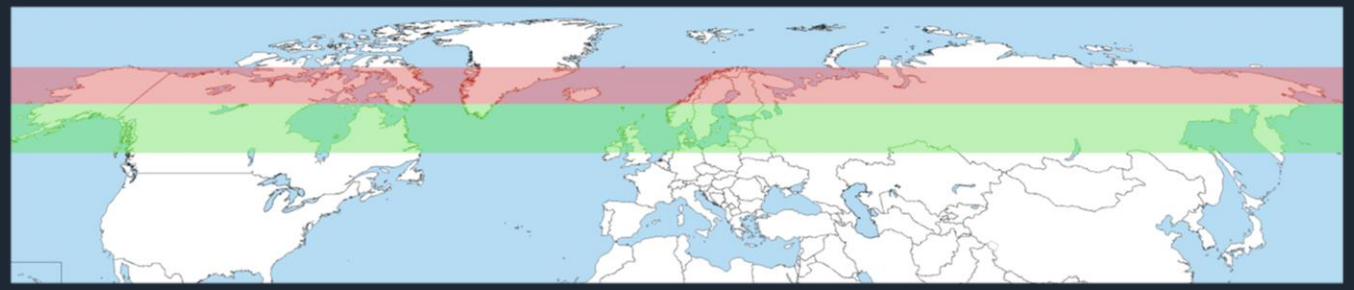
Geostationary Orbit (GSO) protection

To see a quick return of investment, Starlink launched most of its satellites with an inclination of +/- 53 degrees – main grid



- **Starlink uses the same Ku-Band as GEO satellites who have preference over LEO constellations.**
- ITU/FCC set limits on emissions from LEO to protect GSO
- Equivalent Power Flux Density (EPFD) Limits (not exceeding levels that would interfere with GSO
- GSO Arc avoidance: LEO satellites must mute their transmissions when they are in close angular proximity to GSO satellites.
- No TX zone is defined near the geostationary ring
- Decreased GSO protection angle from 18º to 10º



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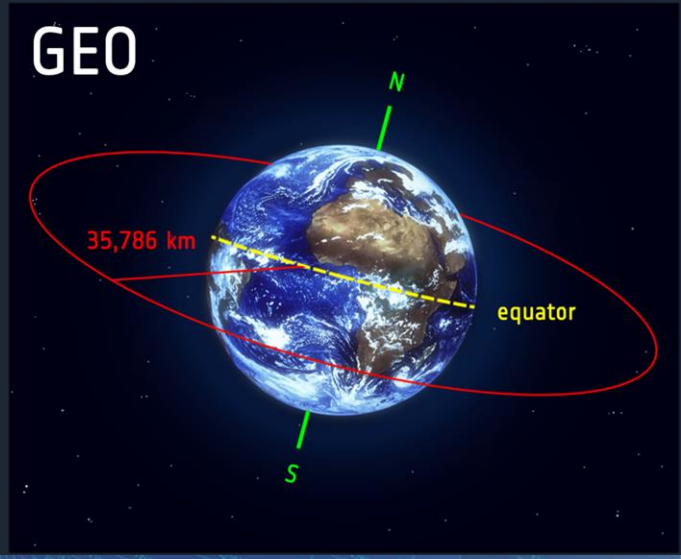
GSO protection examples

Palma ≈ 40 ° to GEO constellation

stellarium
latest version is 24.2

Filtering view to show
GEO Satellites



Norway ≈ 10 ° to GEO

No Starlink Tx (Transmit) zone towards
the geostationary ring

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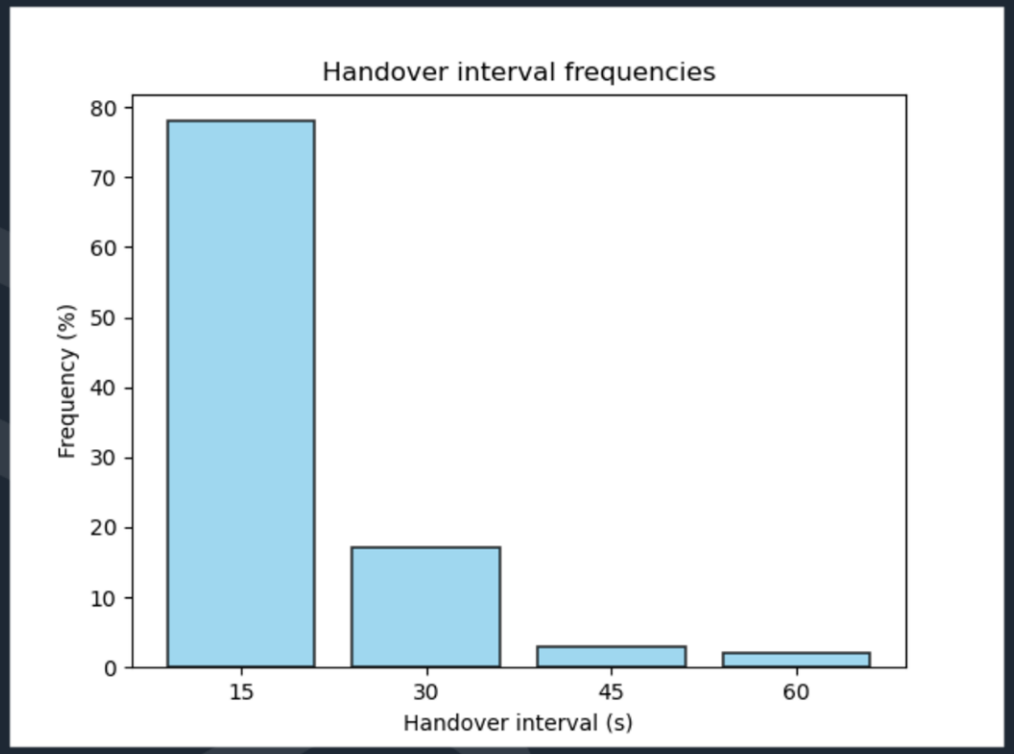
Starlink Handover Frequency and latency

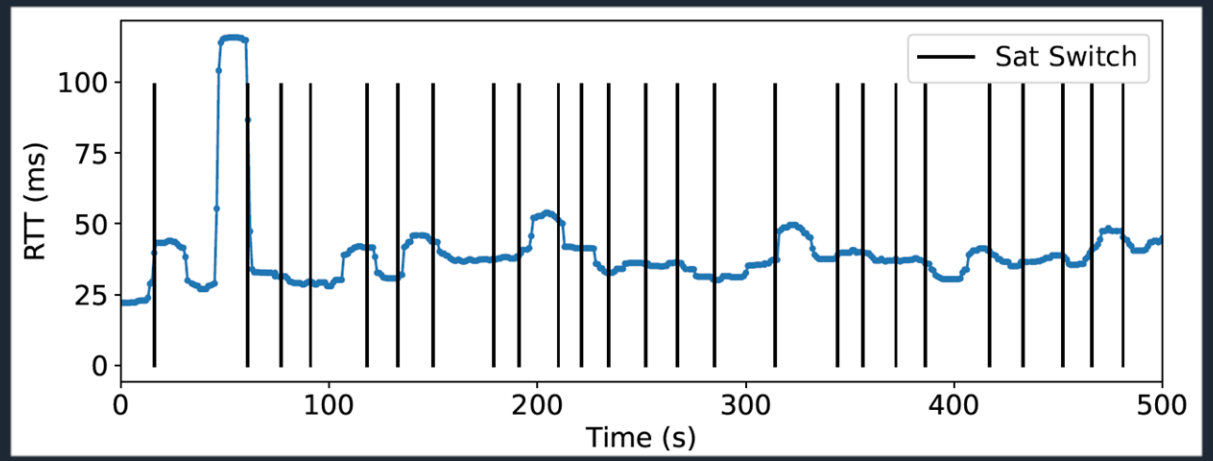
- Starlink uses a **Global Scheduler** that assigns **every 15 seconds** satellites/beams to terminals.
- Terminal does not decide the handover itself, rather the global scheduler

Data collected – OmniAccess experiments



- 80% of handovers are every 15 seconds
- Sometimes the antenna stays more than 15 seconds

Data collected – Stanford University, USA



- Latency is not always due to satellite change (handover), or satellite location.
- Sometimes due to traffic policies and priority
- Cruise package has top priority!

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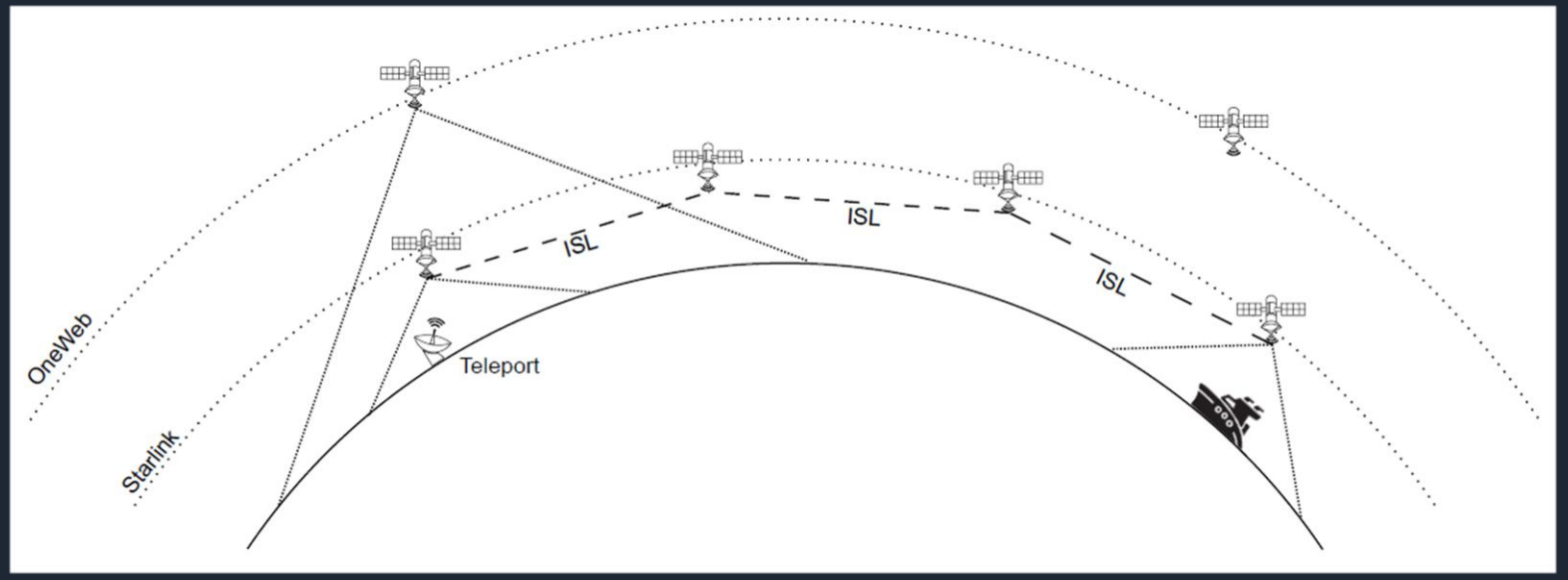
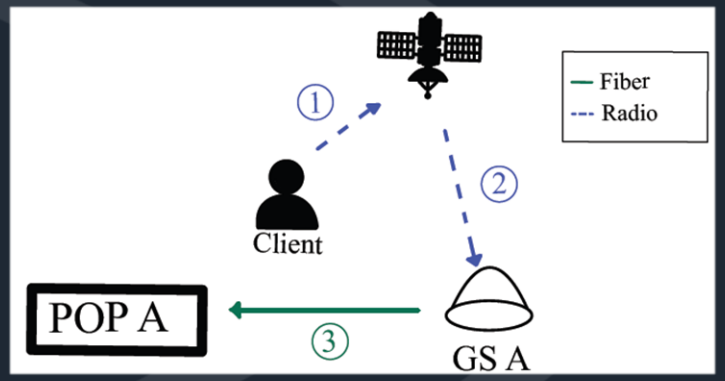
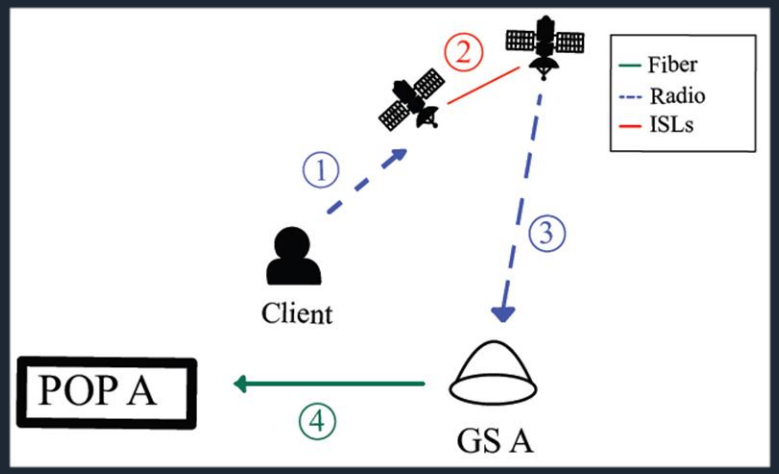
Routing options



- Paths from a **client to its POP** can vary in satellite hops and length
- Latency can be sometimes due to the path

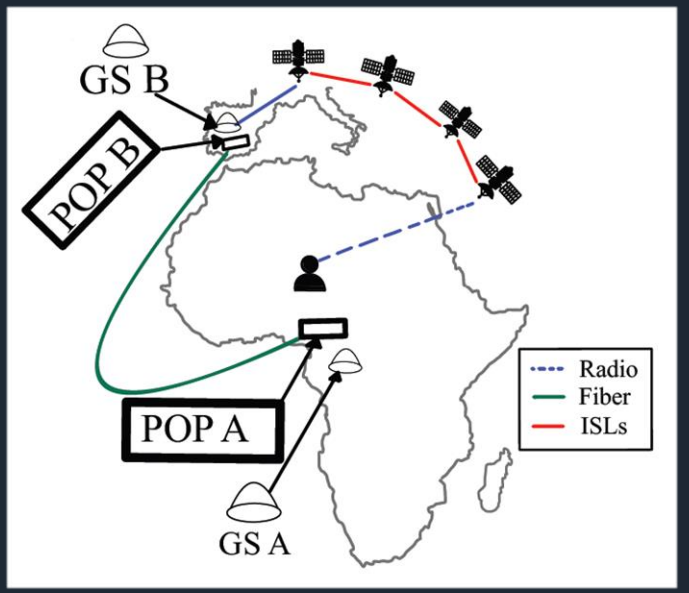


Single Hop Satellite Relay



ISL Routing to Nearest Ground Station

1st satellite does not have visibility to GS



ISL Routing to Far Ground Station

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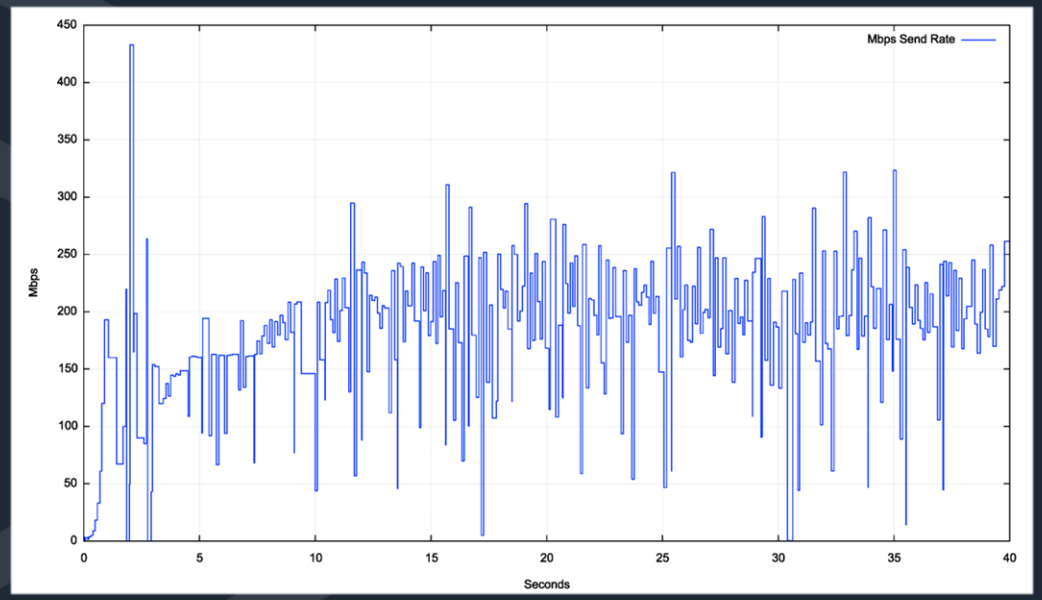
By Geoff Huston on 17 May 2024 – TCP CUBIC vs. BBR Testing results

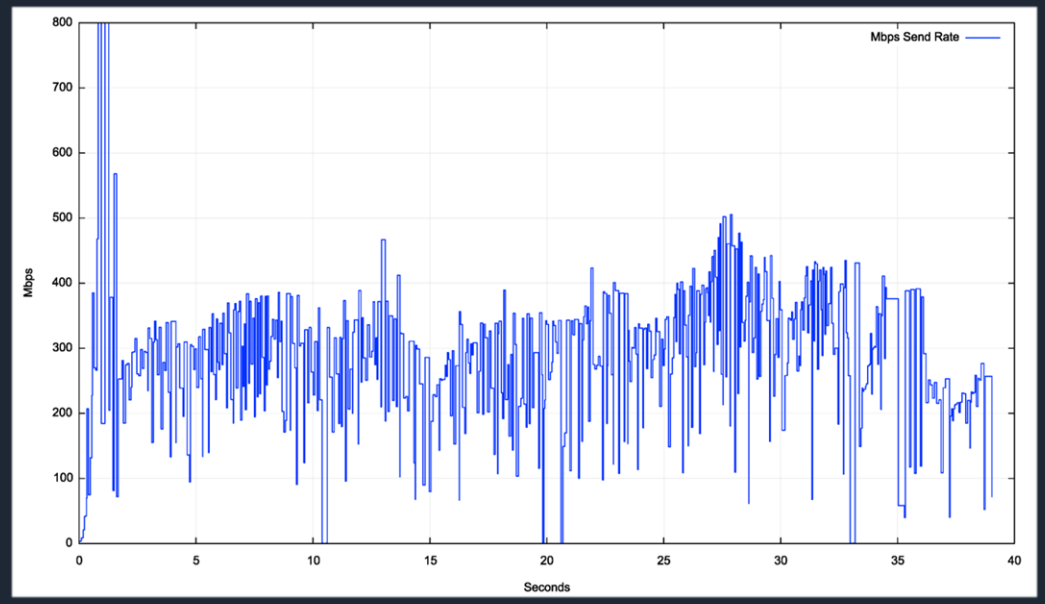
Starlink service has a very high jitter rate, a packet drop rate of around 1% to 2% that is unrelated to network congestion, and a latency profile that jumps regularly every 15 seconds

- **TCP (Transmission Control Protocol)** is the transport protocol that most applications use to communicate across the Internet
- In 2008, congestion control algorithm called **TCP CUBIC** was adopted (*loss-based TCP*)
- **Android, iOS, Linux, Mac or Windows** → chances are that your OS uses **Cubic** by default
- Using Cubic on vessels may lead to suboptimal performance, because a Vessel relies on Wireless links

- ✓ In 2016 Google introduced a **new congestion control algorithm** called **BBR** (Bottleneck Bandwidth and Round-trip propagation time)
- ✓ BBR attempts to position the TCP flow at the onset of network queue formation, rather than oscillating between full and empty queue states (as is the case in most *loss-based TCP* congestion control algorithms).
- ✓ **BBR is particularly well-suited for environments with high packet loss and latency, making it a better fit for maritime and other wireless communication.**



TCP CUBIC over Starlink, off-peak



TCP BBR over Starlink, off-peak

https://blog.apnic.net/2024/05/17/a-transport-protocols-view-of-starlink/

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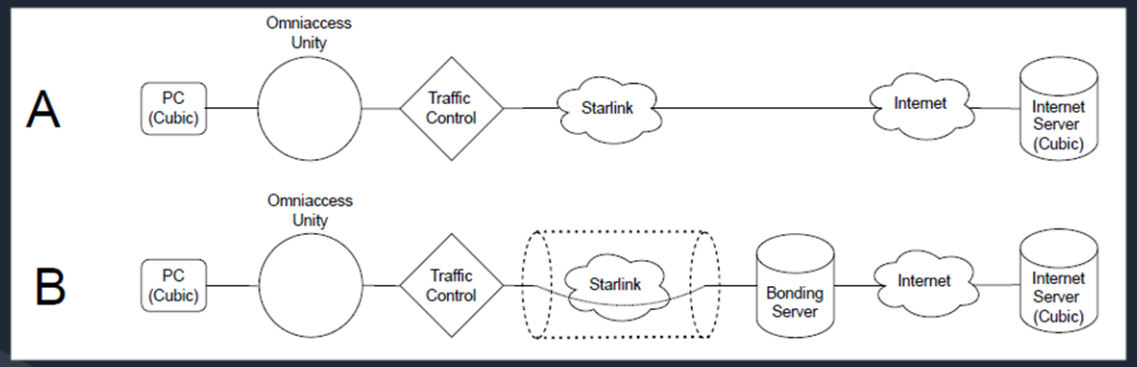
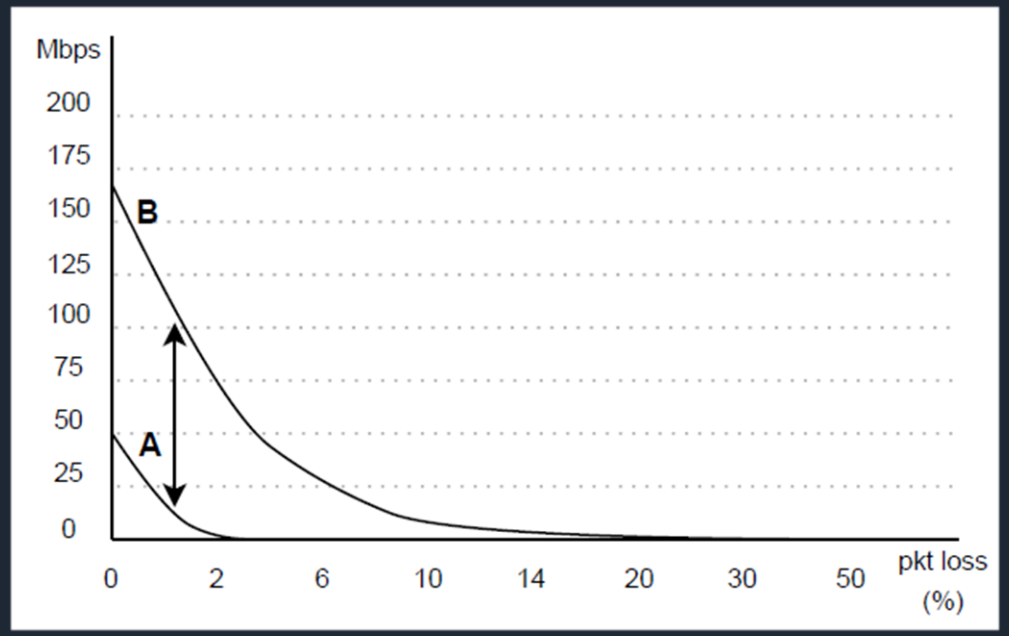
OmniAccess Bonding uses BBR

Omniaccess **Bonding** uses **BBR** to establish its tunnels towards the Bonding server



A → no bonding
B → Bonding

Field results



Test done for a single-file downloads

- *Bonding achieves three times the throughput at 0% packet loss.*
- *At 2% packet loss, bonding maintains 15 times higher bitrate*
- *Beyond 2%, Cubic performance drops to nearly zero, while bonding with BBR retains usability, achieving 25 Mbps at 6% packet loss*

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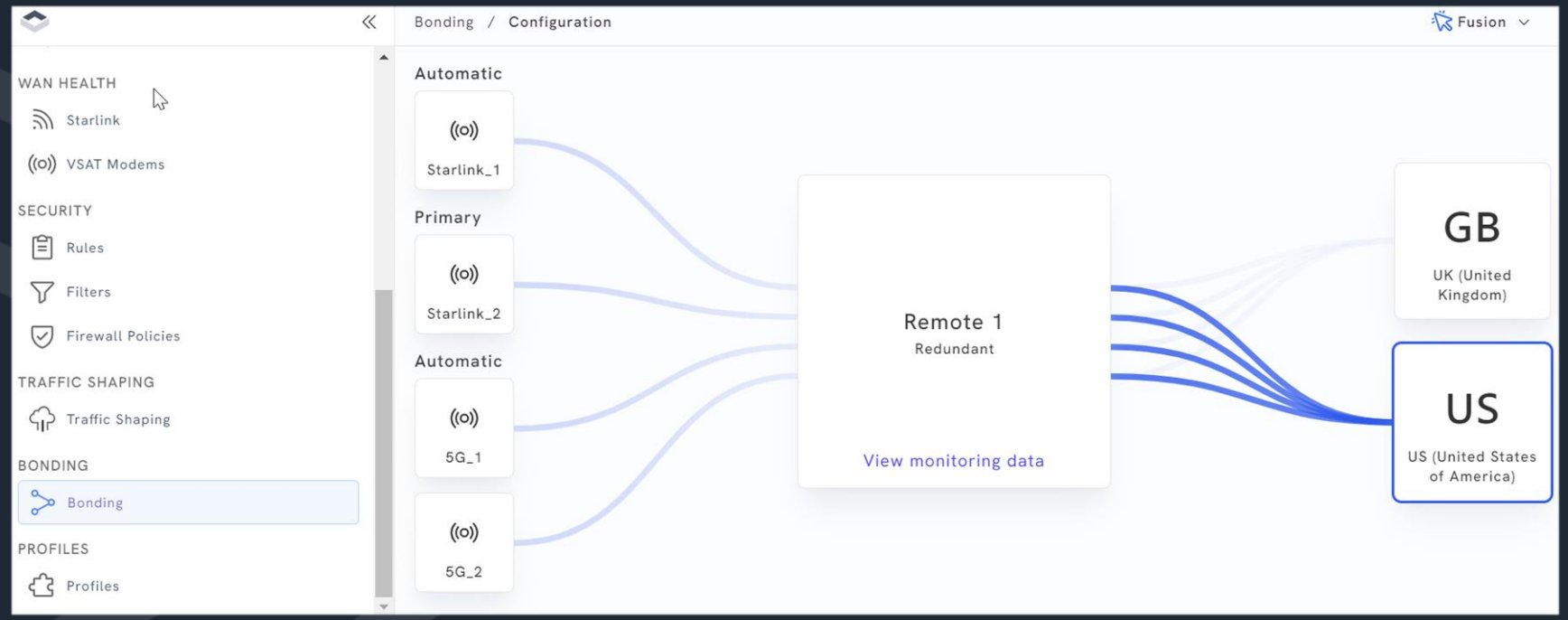
Bonding also has a Chose my IP feature

- Fusion Bonding combines multiple connections
- Increases speed and capacity while also providing resiliency
- Uses **BBR** for higher throughput and performance

- "Choose my IP" for regional internet contents from USA or UK.
  - i.e.: USA **internet breakout** allows watching USA content anywhere in the world.
- Streaming whitelisted (no blocking like the case of virtual/cloud hosted bonding servers)



Chose my IP

Locations OA is planning to add:
- Canada
- Australia
- Italy
- Spain
- Ireland
- Belgium
- Mexico
- Japan
- Netherlands
- Sweden
- Hong Kong
- Denmark
- Portugal
- Czech Republic
- Germany
- France
- Switzerland
- Singapore
- Poland
- Austria
- South Africa

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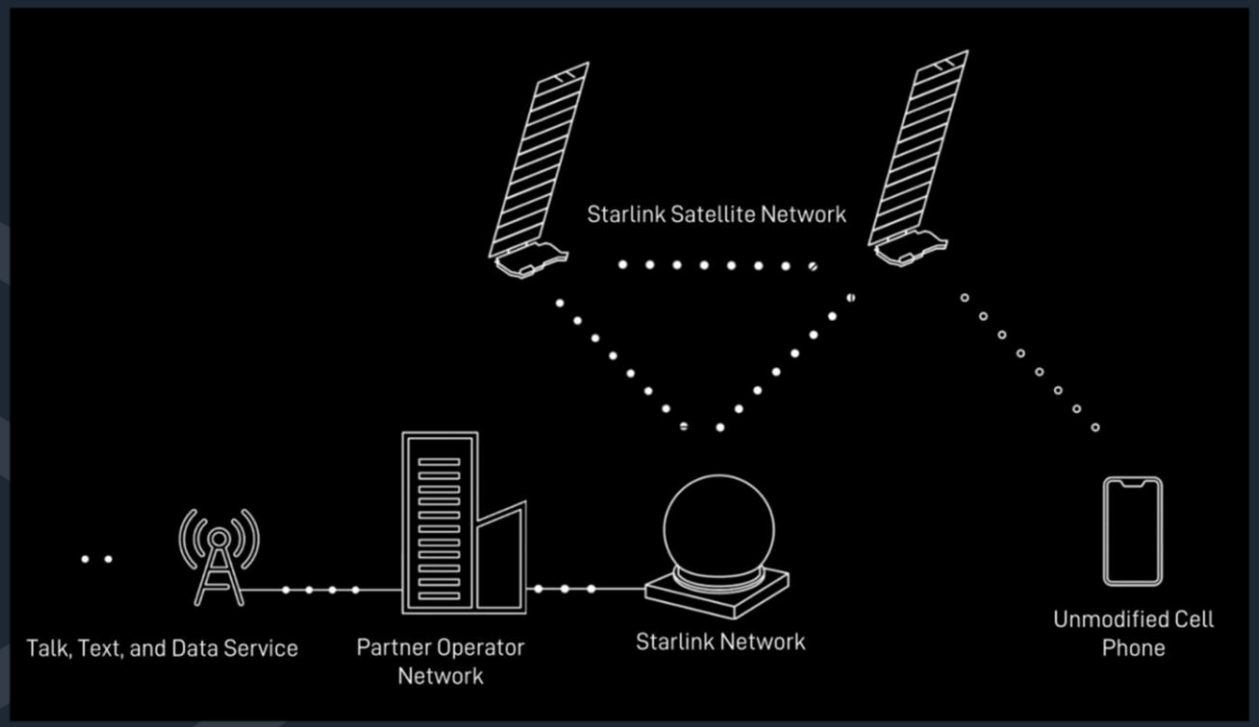
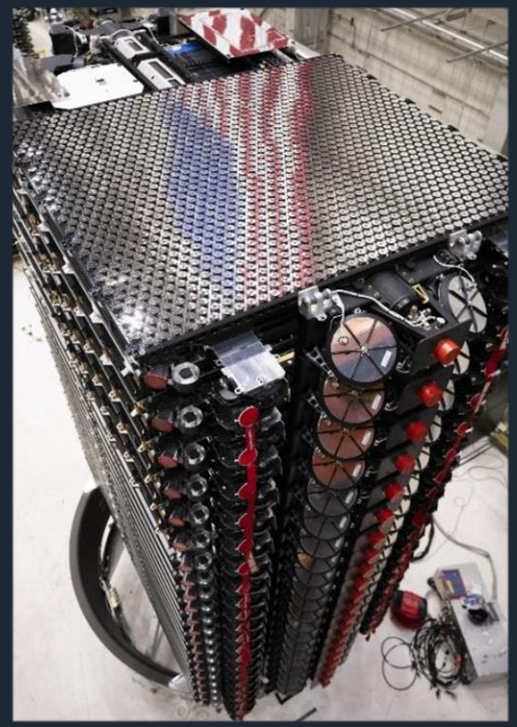
Starlink Direct to Cell

- On January 2, 2024, Starlink launched to orbit first six satellites with Direct to Cell capabilities.
- 1st text messages on January 8, using T-Mobile Network
- The Direct to Cell network to provide **text, voice, and data for LTE** phones and devices
- Text service begins this year, followed by voice, data, and IoT services in 2025





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Elon Musk: Cellular Starlink Will Offer Free Emergency Service to All Phones

Musk wants to make the cellular Starlink service free for emergencies, *as SpaceX is trying to secure regulatory clearance from the FCC*.

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OneWeb LEO Service plans

Bridge plan *theoretical usage*
CIR: 1.17 TB / m
MIR: 11.66 TB / m
Average: maybe between 4 to 6TB / m?

OneWeb ADVANCE LEO Portfolio	Allowance (GB)	MIR (Mbps)		CIR (Mbps)		User Terminals
		FWD	RTN	FWD	RTN	
Bridge	Unlimited	30	6	2.4	1.2	OW10HM
Anchor	20 GB	20	4	2	0.4	Peregrine u8* OW50M OW70M OW11FM
	40 GB					
Onboard	100 GB	20	4	2	0.4	
	250 GB					
Master	350 GB	50	10	8	4	
	500 GB					
	900 GB					
	Unlimited					
Ocean	1200 GB	75	15	12	6	OW70M
	2400 GB					
	Unlimited					
Ocean Pro	5000 GB	125	25	25	9	
	8000 GB					
	Unlimited					
Explorer 1	1200 GB	100	20	0	0	Peregrine u8 OW11FM
	2500 GB					
Explorer 2	1000 GB	200	40	0	0	2 x Peregrine u8 2 x OW11FM
	2500 GB					
	5000 GB					
	10000 GB					

Intellian OW10HM (half-duplex)

Ongoing type approval

Intellian OW11FM

Kymeta Peregrine u8

OW70M

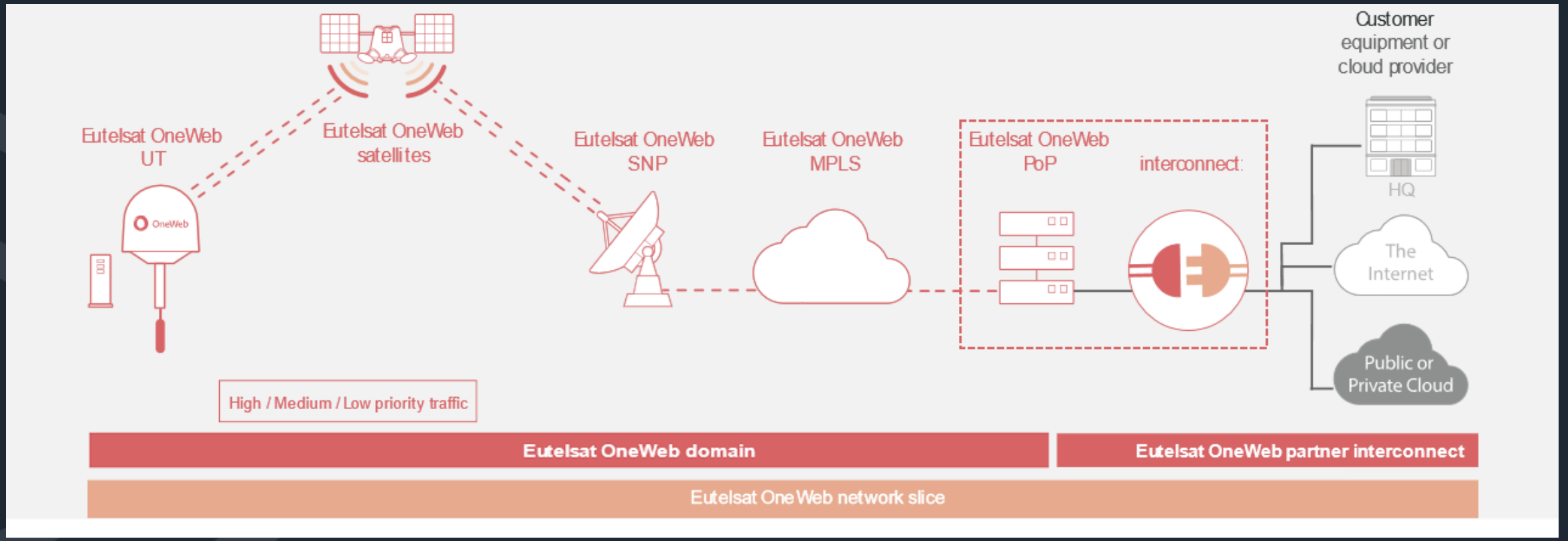
* CIR 6x3 when using Peregrine u8 with "Master" plan

- 12 month term as standard
  - 30% premium for < 12 month term
- Bolt-on data can be added in advance at lower GB rate to avoid overage
  - Overage charges apply automatically when exceeding plan allowance

Bolt-on data:
Volume
50 GB
250 GB
1,000 GB

Eutelsat OneWeb service sells through Partners

- Service goes through Partner infrastructure for internet breakout
- Partner is an authorised third-party provider, i.e.: OmniAccess
- Service does not sell directly to end-user



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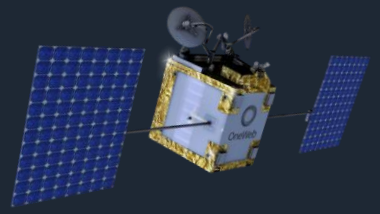
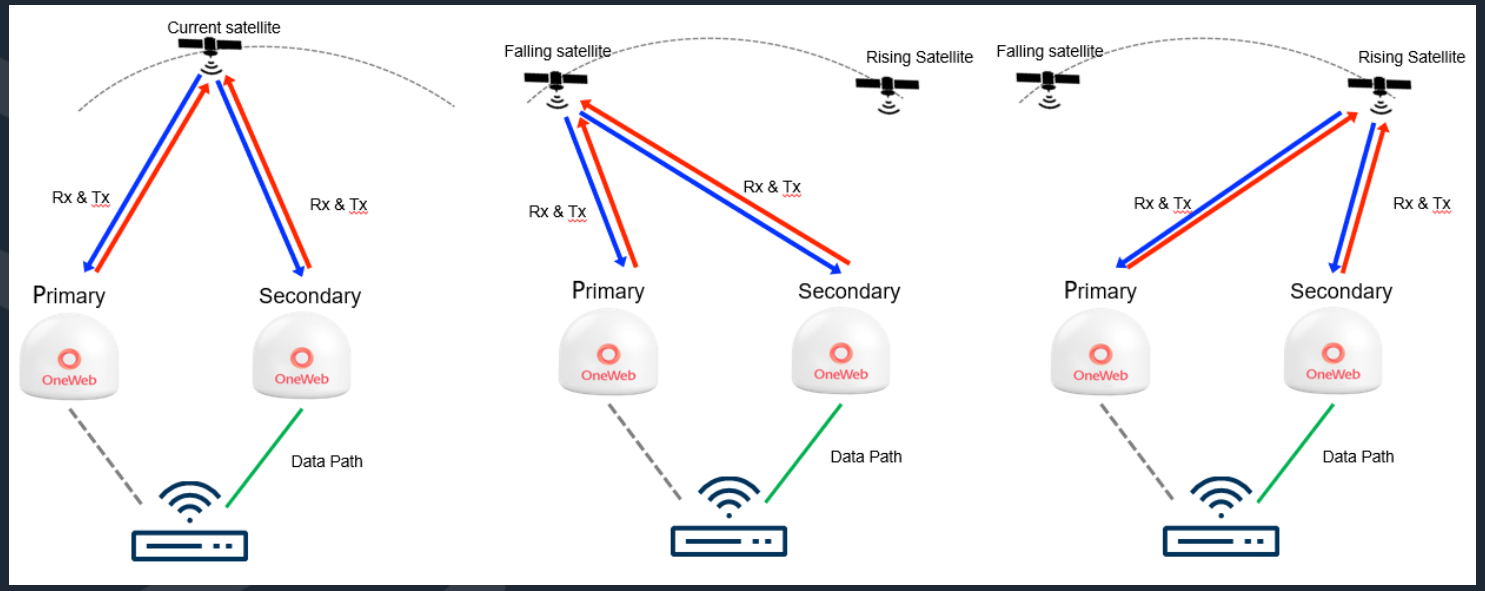
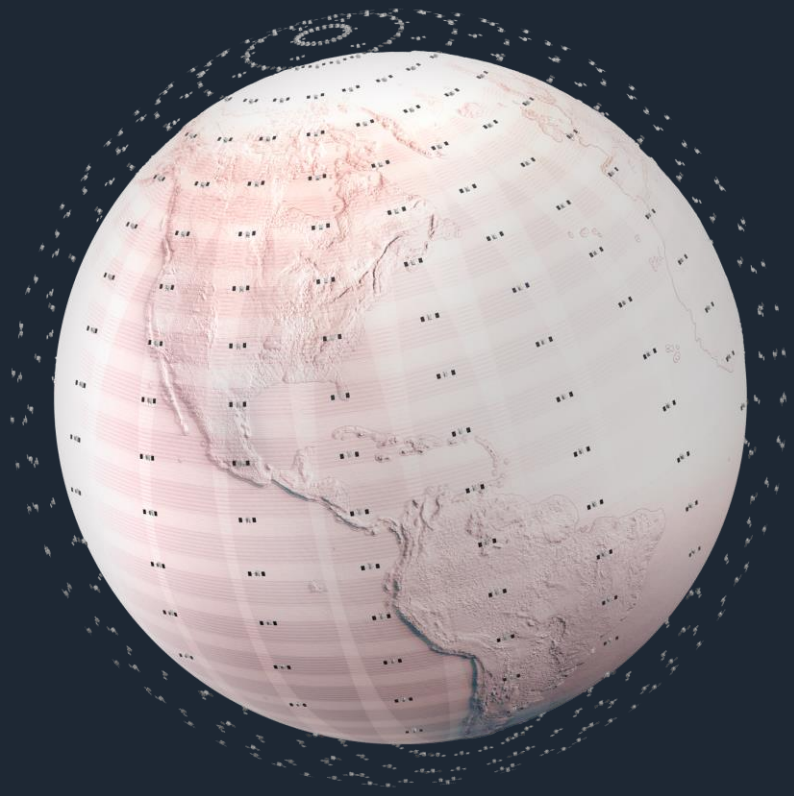
Technical workaround and fixes

- Satellite Pairing – Beam Super Smash
- Ring morphing initiative – Spread the plane
- OW70M performance improvement with the new software upgrade
- New satellites launch







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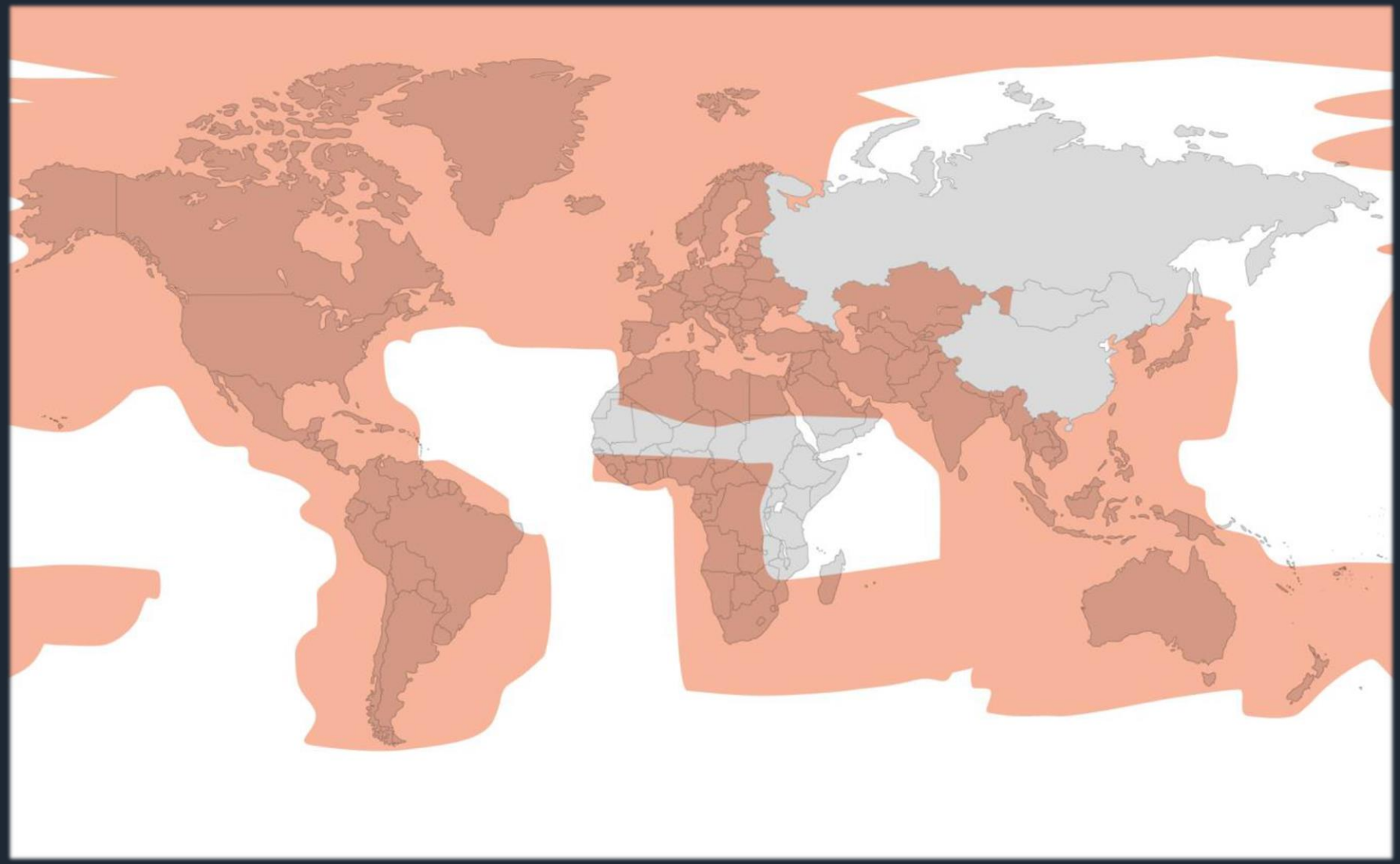
OneWeb – Coverage Forecast – September 2024

FORECAST BASED ON 38 SNPs DEPLOYED GLOBALLY

- Coverage* subject to supply activation, satellite beam
- performance and satellite access
- point (antenna) overruns.
- Coverage and network availability at the edges improving with continued
- roll-out of adjacent SNPs.
- Concurrently, a service improvement plan is being rolled-out globally.



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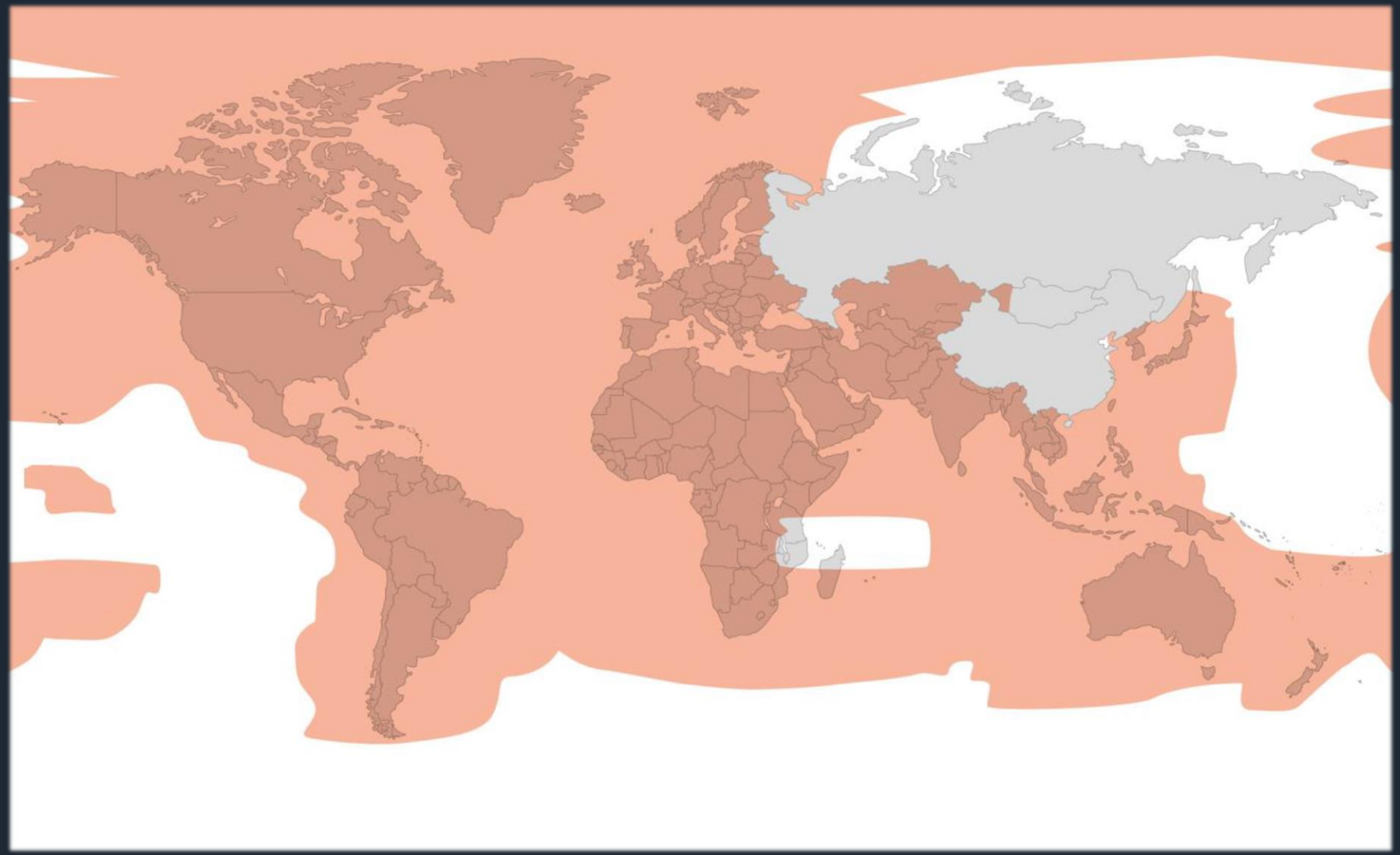

Where Does the GEO Piece Fit in Satellite's Future?

- It's a matter of physics: GEO stays at a fixed point in the sky relative to any location on the ground
- Simplest orbit to communicate with
- Less beam and satellite switching
- Less packet loss, less jitter
- Guaranteed bandwidth – GEO is still the "King of CIR" - SLA

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NG-Firewall
WAN Manager
LAN Manager
WAN Bonding
VPN System
Cybersecurity
Captive Portal
VM Hosting

THE MODULAR UNITY

a single Platform to manage ALL

Cybersecurity
Threat Detection
NextGen Firewall
....

WAN Selection
SDWAN
Bonding
Choose my IP
Connectivity Mgr
Connectivity

IT & Cloud
IT management
VM Hosting
Cloud Services
....

LAN Monitoring
LAN Management
WIFI Management
....
Network

User Management
Captive Portal
User Profiles
Network Access Control
....

Single System

Hot-Standby Systems

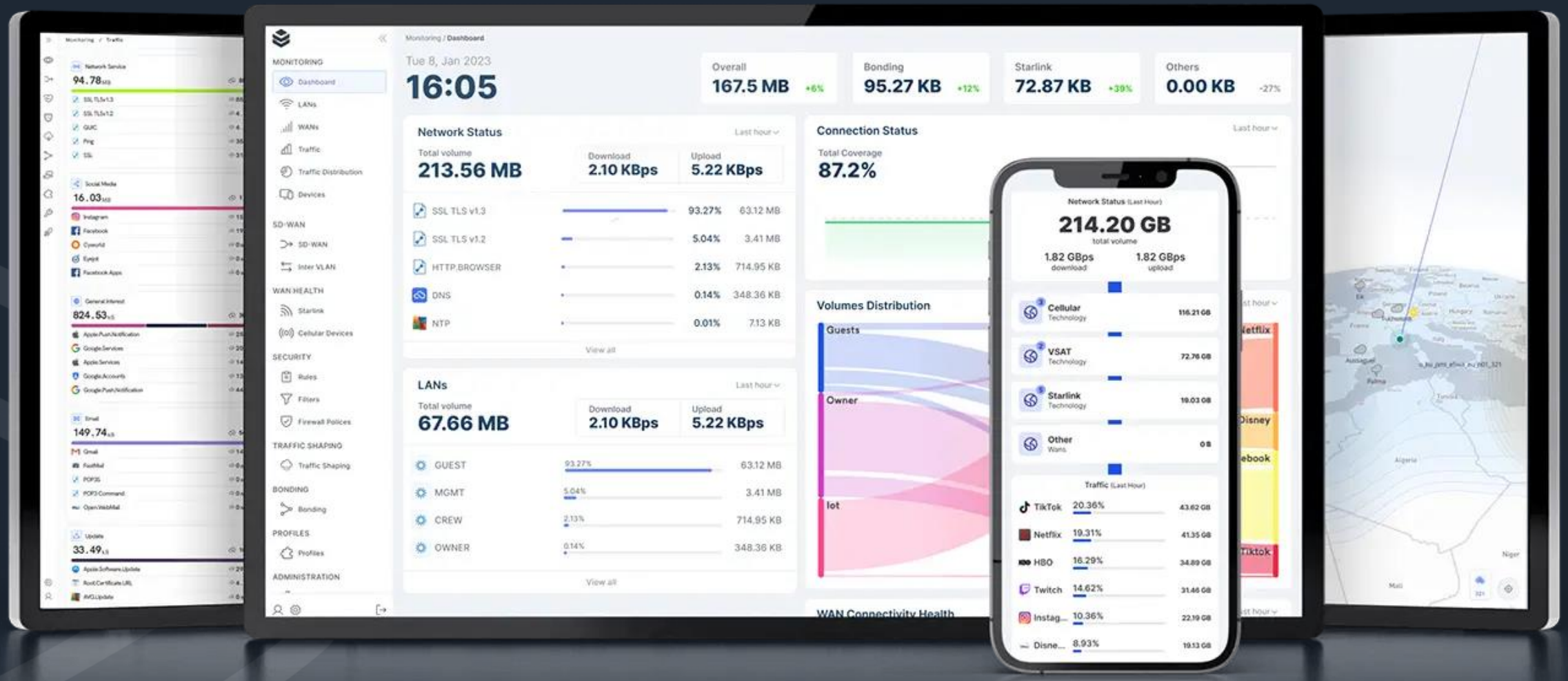
High-Availability Systems

OMNIACCESS

OmniAccess UNITY Platform

UNITY is at the heart of your vessel's digital transformation. It guarantees seamless connectivity, cybersecurity, and flawless onboard networking, delivering the ultimate digital experience for guests and crew alike.

https://www.omniaccess.com/solutions/unity/



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Cyber Security drivers

Principally either Regulation or Cyber attacks
+ [Cyber] Insurance costs ?

accelerated by LEO and Digitalisation

Cyber attacks

2023	• DNV: LockBit ransomware
2020 - 2022	• Port of Lisbon: LockBit ransomware • Port of Houston: vessel operations • IMO: IT systems and website • CMA CGM: "Ragnar Locker" - shipping, port operations & data breech • MSC: customer website
2017	• Saudi Petrochem: "Triton" - OT safety systems • Maersk: "Not Petya" (300m $)
2012	• Saudi Aramco: Shamoon (1 Billion $)

Information Technology (IT)

→ Mainly finance and reputation risks

Operational Technology (OT)

→ Life, Property & Environment + above risks

Even Cybersecurity leaders get attacked !

(6) Data Breach Hits Cyber Giant Fortinet | LinkedIn

CSH Cyber Security Hub Newsletter

Data Breach Hits Cyber Giant Fortinet

September 13, 2024

Cybersecurity leader Fortinet has acknowledged a data breach after a threat actor claimed to have stolen 440GB of data from the company's Microsoft Azure SharePoint server

The individual also shared login credentials, allowing other hackers to download it.

Fortinet confirmed that the breach involved customer data from a "third-party cloud-based shared file drive.

The **threat actor**, operating under the alias "**Fortibitch**" demanded ransom. However, the company refused to comply.

According to Fortinet an individual gained unauthorized access to a limited number of files stored on Fortinet's instance of a third-party cloud-based shared file drive. This included limited data related to a small number of Fortinet customers.

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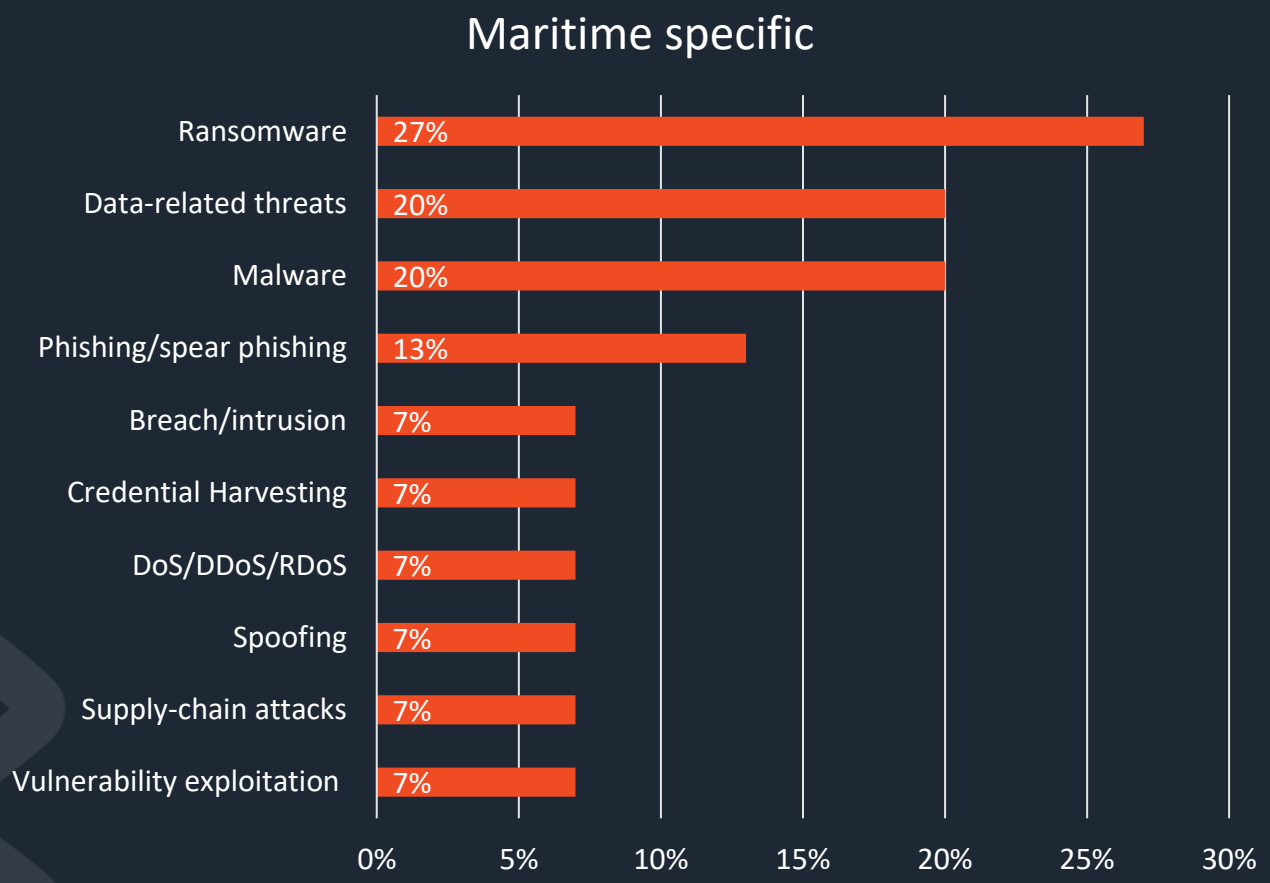
Maritime Threats in 2023



Ref: ENISA THREAT LANDSCAPE: TRANSPORT SECTOR (March 2023)

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Regulations & Compliance

MSC.428(98)

NIS2

1. Management accountability
2. Reporting to authorities
3. Risk Management
4. Business Continuity

UR E26

For the ship as a collective entity for cyber resilience

UR E27

for third-party equipment suppliers

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Evolution of Maritime regulation

2018

2019

BV NR 659

Additional class notations for NS, NC, equipment

2020

IACS Rec 166

Recommendations for NC and equipment

2021

IMO Res 428

Cyber Security for NS

MANDATORY + PORT STATE CONTROLS

2022

IACS UR E26
IACS UR E27

Requirements for NC and equipment

2023

Rec. 171

Cyber Risk in SMS

2024

MANDATORY Cyber security Requirements

All Class Societies NC and Equipment

NS: Navigational Systems
NC: Networked Communication

IMPLEMENTATION PHASE

OMNIACCESS

Cybersecurity
Services around the NIST Framework

The industries largest database for Maritime Threats thanks to +1000 Vessels currently monitored

Custom Threat Intelligence for Customers

OmniAccess Open CTI Platform

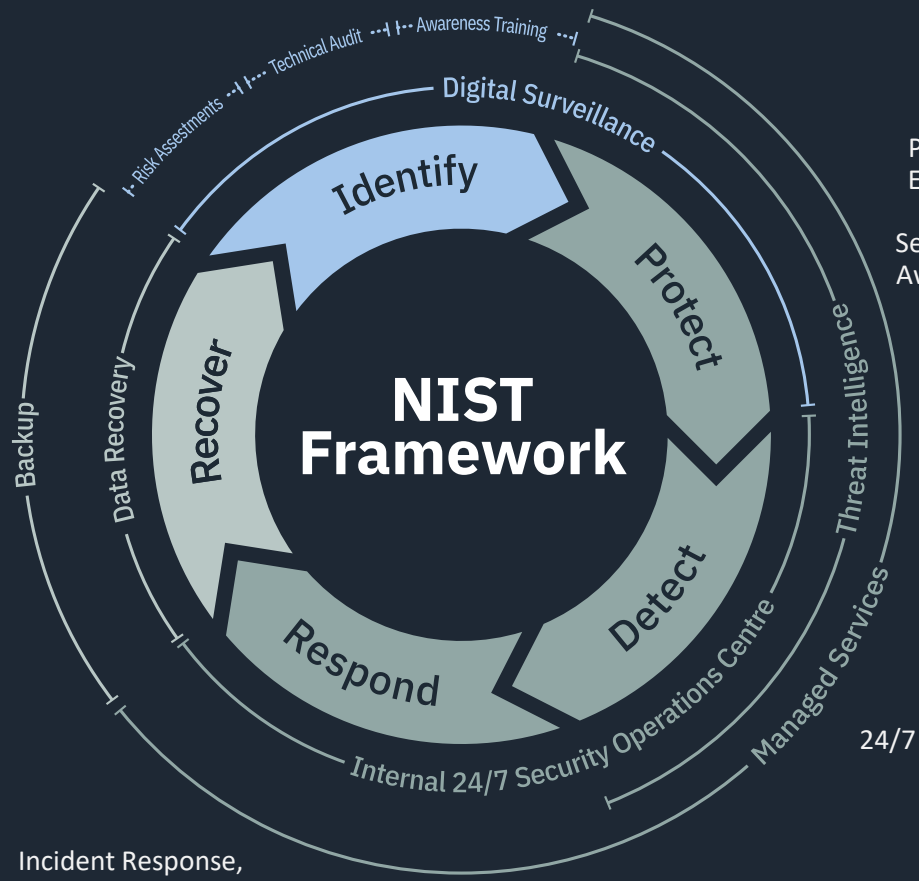
OmniAccess SOC

FORTINET splunk> AVANAN THE CLOUD SECURITY PLATFORM cisco

CROWDSTRIKE paloalto NETWORKS tenable Microsoft

Threat Detection, Risk Assessment, Vulnerability Scan, Penetration Test, OSINT report

Forensic Analysis, Backup, etc.



Policies, Antivirus, EDR/XDR, IDS/IPS, Network Segmentation, Crew Awareness Training, MFA, zero trust

SOC
24/7 Security Operations Center

Incident Response, Firewall and Network Reconfiguration, Access and Authentication Review

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Cybersecurity

Predefined Packages that can be customized a la carte

	Threat Detection	CyberSec	CyberSec+
	Our fully certified 24/7 SOC team is constantly vigilant to identify any suspicious activity or breaches.	Fully managed perimeter and endpoints protection, with secured third parties' VPN access.	Fully managed advanced perimeter and LAN protection, with continuous assessment of the vessel's security posture.
Threat Detection	✓	✓	✓
Alerting & Monitoring	✓	✓	✓
Reporting & Dashboards	✓	✓	✓
Threat Intelligence	✓	✓	✓
External VPN		✓	✓
Endpoint Protection (EDR)		✓	✓
Perimeter Protection (Managed Firewall)		✓	✓
Email Protection (Managed)			✓
Advanced Threat Detection & Response			✓
Risk Assessment			✓
Vulnerabilty Scan			✓
Penetration Test / Technical Audit			✓
Intrusion Detection/ Prevention System (IDS/IPS)			✓

Professional Services

Tailored expertise at your disposal whenever you need it. Contract our professional services whenever you need additional protection.

CyberSec	Intelligence
Risk Assessment	Digital Footprint
Test /Technical Audit	VIP Digital Protection
Vulnerability Scan	Deep & Dark Web Investigations / Analysis
Forensics	
Data Recovery	
Awareness Training	

OMNIACCESS

Cybersecurity
In-house Security Operations Center

- 24/7 detection and response
- Continuous Threat Intelligence.
- Advanced threat alerts correlation and analysis tools.
- Real-time alerting and reporting.
- ISO 27001 Certified

OMNIACCESS

THANK YOU!

marwan.chartouny@omniaccess.com