OmniAccess

IRSO - 2023

The advantages of secured multi-WAN maritime connectivity

www.OmniAccess.com

CONNECTIVITY OPTIONS ON A VESSEL

Satellite
Global coverage
dedicated
and/or
best-effort

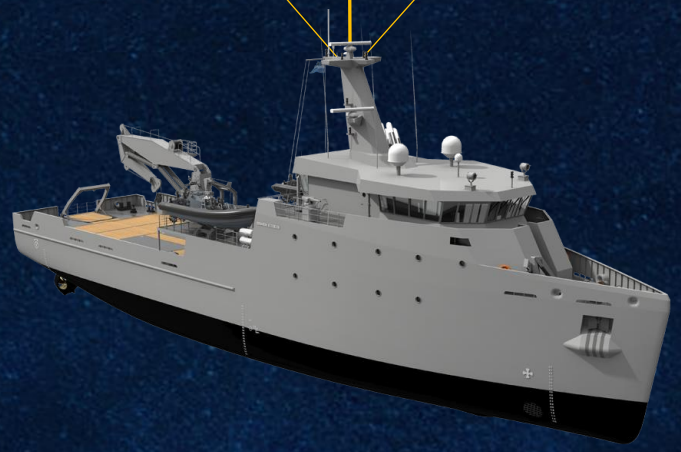
Satellite

Cellular
Shore-based, best-effort

4G/5G

Shore WiFi

Shore WiFi
Shore-based
P-t-P



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GEO / MEO / LEO

- GEO: Geo-stationary Orbit
- MEO: Medium Earth Orbit
- LEO: Low Earth Orbit

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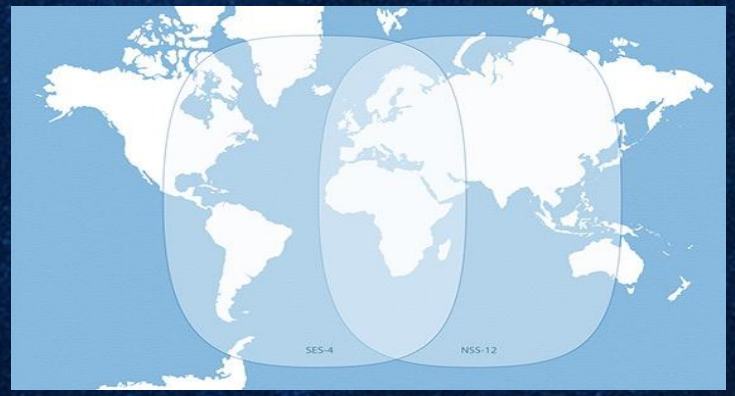
SATELLITE FREQUENCY BANDS

C-band

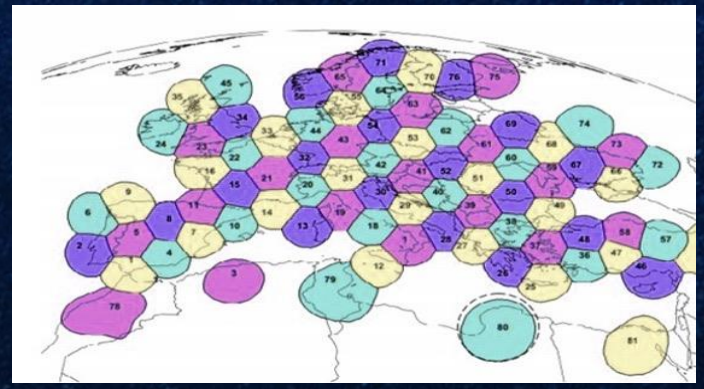


- ✓ Only used by VSAT GEO.
- ✓ Very Large footprints.
- ✓ Global coverage.
- ✓ Weather resistant.
- ✓ Large antennas (2.4m).
- ✓ 4 to 8 GHz range

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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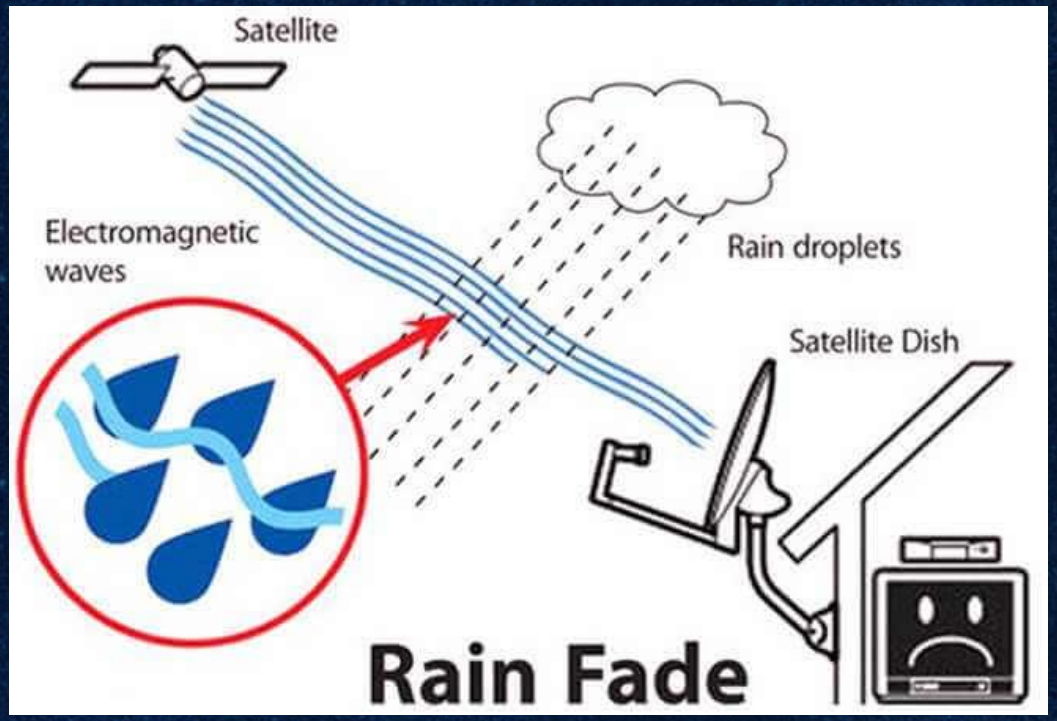
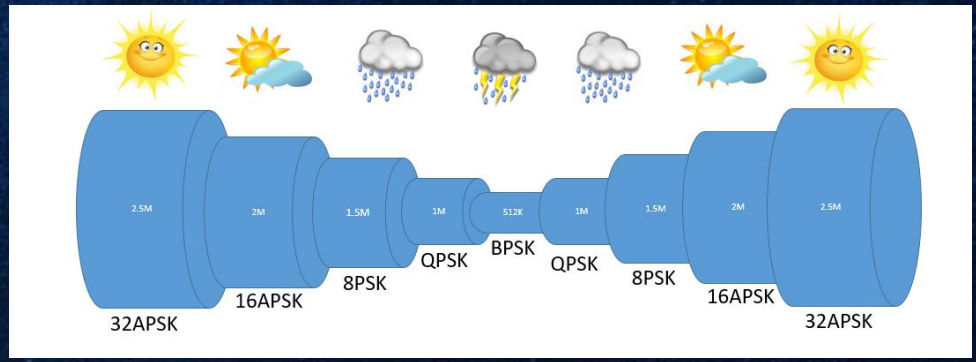
Signal fades and mitigation techniques

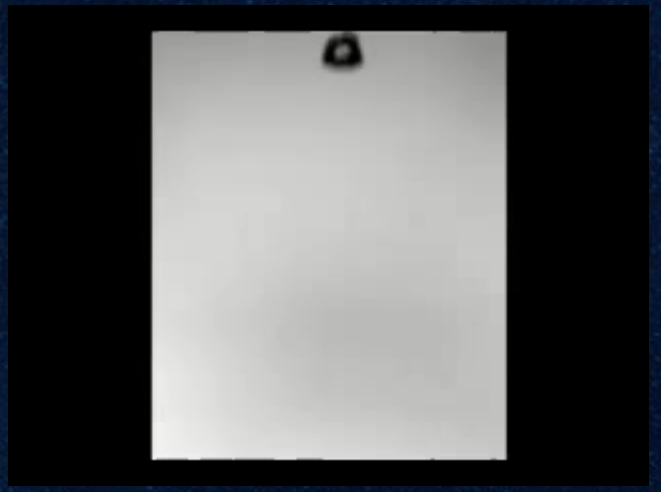
Several effects must be considered (ITU-R P.618-13)

- Attenuation by **rain**
- Attenuation by atmospheric gases
- Attenuation by clouds, sand and dust storms
- Etc.



Adaptive Coding and Modulation (ACM)





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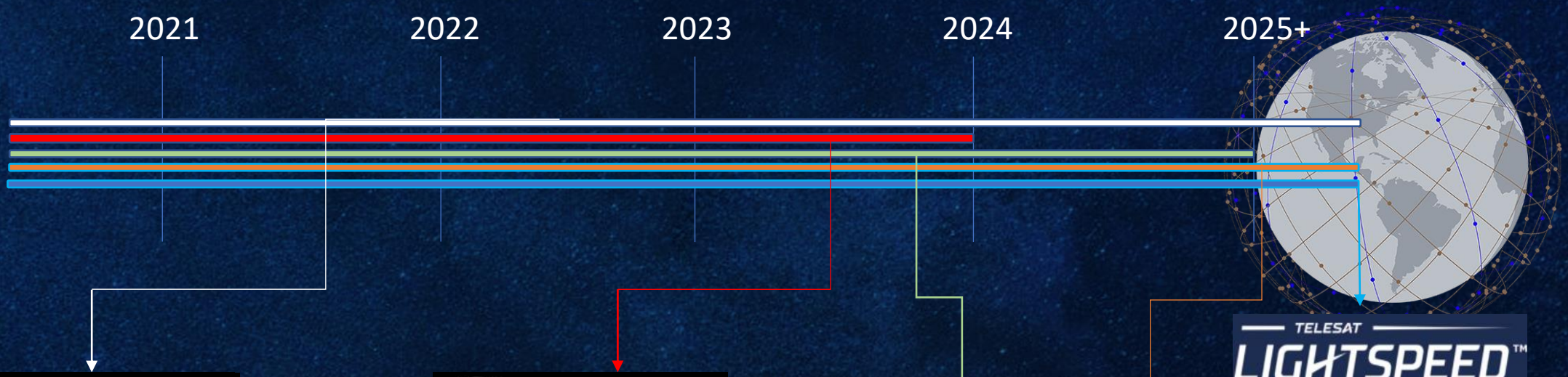
MEO/LEO: CONSTELLATIONS

2021 2022 2023 2024 2025+



STARLINK

- 3,580 satellites in February 2023, (applied for up to 42,000)
- Ku band service to UT
- Best effort capacity ONLY

OneWeb

- 648 satellites – 618 already in orbit
- 588 active satellites – 60 spares
- Ku band service to UT
- Burstable and dedicated capacity with network SLAs

TELESAT LIGHTSPEED™

- 298 Satellites
- Ka band service
- Dedicated capacity, for high-end mobility

O3b mPOWER

- 2 satellites in Dec-22, up to 40 in total
- Ka band service to UT
- Dedicated capacity

amazon Project Kuiper

- 3200+ satellites
- First 2 prototype satellites launched on October 6th, 23
- 100 to 400 Mbps

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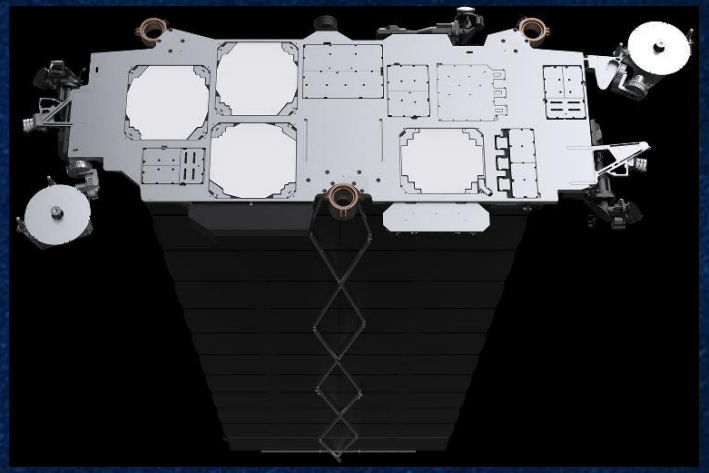
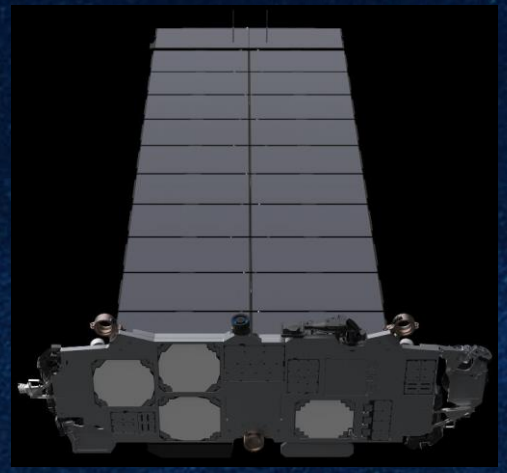
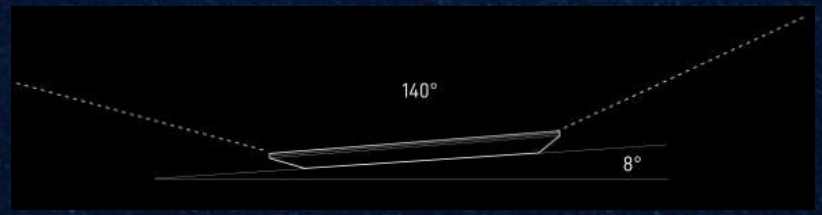
Starlink LEO Service





- Starlink, by SpaceX , is a LEO constellation of thousands of satellites that orbiting above earth at about 550km
- Each satellite uses:
  - **Satellite → U**T: Ku band:
    - 4 powerful **phased array** antennas: 3 for Downlink / 1 for Uplink
    - Each antenna projects 8 beams in 2 polarizations.
    - A total 48 downlink beams and 16 uplink beams
  - **Satellite → Gateway**: Ka band: 2 parabolic antennas
- New Satellites feature a single solar array
- Best Effort service (**MIR** only):
  - 220/25Mbps (Down/Up)
- Starlink states Global Coverage by now
  - **However**, in coastal waters it is subject to regulatory approval.



Flat High-Performance antennas are used for the maritime service

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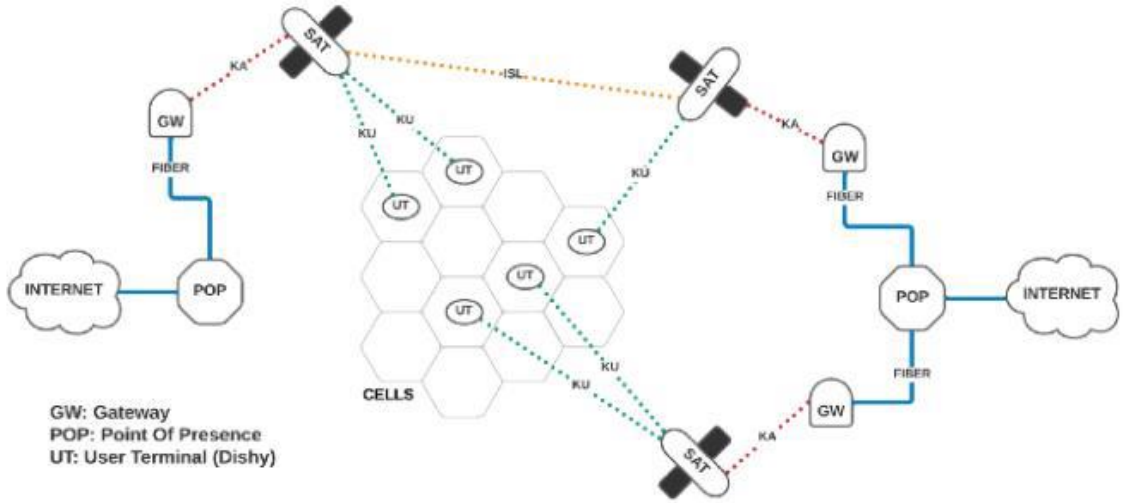
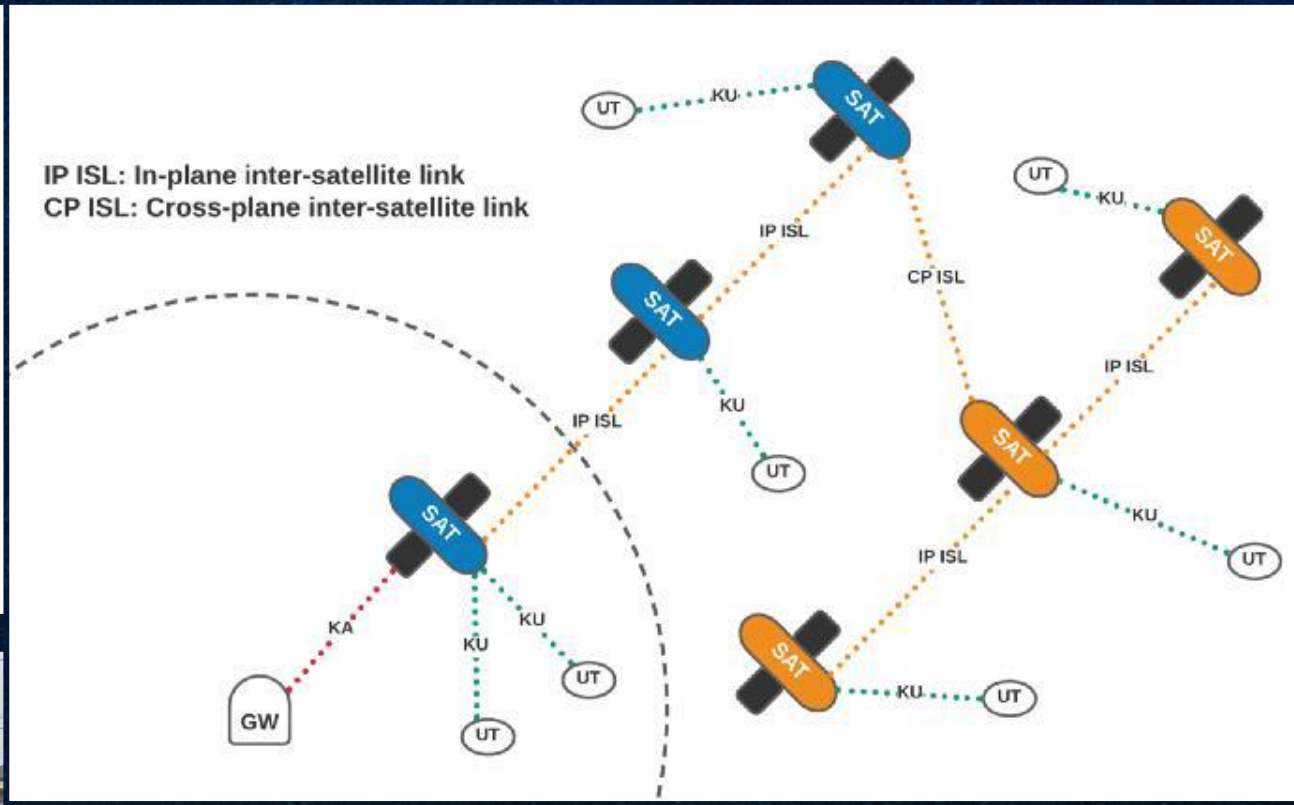
Starlink Network Overview

- 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.





Ibi (Alicante) Starlink gateway

- 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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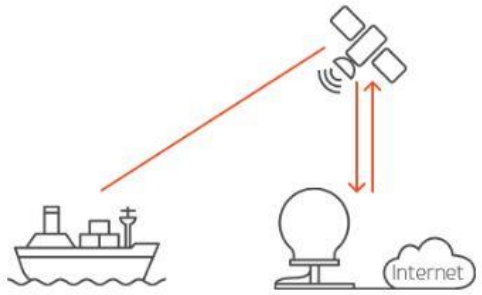
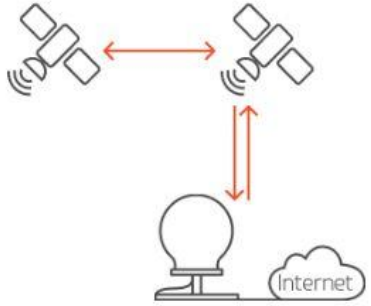
Starlink Satellites

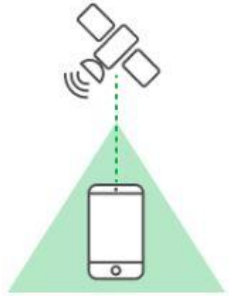
There are three versions of the Starlink satellite: version 1, version 1.5, and version 2.



Version 1 satellite is small and uses Ka signals to communicate with the Earth.



Version 1.5 satellite adds inter-satellite communication, meaning that it can communicate with other satellites without needing an Earth station directly beneath it. This could potentially reduce the number of required Earth stations.



Version 2 satellite is currently being launched and is significantly larger, weighing 1,000 kilograms more.
It will offer mobile service and is planned for 2023.

V1.0	V1.5	V2.0
Design: Flat panel with single solar array	Design: Flat panel with single solar array	Design: Flat panel with single solar array
Band to Ground station: Ka Band to terminals: Ku	Band to Ground station: Ka Band to terminals: Ku	Band to Ground station: Ka Band to terminals: Ku
Weight: 260 kg	Inter-sat Laser system	Inter-sat Laser system
Launch date: November 2019	Weight: 295 kg	Mobile service
	Launch date: January 2021	Weight: 1,250 kg
		Launch date: Planned 2023

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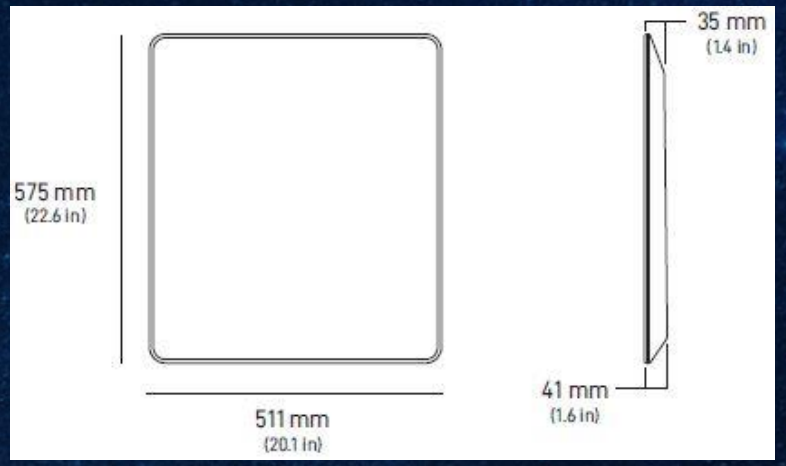
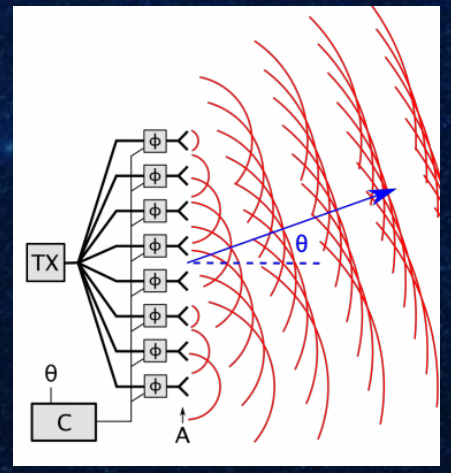
Starlink Maritime Terminal

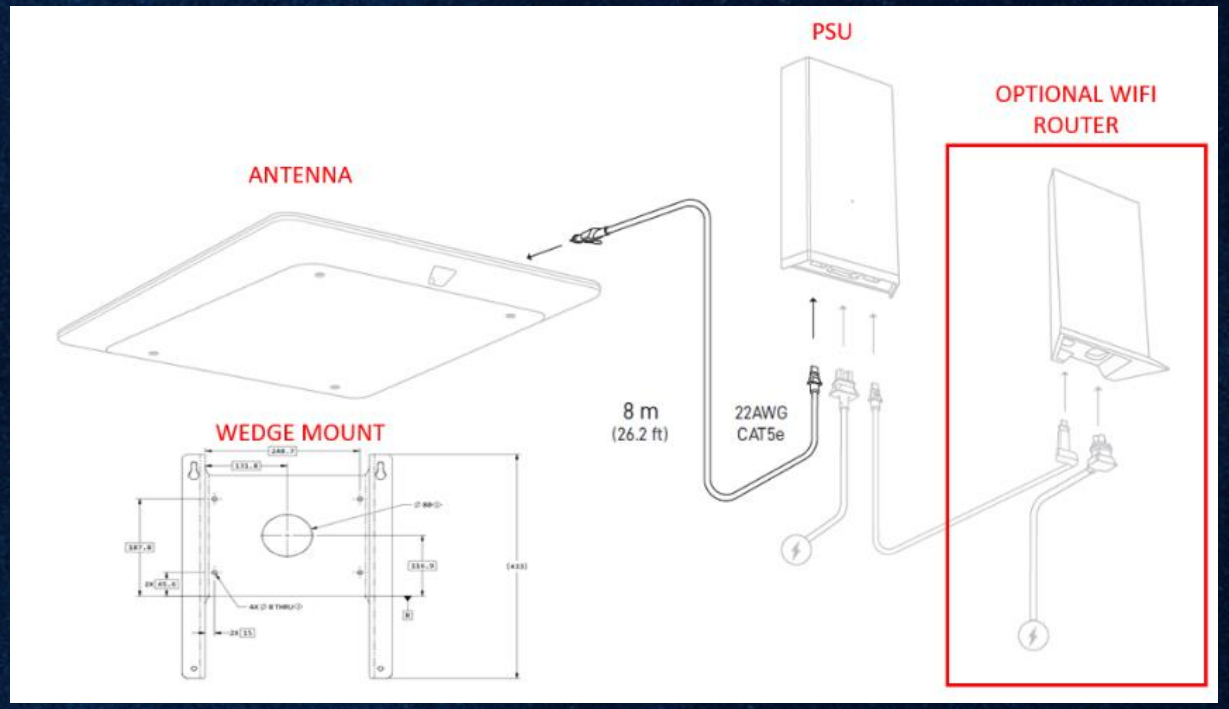
The Starlink maritime high-performance terminals are **Electronically Steered flat-panel Arrays**

Each antenna kit includes:

- Power Supply Unit (PSU).
- 8 meters (or optionally 25 meters) cable between the antenna and the PSU.
- Wi-Fi Router
- 5 meters cable, between PSU and firewall/router.
- Wedge mount kit.







Phased array, means a computer-controlled array of antennas which creates a beam of radio waves that can be electronically steered to point in different directions without moving the antenna itself

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Starlink Packages and Service Availability

Mobile Priority Service :

- **50GB, 1TB, or 5TB** of Priority Data
- **220 Mbps** download / **25 Mbps** upload (MIR only / no CIR).

MOBILE SERVICE PLANS

SERVICE PACKAGE	Service Availability	Latency (ms)	Expected Download (mbps)	Expected Upload (mbps)
RECREATIONAL	≥99%	<99	5-50	2-10
COMMERCIAL	≥99%	<99	40-220	8-25
PREMIUM	≥99%	<99	60-250	10-30

- **Stated speeds and uninterrupted use of Services are not guaranteed**.
- Users may experience higher latencies in regions that are far from Starlink ground stations, or during periods of high load on their user terminal.
- Actual speeds will likely be lower than the maximum speeds during times of high usage.
- Starlink may temporarily reduce speeds if our network is congested.

* Billing and data cycle: 1st of the month to the last day of the month
* Subject to Starlink T&C

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Sample Cluster of 8 x Starlink HP terminals along with 4G/5G antennas, delivering high speed data-rates for a Cruise Ship, and **VSAT** antenna guaranteeing **CIR** for its mission critical applications

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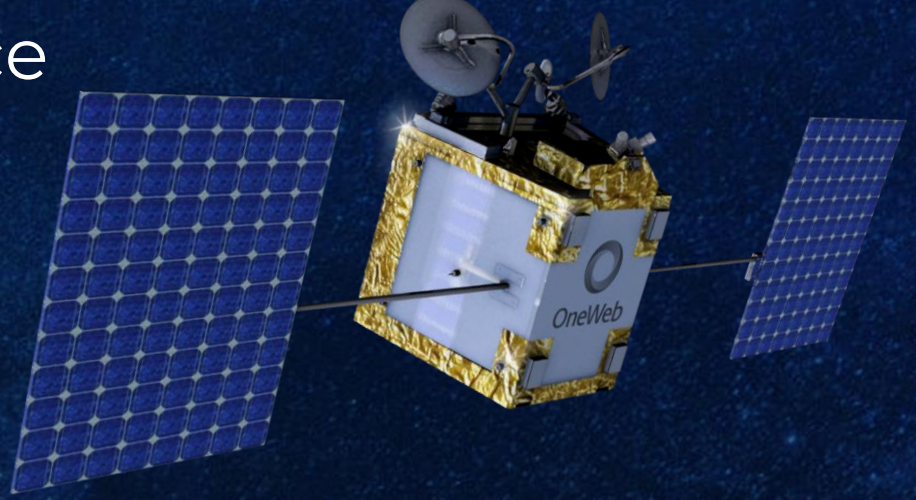
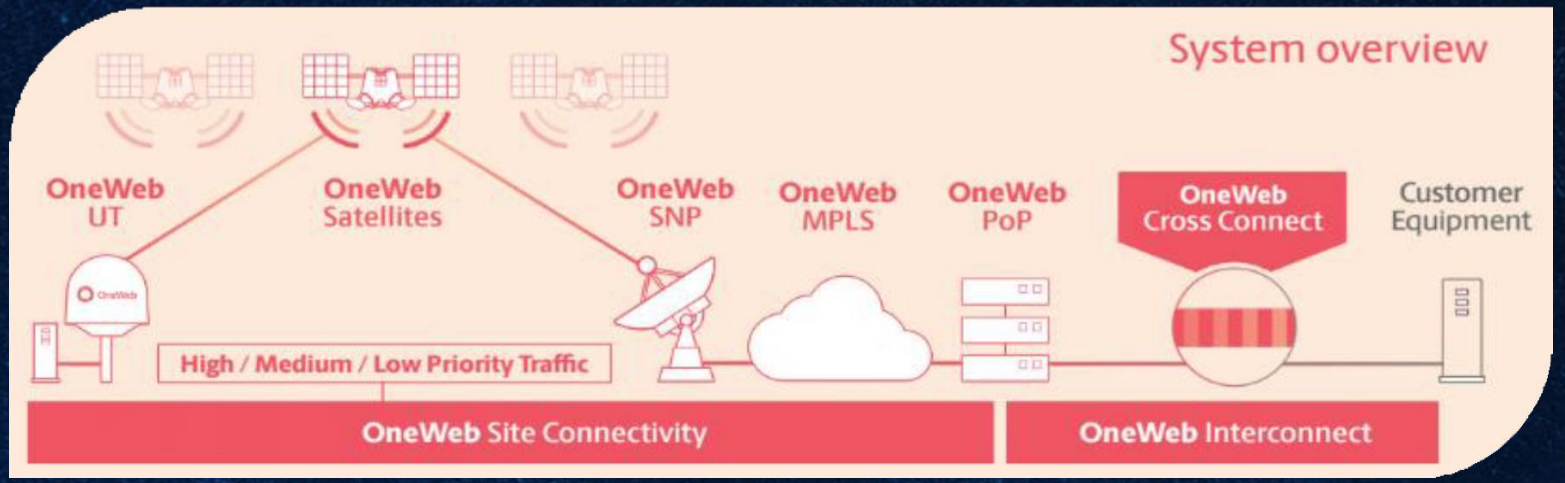
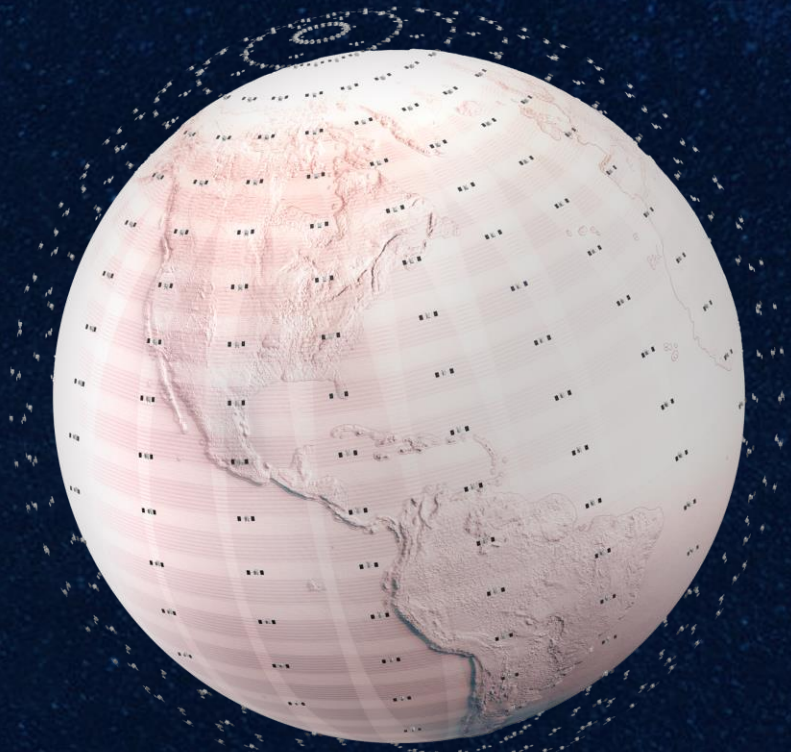
OneWeb LEO Service



- 648 satellites in 12 planes (634 already in orbit)
- 1200km above the Earth
- 588 active
- 60 spare (5 per plane)

- 2 Satellite Operations Centers (SOCs)
- 20+ Points of Presence (PoPs) and growing
- 40+ Satellite Network Portals (SNPs)





OneWeb Network coverage

Nov 2021

Above 50˚N

May 2023

Above 35˚N

Aug 2023

Above 25˚N
&
Below 25 ˚S

Q4 2023

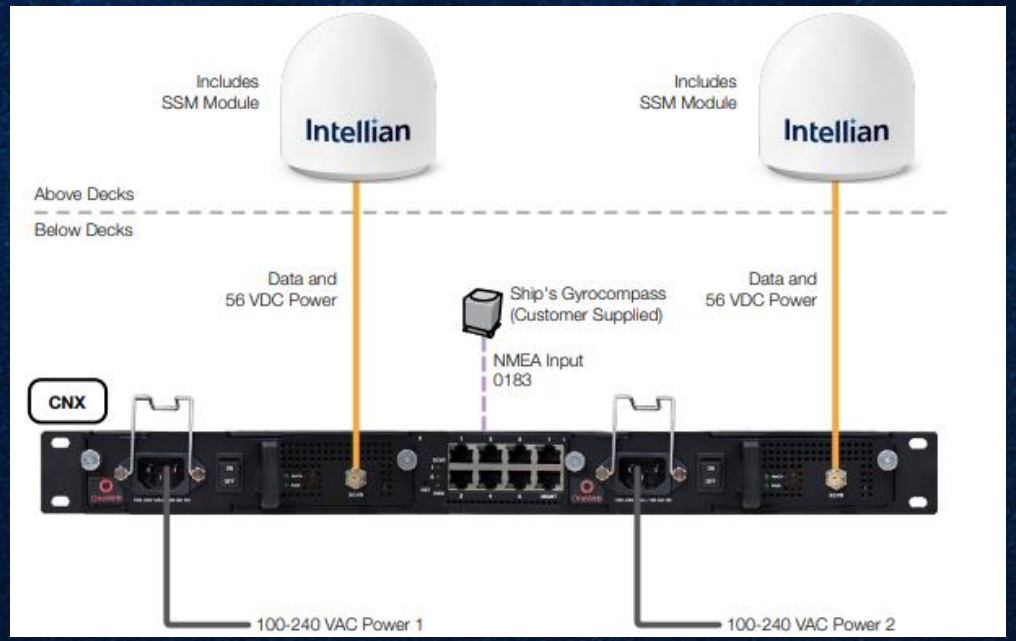
Global Coverage

Maritime service
June 2023

OneWeb – Antennas

Parabolic antennas: Dual parabolic Intellian antennas

Single Cable Connection between the outdoor unit(s) and the indoor unit



Flat panel antennas: Single or dual configuration

- Electronically controlled pointing, tracking and polarization
- Low profile & light weight, 30kg
- IP66, and Salt Fog Tested
- LEO+LTE variant option

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OneWeb / Intellian dual-parabolic antenna details

INDOOR UNIT

CNX (Customer Network Exchange)

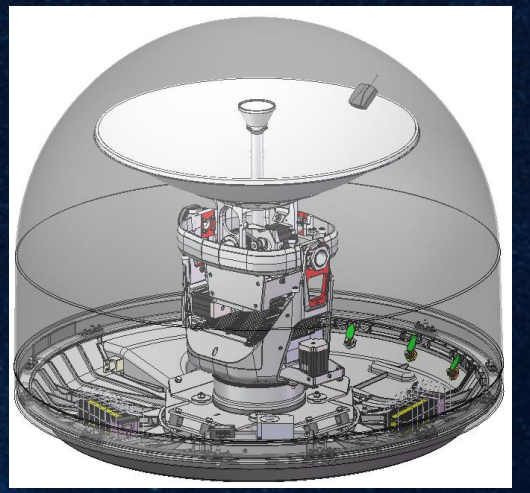
Item	Specification
Size (W x D x H)	442mm x 249mm x 40.4mm (17.4” x 9.8” x 1.6”)
Weight	5.1kg (11.2lbs)
Antenna Subsystem Interface	Eight GigE RJ-45 Ethernet(1 Management Port)
Encryption	MoCA 2.0 E-band (400~700MHz)
AC Input Voltage	AC 100V ~ 240V/50Hz~60Hz
Operating Power	Max. 30W
DC output range	DC 50V +/- 5%
Output Power (For each power module)	Max ~250W(Total: Max ~ 500W)
LEDs	Power: Operational – Solid GREEN Fault Condition – Solid RED Operating with Backup S/W – Blinking RED Off – No power

Front Panel

Rear Panel

OUTDOOR UNIT

Radome Height	960 mm
Radome Diameter	1122 mm
Reflector Diameter	730 mm
Antenna Weight(TBD)	Antenna: 40 kg Radome: 25 kg Total UT: 65 kg
Platform	3 Axis / AZ, EL, CL
Field of View	+/-80 ˚ from zenith
Azimuth range	Unlimited
Elevation range	-80˚ ~ +80˚
Environmental	
Operating Temperature	-25 ℃ ~ +55 ℃
Water Ingress	IPX6



Heater module can operate at -10℃

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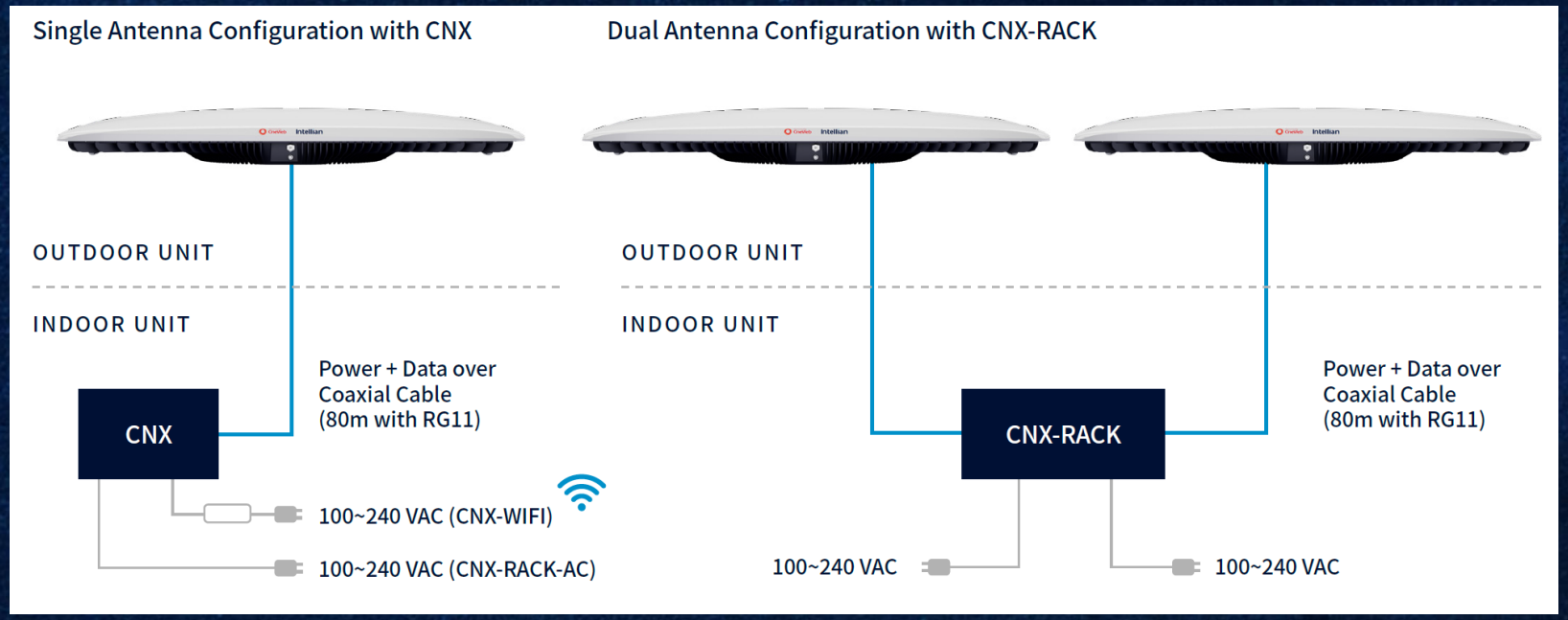
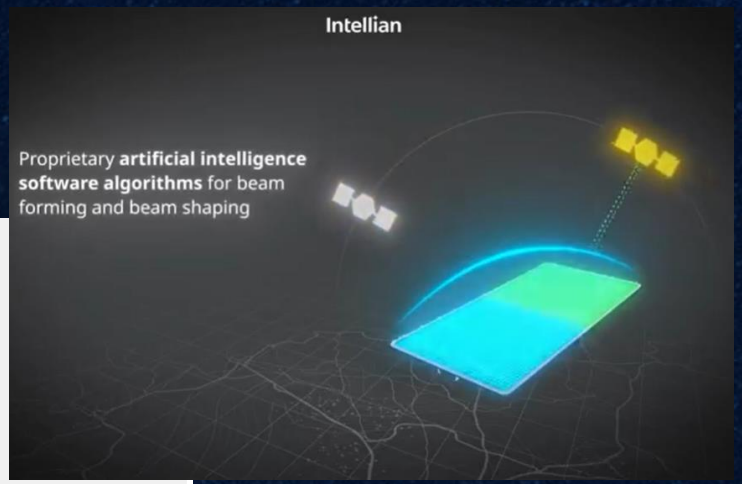
New Intellian flat Pannel for OneWeb - OW11FM





Outdoor Unit

Throughput (peak)	DL: 195 Mbps / UL: 32 Mbps
G/T	10.7 dB/K
EIRP	+36.6 dBW (Dual Carrier)
Field of View	+/- 70° from Zenith, 360° Azimuth
Size	96 cm x 50 cm x 12 cm (37.8" x 19.7" x 4.7")
Weight	16 kg (35 lb)
Power	340 W (max)
Ingress	IP66
Operating Temp	-40 °C to +55 °C (-40 °F to 131 °F)
Interface	F-Type conn

Indoor Units

	CNX-WIFI	CNX-RACK-AC
Dimensions	21 cm x 17 cm x 8 cm (8.2" x 6.7" x 3.1")	44.2 cm x 25 cm x 4.4 cm (19" x 1 RU chassis)
Weight	0.6 kg (1.3 lb)	6.3 kg (13.9 lb)
Power	18 W (max), 8 W (avg)	30 W (max), 16 W (avg)
Operating Temp	0 °C to +40 °C (32 °F to 104 °F)	-25 °C to +55 °C (-13 °F to 131 °F)
Data Interface	WiFi-6 4-port GigE RJ45	8-port GigE RJ45, 1x USB (Type-A), 1x NMEA0183 / 1x NMEA2000
PSA	Universal AC Power (100 – 240 VAC)	Dual 450 W Power Modules 100 – 240 VAC

OW11FM FLAT PANEL FOR MARITIME

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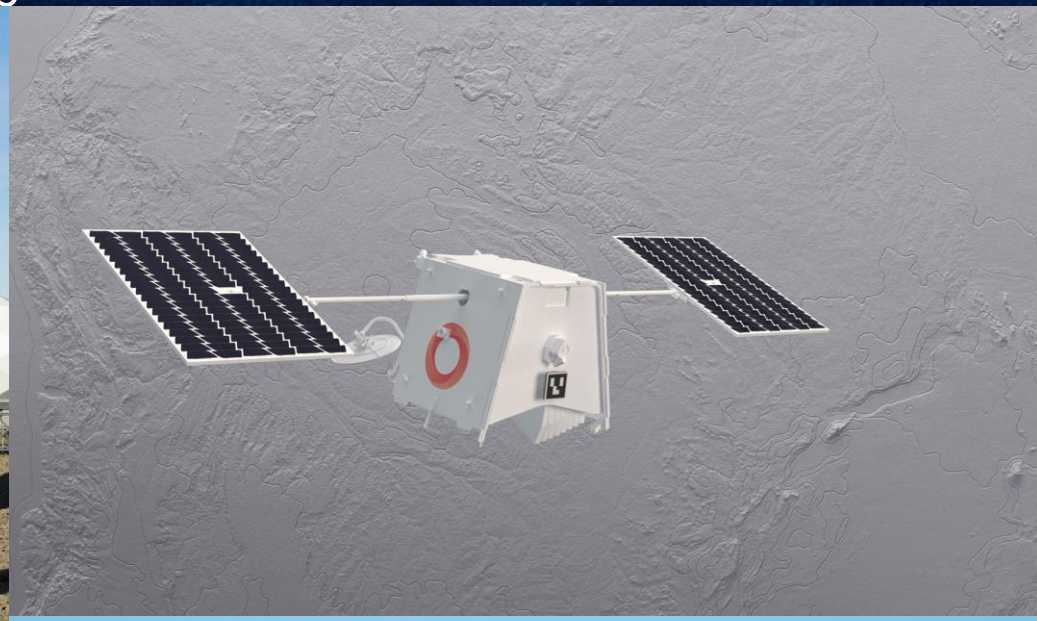
OneWeb Gateways



Largest ground station site serving the Arctic circle

Gateway to New Zealand

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OneWeb LEO service portfolio

ADVANCE LEO Portfolio	Allowance (GB)	MIR (Mbps)		CIR (Mbps)		User Terminals
		FWD	RTN	FWD	RTN	
Anchor	20 GB	20	4	2	0.4	Peregrine u8* OW50M OW70M
	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
	2500 GB					
Explorer 2	1000 GB	200	40	0	0	2 x Peregrine u8
	2500 GB					
	5000 GB					
	10000 GB					

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

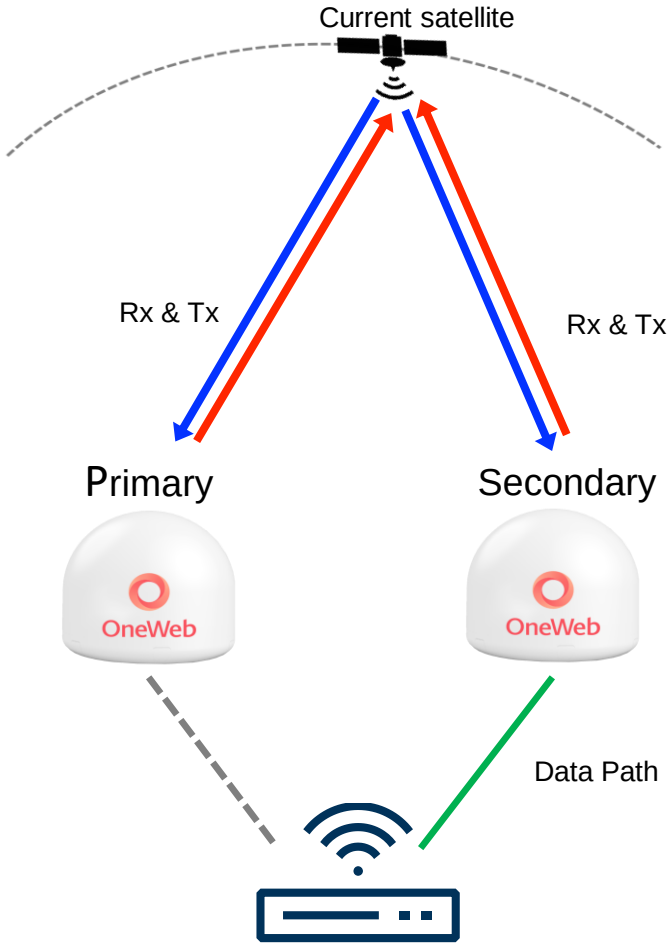
Kymeta Peregrine u8

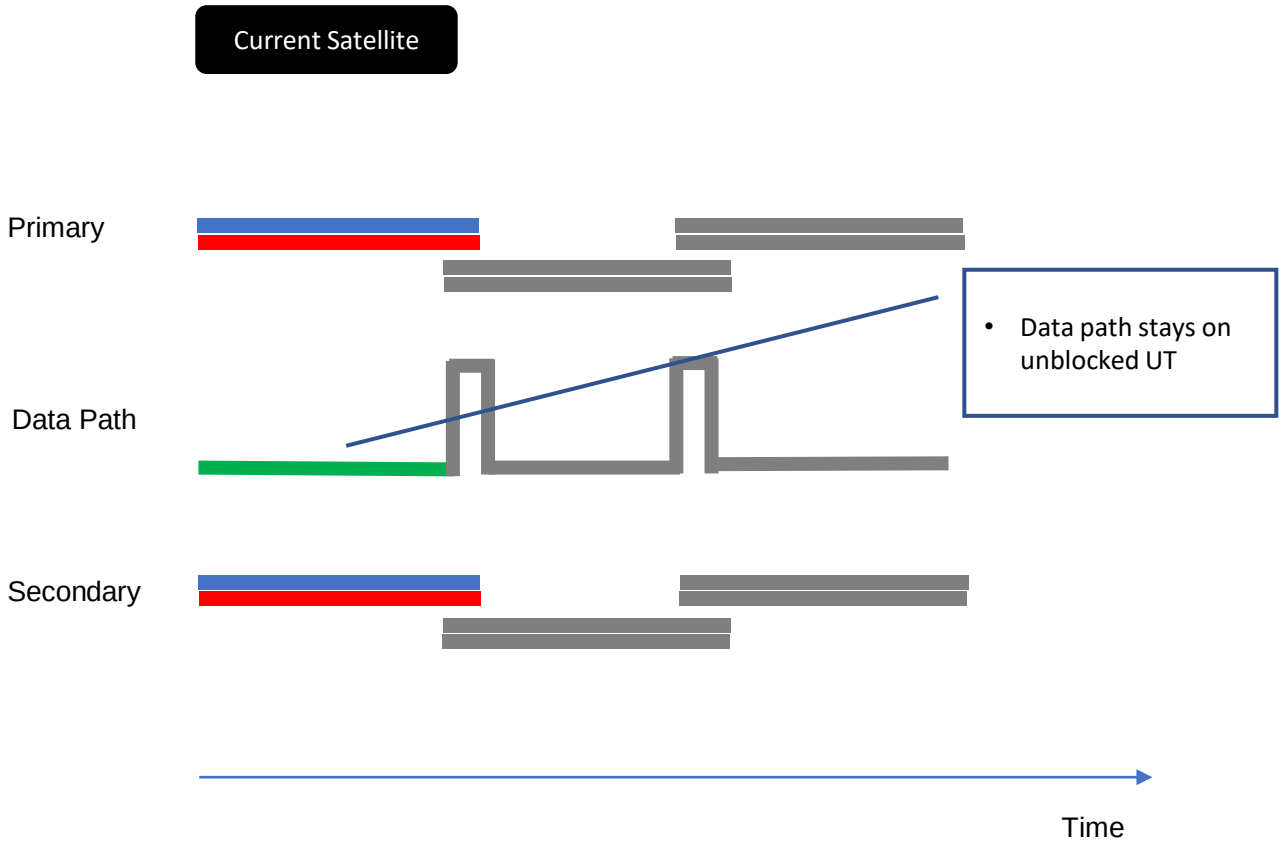
OW70M

- 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

Handover Tracking Operation (OW-50M_70M)





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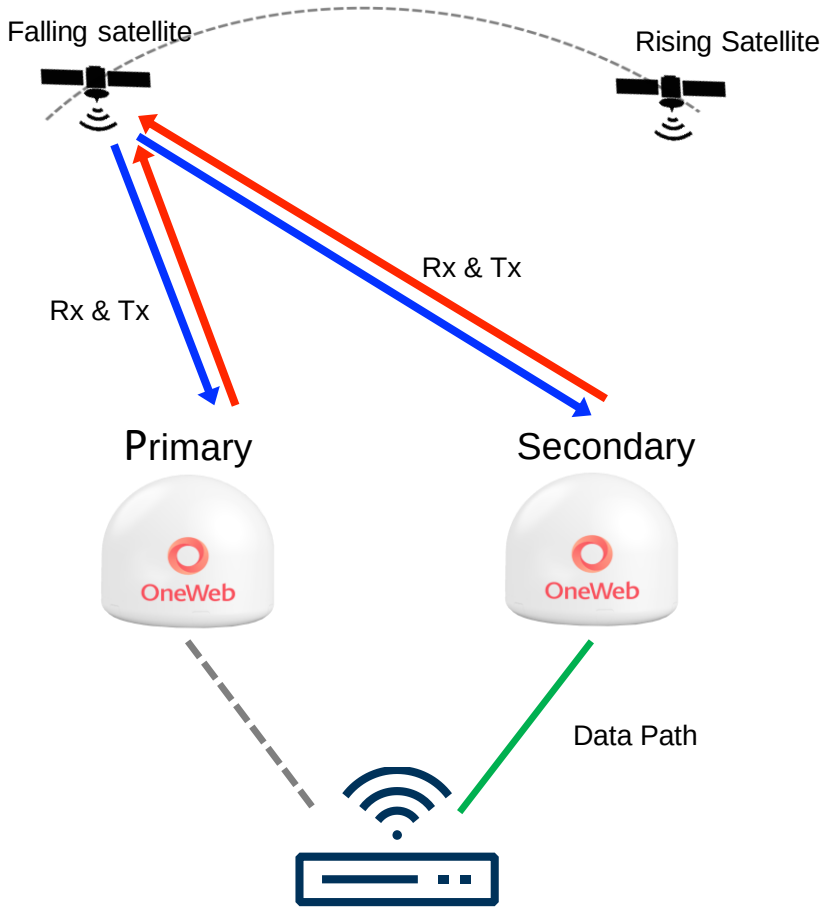

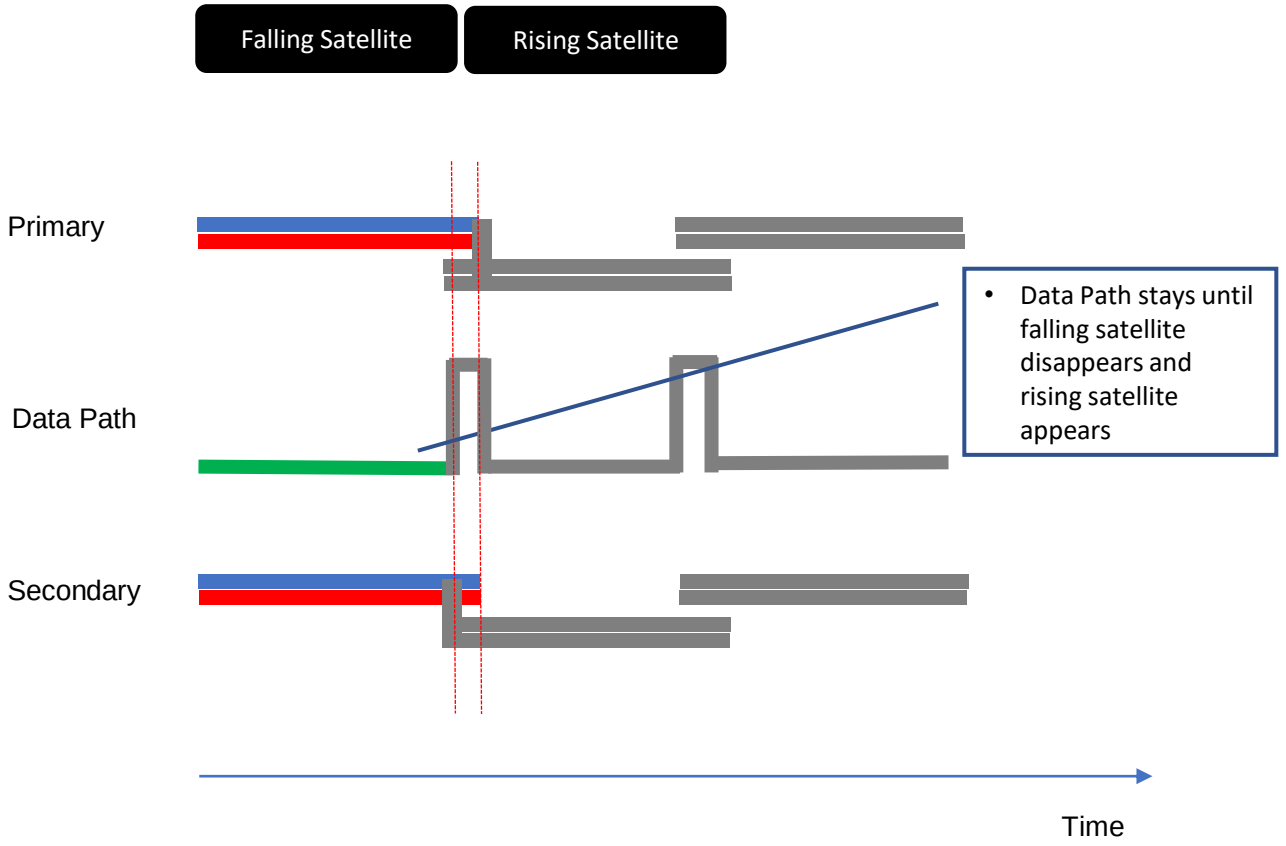

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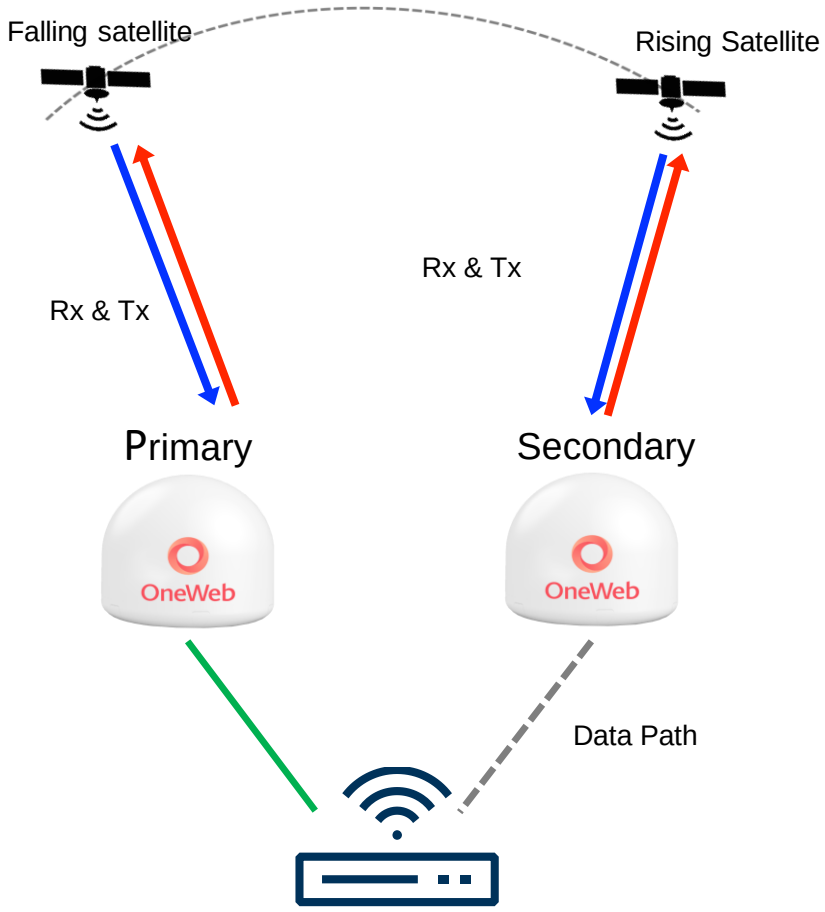

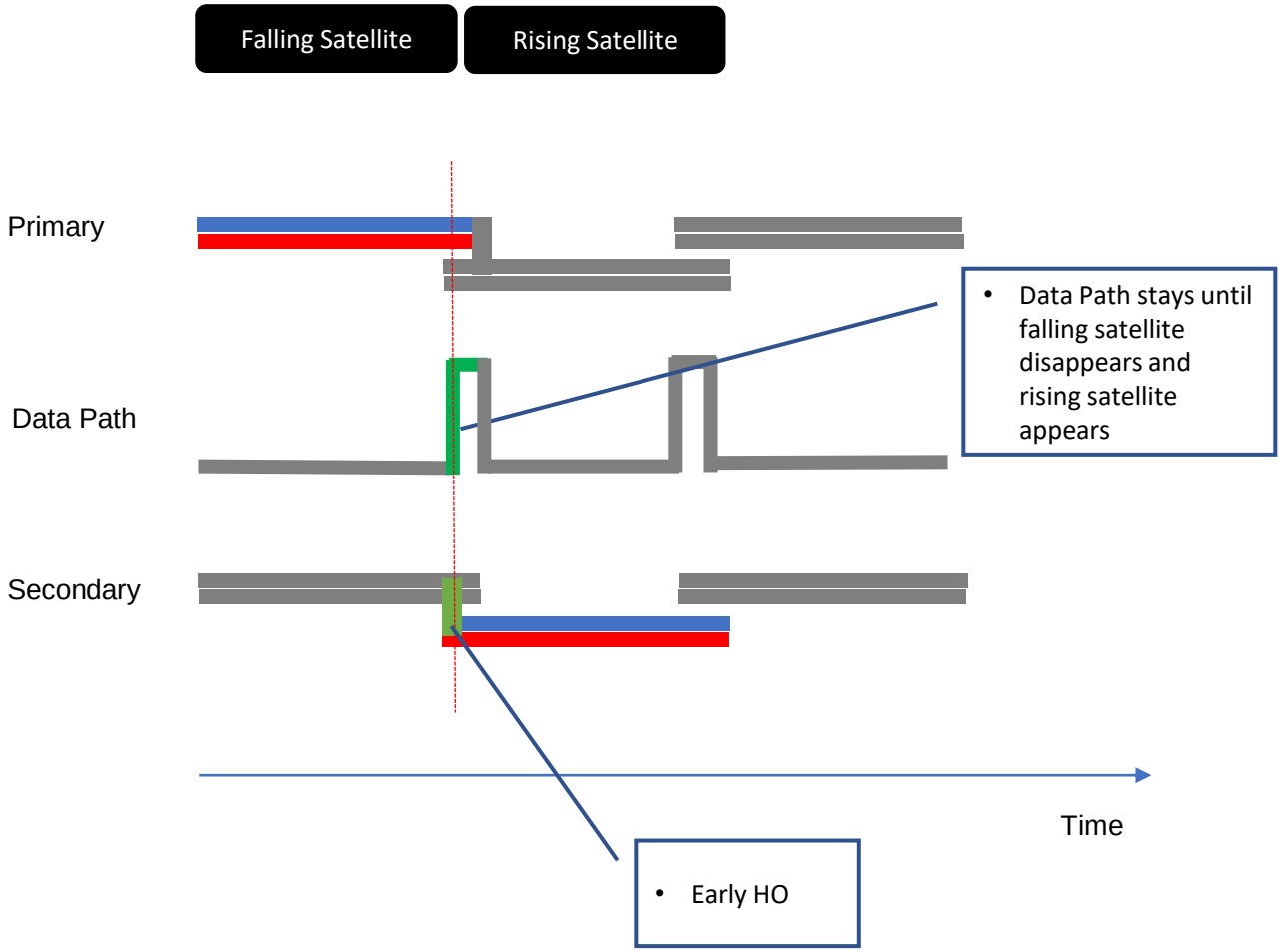

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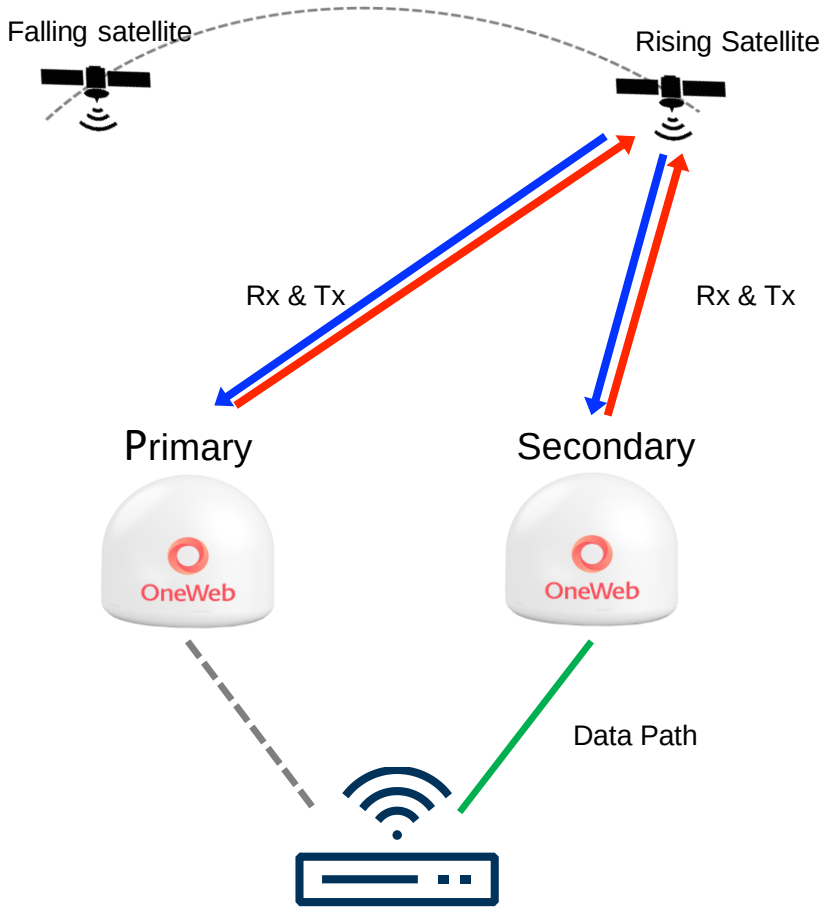

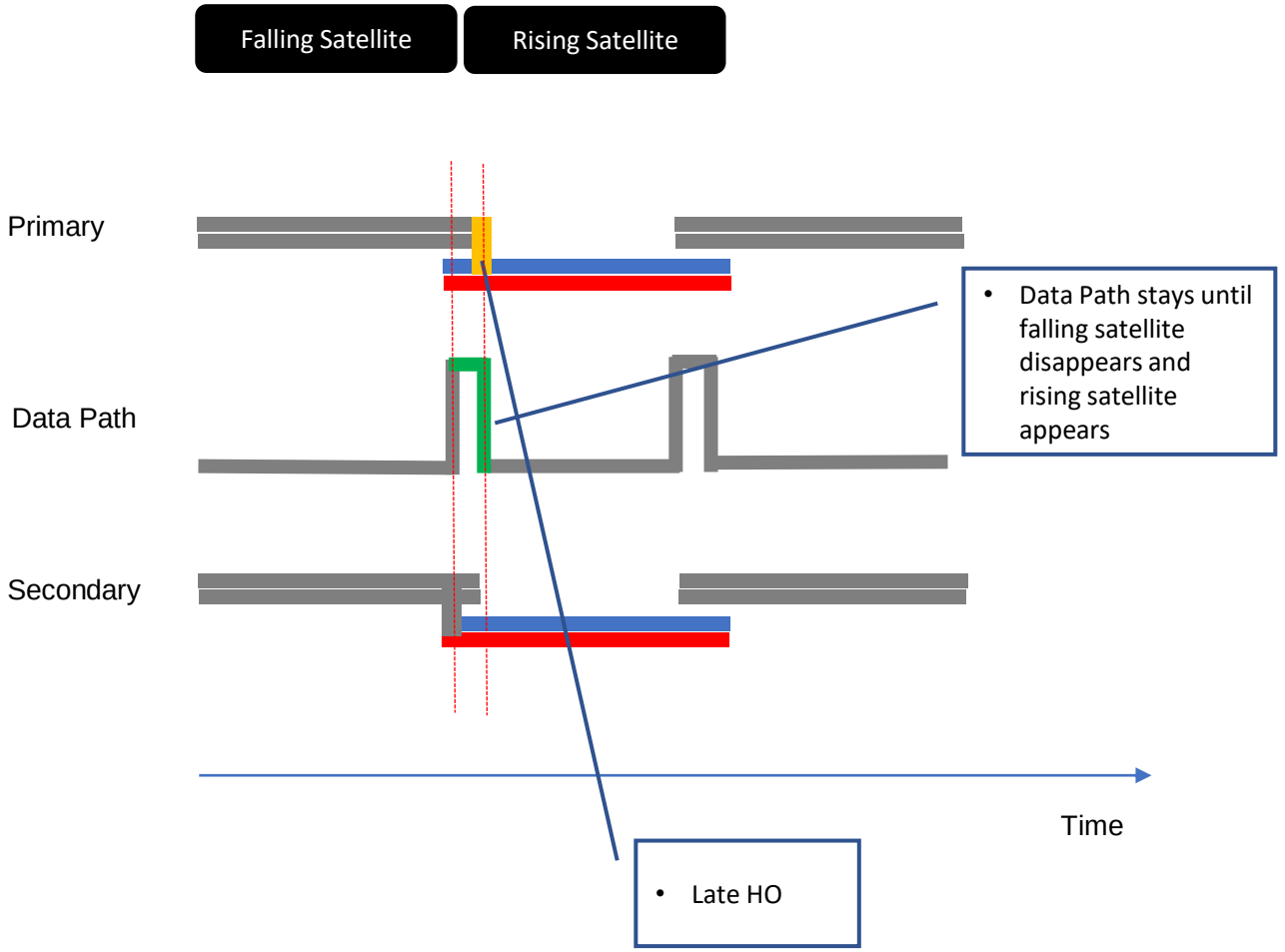

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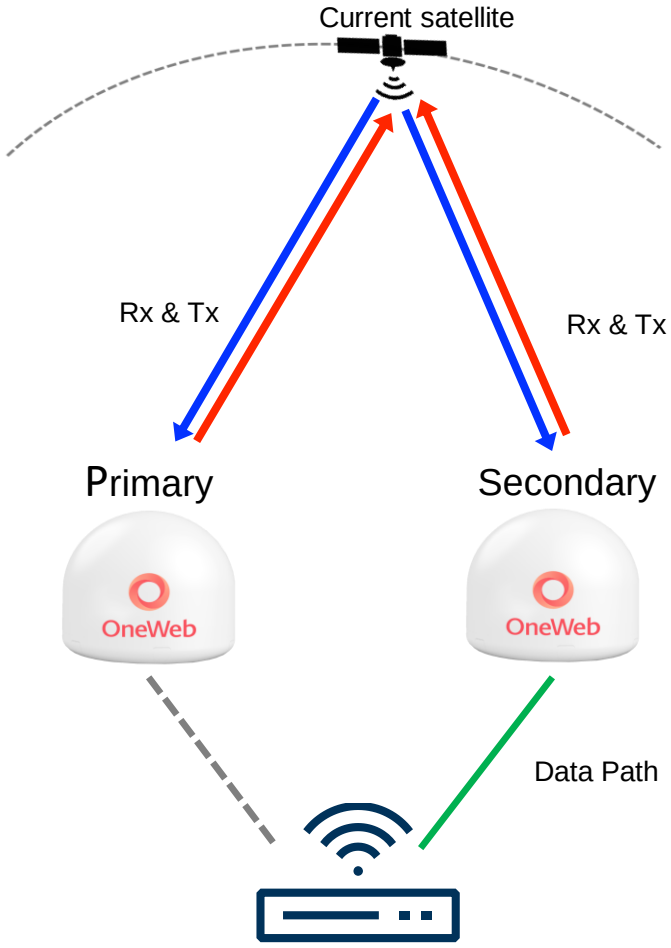

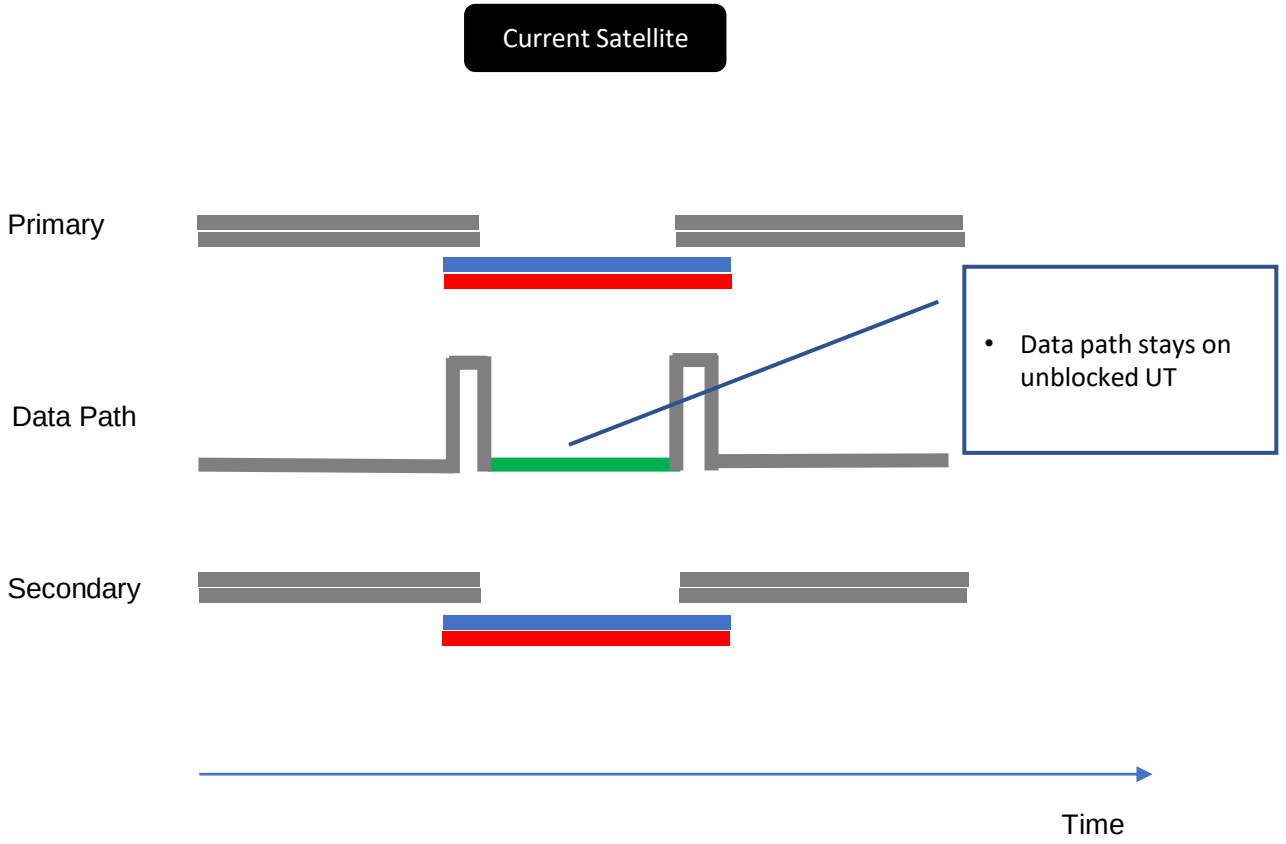

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O3B Mpower

- Under construction and deployment
- 2 first satellites (O3b) launched in December 2022
- Network Initially comprises 11 satellites in MEO
- Satellites use fully shapable and steerable spot beams
- Satellites are based on Boeing's multi-orbit BSS-702X satellite
- The phased array antennas can provide up to 5000 spot beams per satellite

Guaranteed service (CIR):

- From 50 Mbps to Gbps (FWD+RET)
- 150ms latency
- Ka band to UT

Service Launch:

- Planned for Q4 2023

Service Areas:

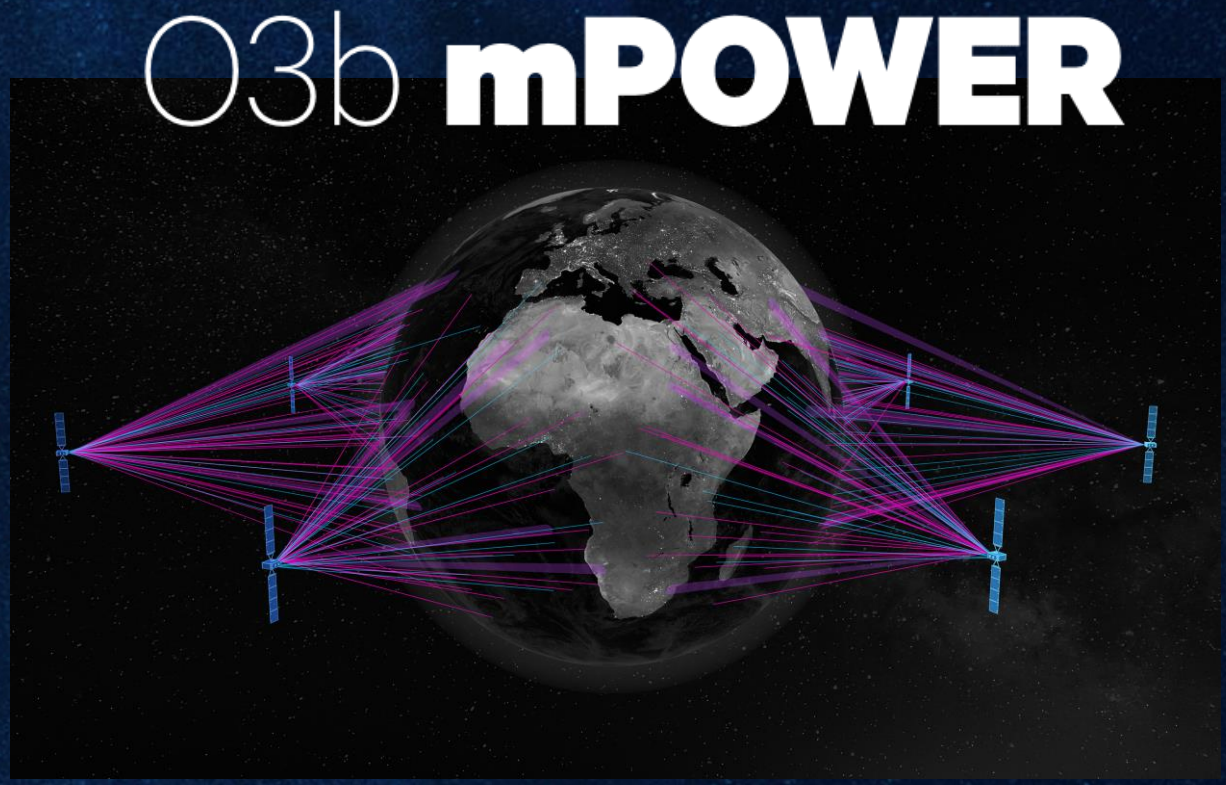
- 50 degrees North/South (MEO belt)

Network SLA's

- Network Uptime 99.5%
- CIR Service Availability > 98.5%

Maritime Terminals:

- Intellian mP130NX and others to come



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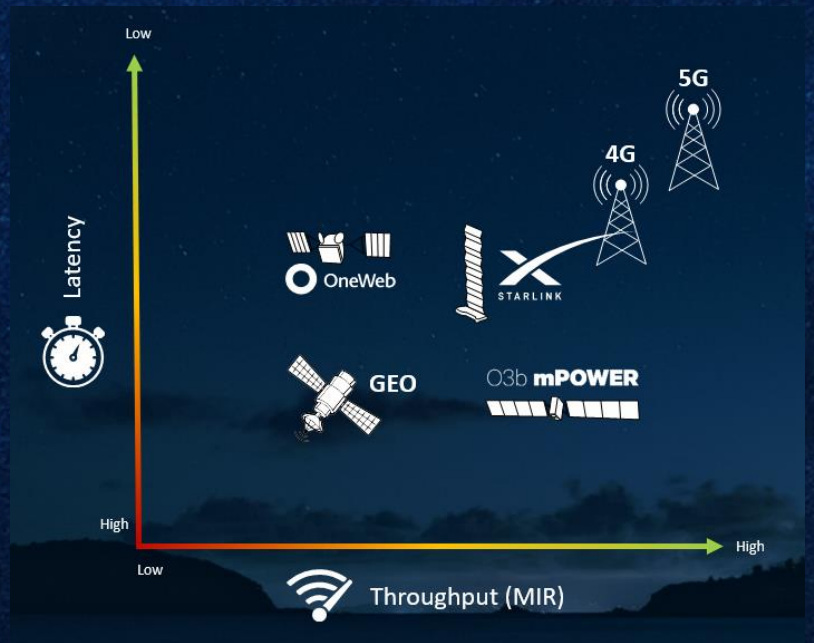
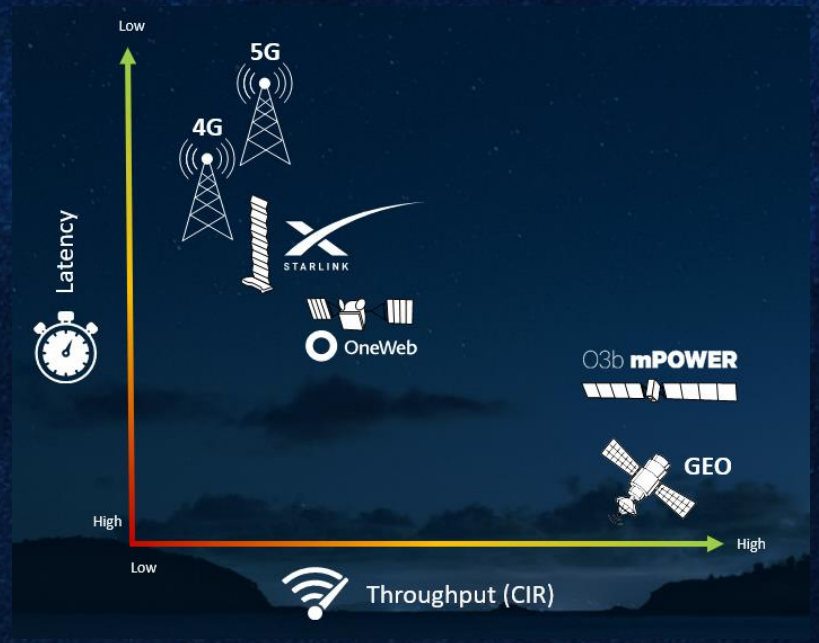
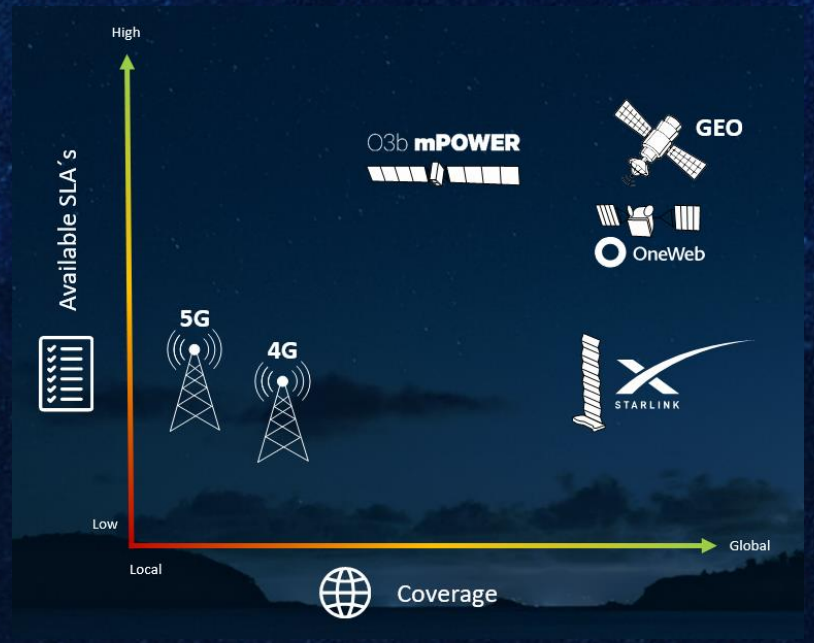
The Dilemma of WAN choice!

Each connectivity technology provides its own characteristics.







- VSAT – for high global availability, mission-critical applications, and dedicated capacity needs (e.g., to run videoconferences while at remote locations, or to transport remote control messaging/data).
- LEO: Starlink or OneWeb – for high-throughput and low-latency best-effort connectivity, deploying rapidly in many regions of the world (subject to local regulations).
- 4G/5G – for high-throughput best-effort connectivity, especially available close to densely populated shore areas.
- L-band – like, e.g., Iridium Certus providing truly global connectivity up to 700 Kbps for emergency and backdoor connectivity, or Fleet-Broadband (FBB).

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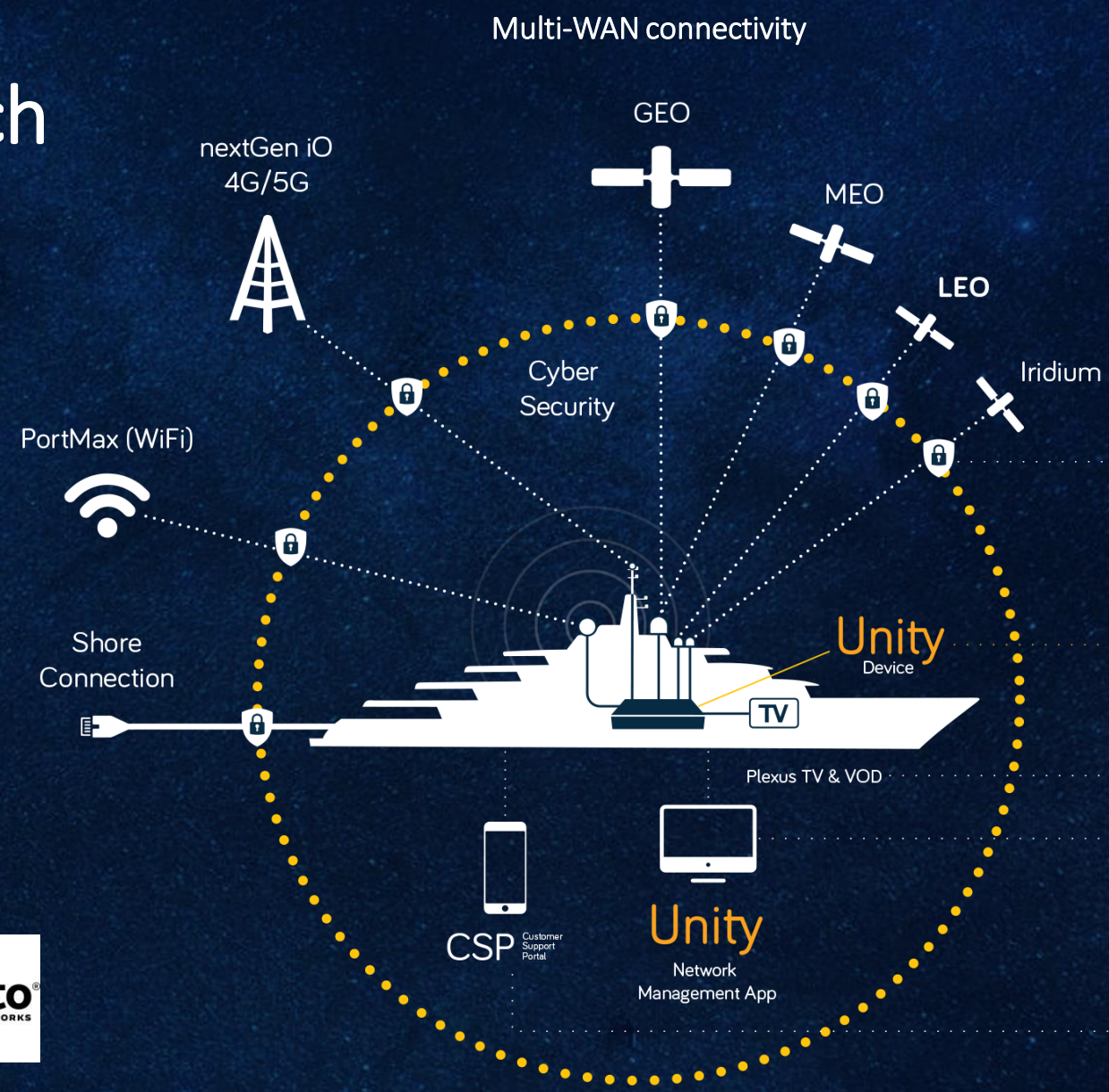
OmniAccess all-round approach



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NOC / SOC
24/7 monitoring

Network Operations

Onboard Network Support

Engineering Services

Cyber Security Services

OmniAccess

Newtec

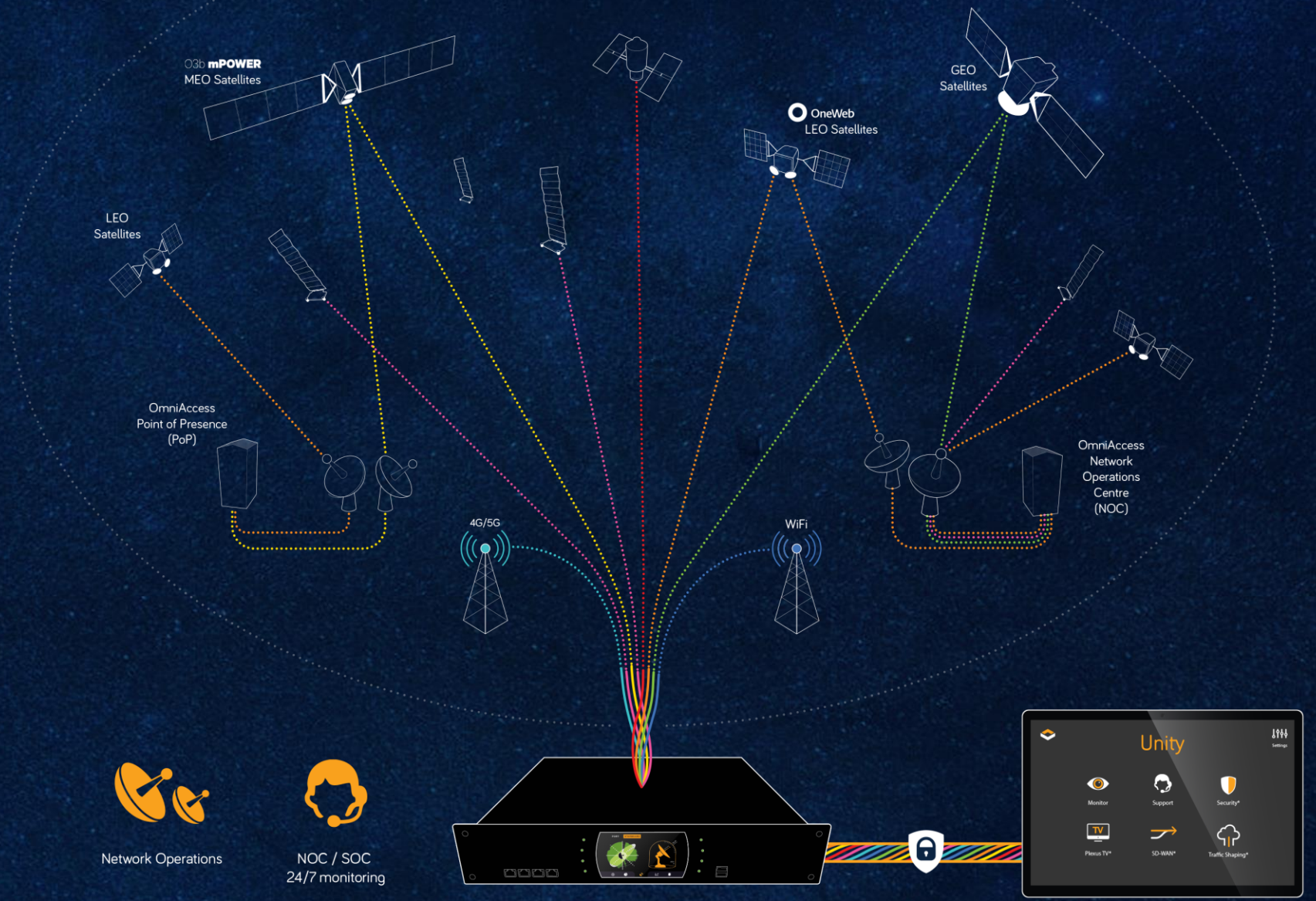
FORTINET

CISCO

paloalto NETWORKS

www.omniaccess.com/connectivity

nextGenFUSION



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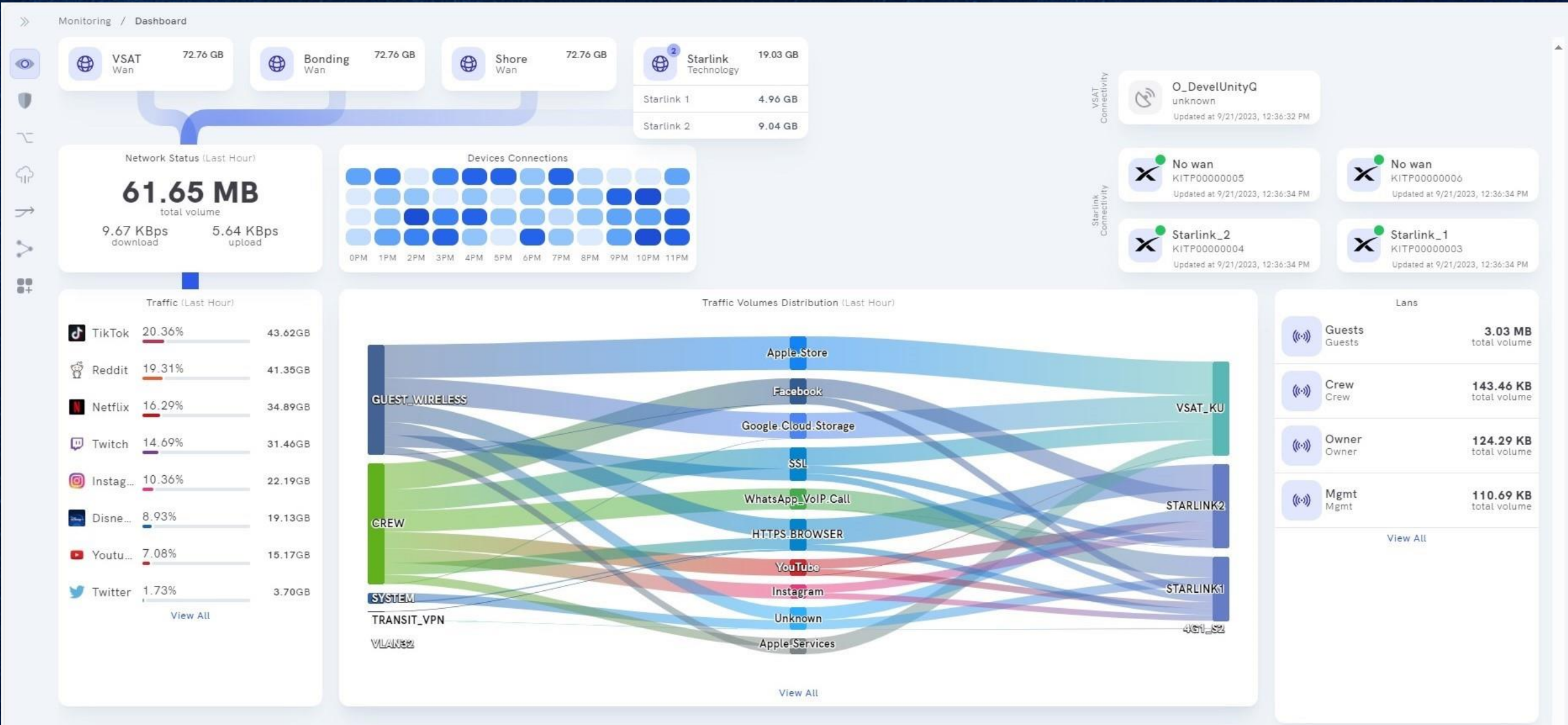
Strictly Confidential – To not distribute

Unity Realtime monitor

Unity SD-WAN Realtime monitor showing the different traffic (down to the application layer) being intelligently forwarded to the different WAN's



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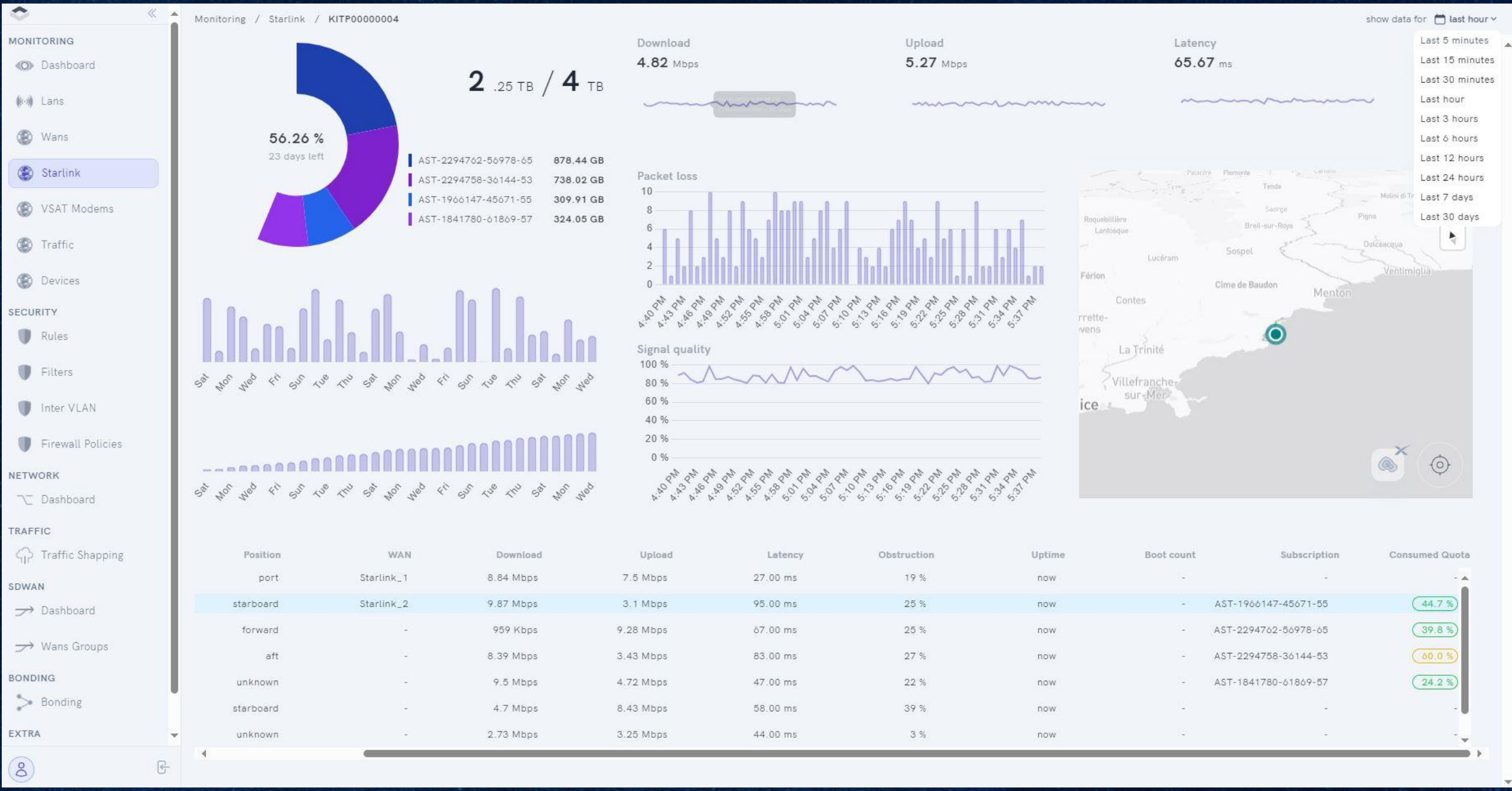
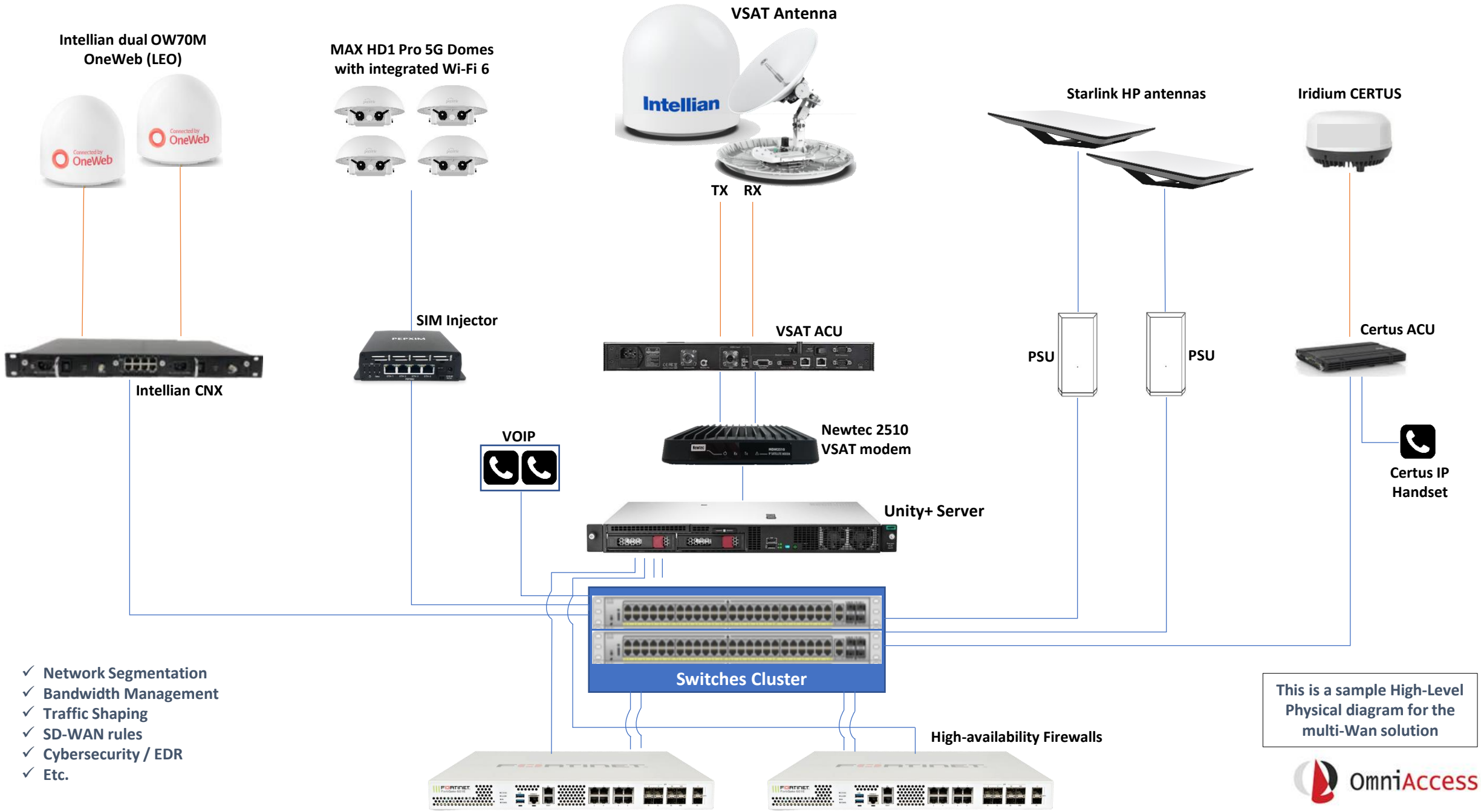
Starlink service monitor in OmniAccess Unity Interface



Position	WAN	Download	Upload	Latency	Obstruction	Uptime	Boot count	Subscription	Consumed Quota
port	Starlink_1	8.84 Mbps	7.5 Mbps	27.00 ms	19 %	now	-	-	-
starboard	Starlink_2	9.87 Mbps	3.1 Mbps	95.00 ms	25 %	now	-	AST-1966147-45671-55	44.7 %
forward	-	959 Kbps	9.28 Mbps	67.00 ms	25 %	now	-	AST-2294762-56978-65	39.8 %
aft	-	8.39 Mbps	3.43 Mbps	83.00 ms	27 %	now	-	AST-2294758-36144-53	60.0 %
unknown	-	9.5 Mbps	4.72 Mbps	47.00 ms	22 %	now	-	AST-1841780-61869-57	24.2 %
starboard	-	4.7 Mbps	8.43 Mbps	58.00 ms	39 %	now	-	-	-
unknown	-	2.73 Mbps	3.25 Mbps	44.00 ms	3 %	now	-	-	-

Sample High-level diagram – VSAT + 2 x LEO + 4G/5G + Iridium – with high-availability Firewalls



- ✓ Network Segmentation
- ✓ Bandwidth Management
- ✓ Traffic Shaping
- ✓ SD-WAN rules
- ✓ Cybersecurity / EDR
- ✓ Etc.

This is a sample High-Level Physical diagram for the multi-Wan solution

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CYBER-SECURITY

The **Risks** Posed by Cyberattacks

Disruption of Operations

Cyberattacks can cause disruption to operations, leading to delays and other issues.

Financial Loss

Cyberattacks can lead to significant financial losses for maritime companies.

Data Breach

Cyberattacks can result in the unauthorized access of sensitive data.

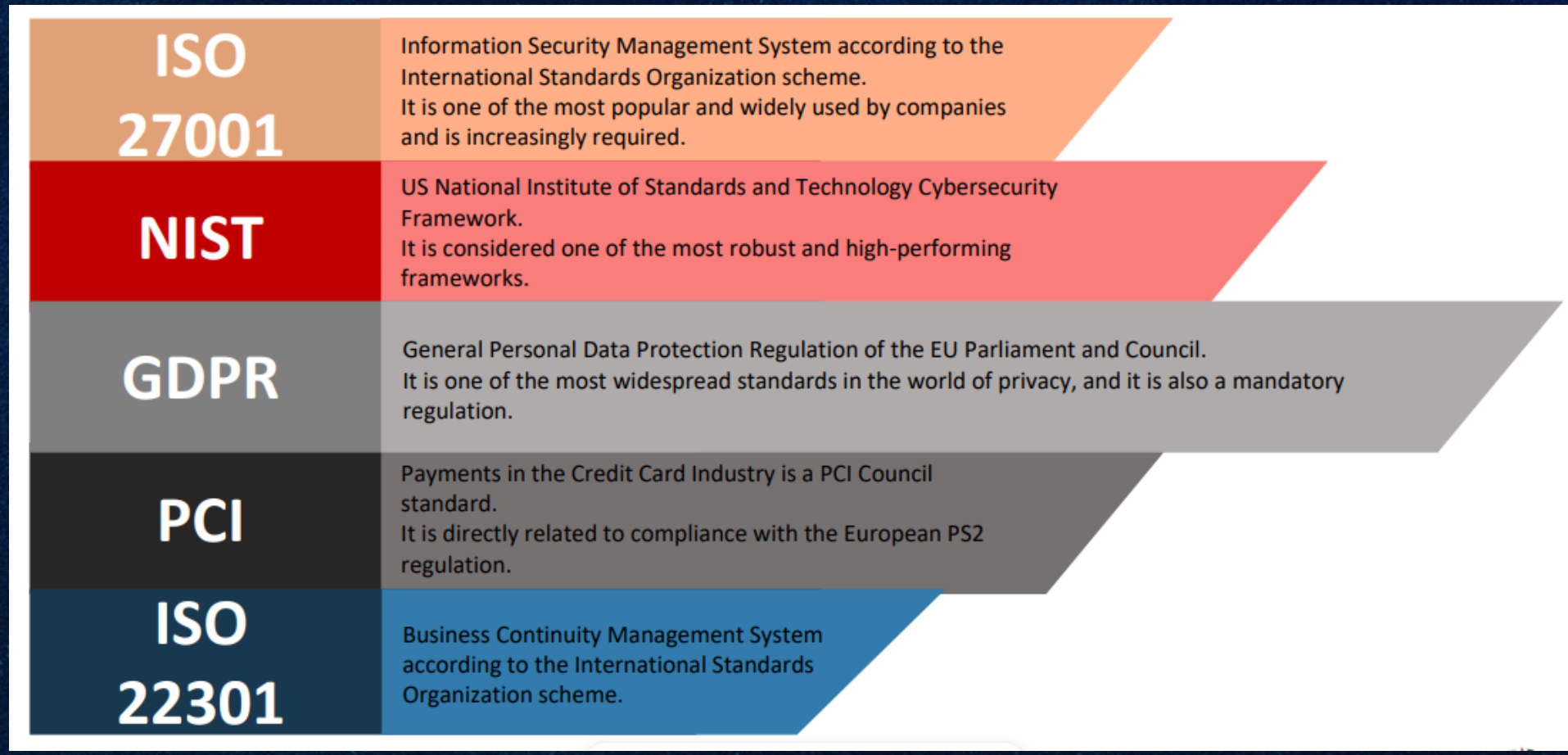
Reputational Damage

Cyberattacks can damage the reputation of a maritime company.

Cyberattacks pose a serious risk to the maritime industry
It is essential to understand the potential risks and take steps to protect against them.

Cybersecurity – Compliance

VESSELS' COMPLIANCE



IMO (MSC FAL 1 /Circ 3): *"Stakeholders should take the necessary steps to safeguard shipping from current and emerging threats and vulnerabilities related to digitization, integration and automation of processes and systems in shipping."*

IACS UR E26 and E27 introduce new regulations requiring to build **secure IT/OT infrastructure and tools on vessels starting in July 2024**.

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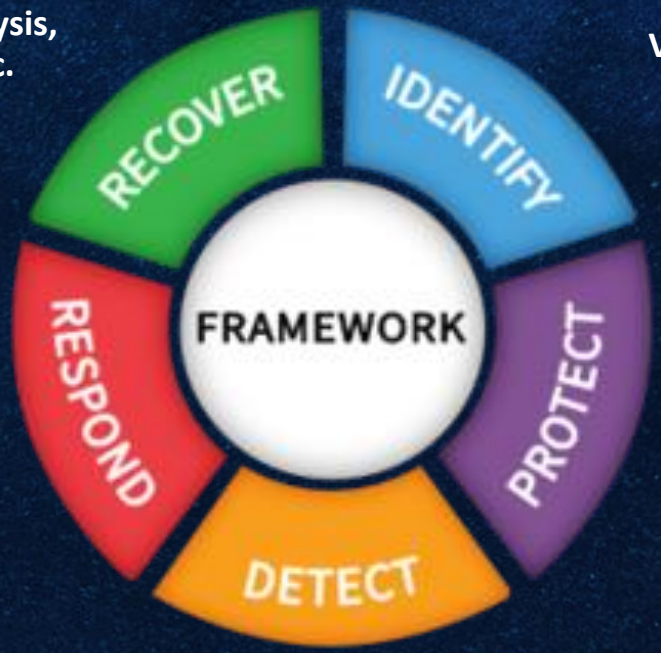
IMPLEMENTING CYBERSECURITY

NIST framework sets a reference for Cybersecurity implementation.

https://www.nist.gov/cybersecurity

National Institute of Standards and Technology at the U.S. Department of Commerce

Forensic Analysis, Backup, etc.



Risk Assessment, Vulnerability Scan, Penetration Test, OSINT report


Risk assessment


Penetration tests


Vulnerability scan

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

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

SOC

24/7 Security Operations Center

A Security Operations Center (SOC) provides peace of mind of having a team looking after your security 24/7.

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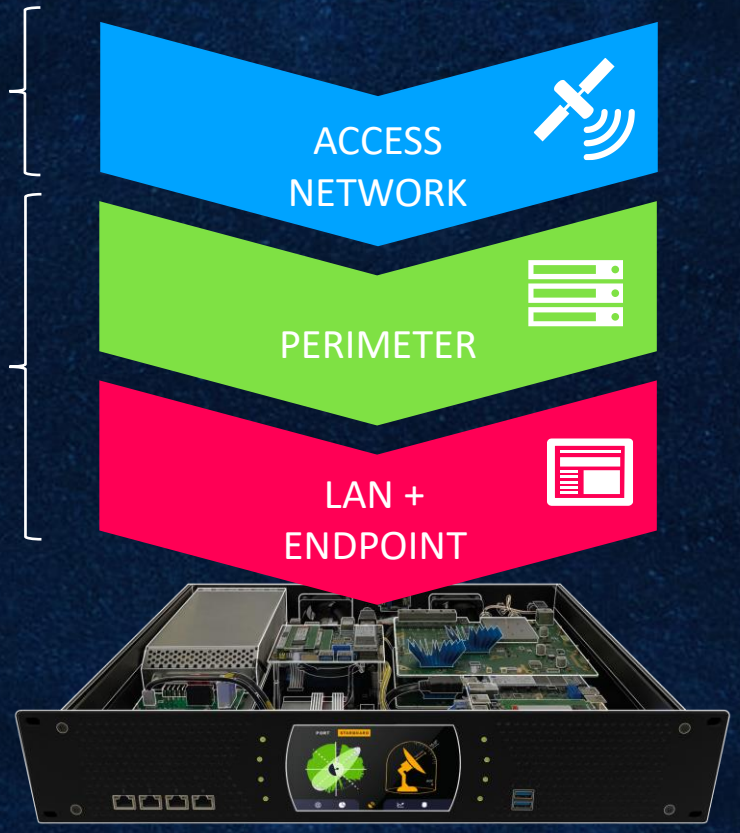
Cybersecurity levels for Vessels

An end-to-end security service will insure a three-layer security service.
The full protection of the:

- ✓ Access Network (Satellite/WAN link)
- ✓ Perimiter (Firewall)
- ✓ Onboard Network (Endpoints)

NOC
Network Operations Center

SOC
Security Operations Center



nextGen
Broadbeam
VSAT

Cybersec

Cybersec+

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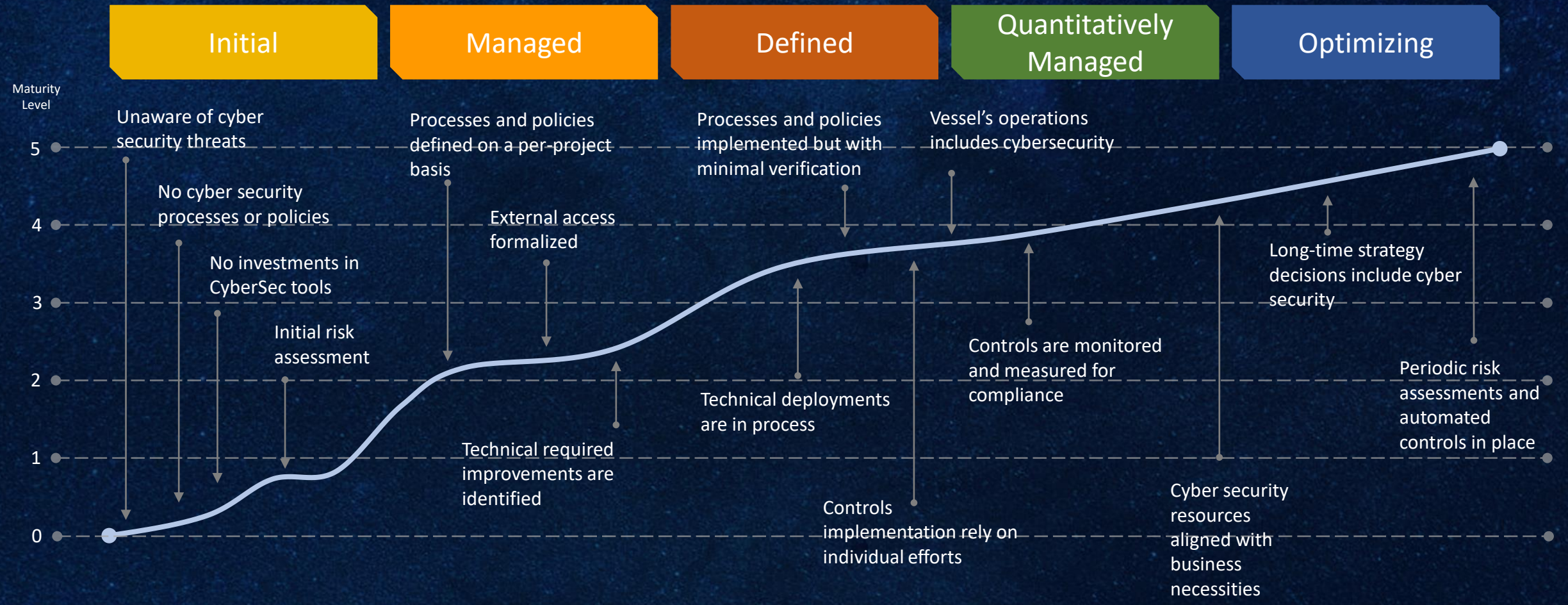
TRACKING YOUR VESSEL'S MATURITY LEVEL

Roadmap to achieve comprehensive protection from cyber-risks.



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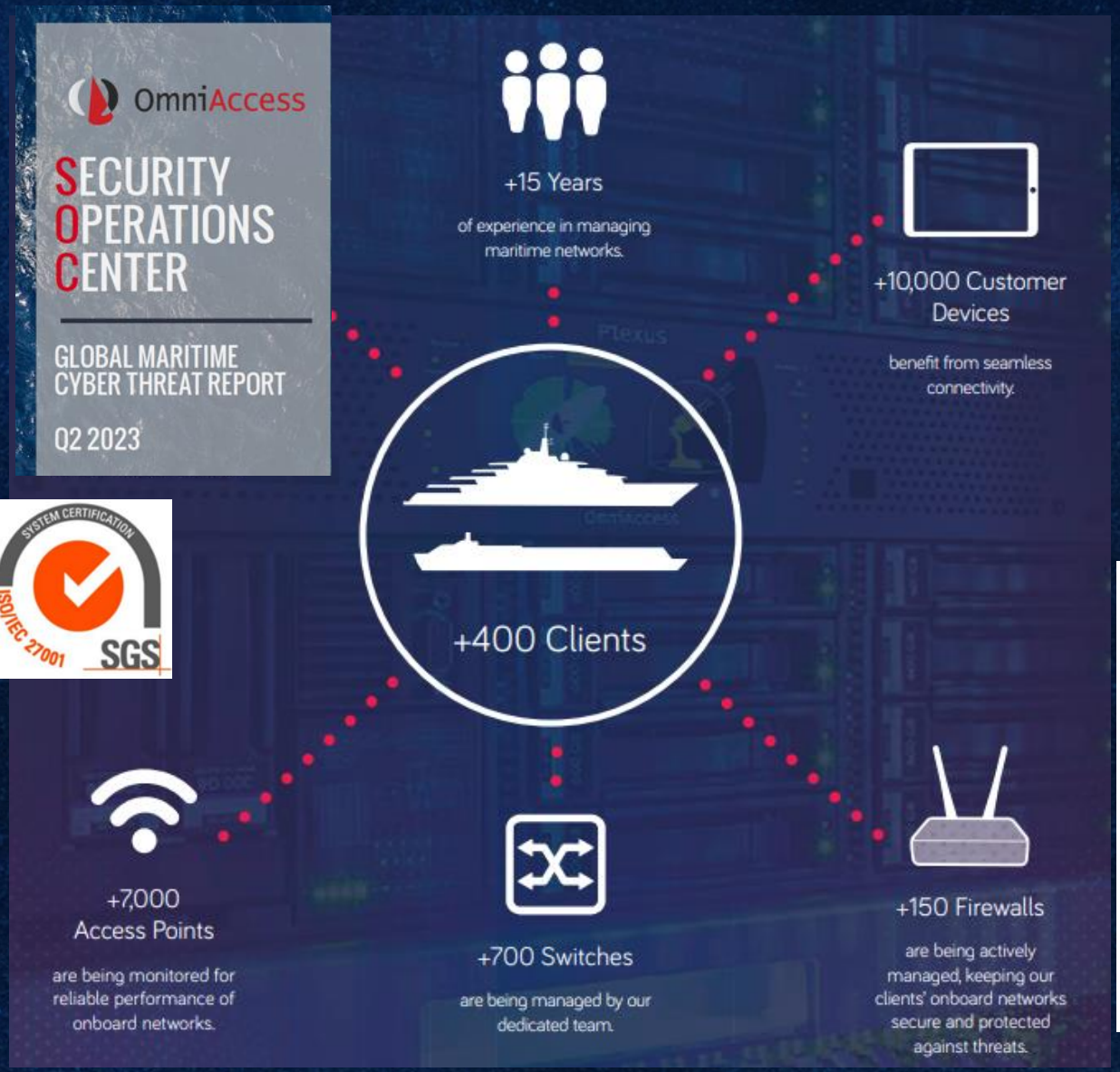
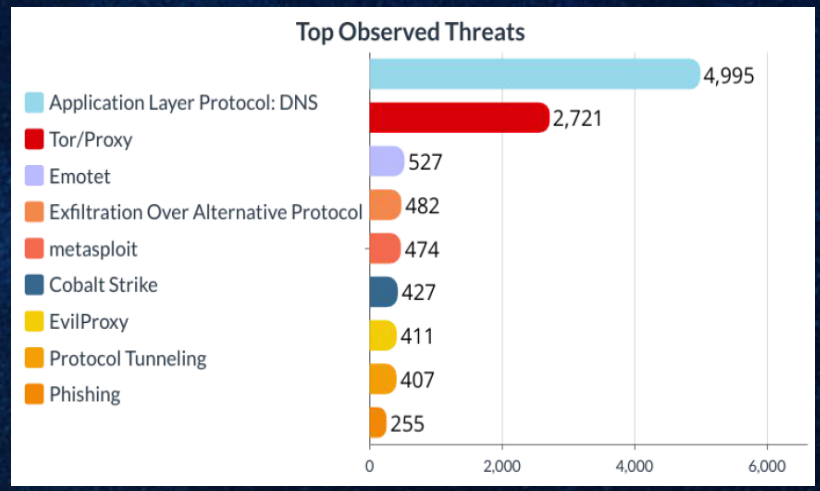
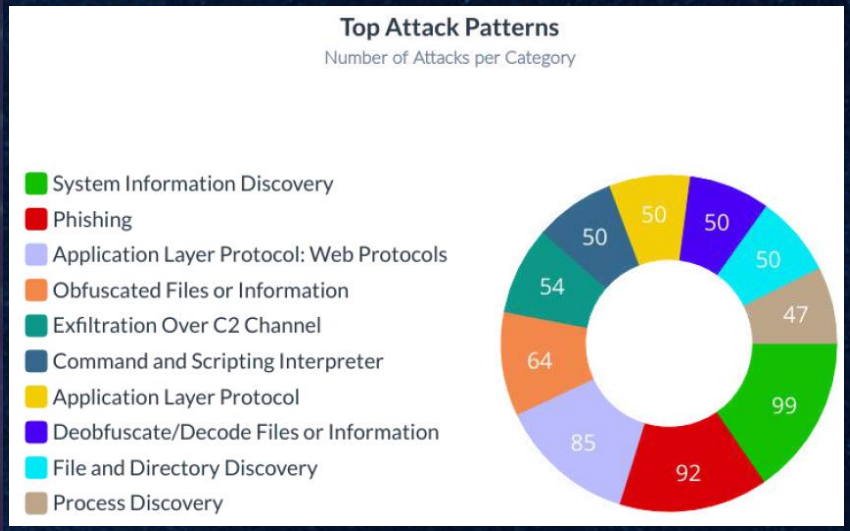
Who we are







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Flexible Contracts (VSAT)

The bandwidth you need, when you need it!

Our contract terms are designed to allow speed changes in-line with the yacht's needs throughout the season. Less bandwidth may be needed, for example, during crew only operation, whereas a "boost" in bandwidth will ensure user satisfaction during that important charter week or whilst the owner is onboard. The service may even need to be paused during a few months off season, or during shipyard periods. Rather than spreading your annual budget evenly throughout the year, make the most of it by adjusting your nextGen Broadbeam contract to your requirements.

Our Key Differentiators

- Customized data plans; in other words, we are focused on Customer needs and do not just sell off the shelf plans.
  - i.e.: **More uplink** than downlink, for R/V's, for specific real time video and critical control solutions for underwater ROVs
- M2M, 6M and Annual VSAT contract periods – Short duration upgrades, downgrades, and suspensions.
- Frequently and highly reachable VSAT MIR
- Global VSAT coverage / Satellite Redundancy / Multiple Teleports / Multiple beams
- 24/7 NOC (Network Operations Center) for the multi-WANs (VSAT, LEO (Starlink), 4G/5G, etc.)
- 24/7 SOC (Security Operations Center) for Cyber Security professional services
- Option to choose your IP (US, UK and Spanish IP's)
- "nextGen Fusion" intelligently aggregating all WANs into a single pipe (with free 4G/5G in Europe)
- LEO (Starlink and/or OneWeb) premium partner, providing service and 24x7 support
- **All WAN´s/Connectivity's in a single contract, single point of contact and single 24x7 support entity. (One hand to shake).**
- Dedicated Account Managers, taking closer care of each and every Account/Customer

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Questions?

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