

The background of the slide is a photograph of a satellite ground station at night. Several large white parabolic satellite dishes are visible, some pointing towards the sky. The station buildings are illuminated with warm yellow lights, contrasting with the dark blue night sky and the snow-covered ground. The station is situated in a snowy, mountainous area with evergreen trees in the background.

Marlink, the pioneer in business critical communication solutions customers can rely on.

Marlink: A Growing Group



Creating the world's leading maritime communications, digital solutions and servicing group.

Global Expansion

- Enhance Global Presence
- Larger footprint S-Europe, Asia, MEA



Customer Base

- Best-in-class Portfolio & Service Maintenance



Market Proximity

- Cater for customers in all maritime verticals



Digitalization

- Enabling digital remote operations for our customers



Maritime Market Leadership

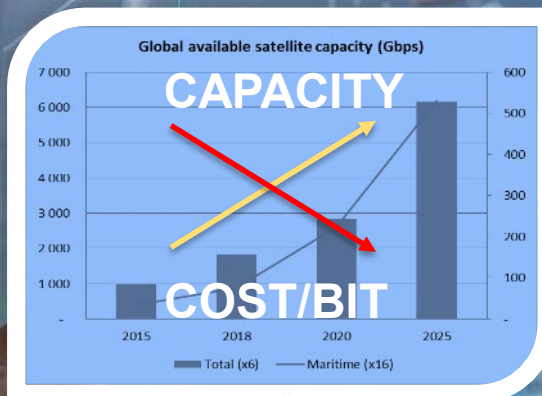
- No 1 maritime VSAT company: more than 5,000 VSAT
- Best in class Ku-band network in the industry



Marlink Group: A Solid Foundation



Satcom Industry is Changing



- Huge capacity increase
- Cost/bit reduction
- From supply to demand
- New constellations & LEO/MEO initiatives

MARKET
CONSOLIDATION



- Affordable high-speed broadband enabling digitalization
- Fueling increase in Broadband penetration, data usage, capacity needs etc.

Digitalisation@Sea



SHIPPING 4.0

Yesterday

Today

Tomorrow

Day after tomorrow

Future

DESCRIPTIVE STAGE
REPORT

DIAGNOSTIC STAGE
DISCOVER & CONTROL

PREVENTIVE STAGE
FORECAST

PRESCRIPTIVE STAGE
ANTICIPATE

ANALOG SHIPS

CONNECTED SHIPS

DIGITISED SHIPS

SMART SHIPS

AUTONOMOUS SHIPS

Tools and associated processes did not allow further operation improvment

Crew operated vessels

Crew operated vessels
+
Remote assistance

Remote operated vessels
+
Crew assistance

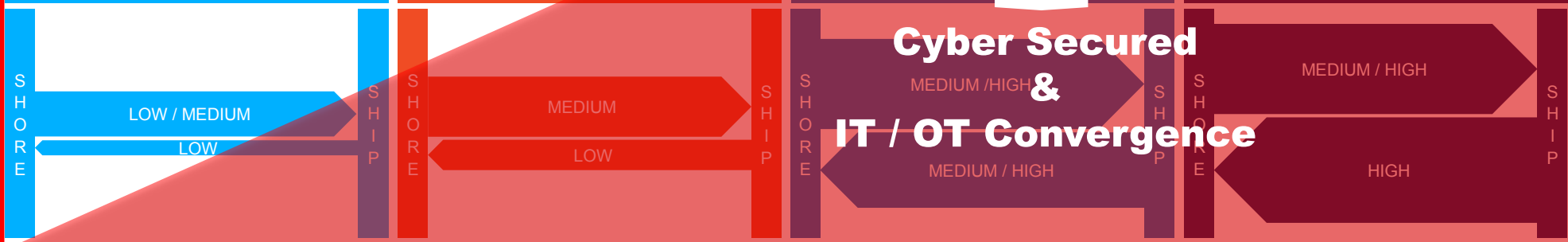
Unmanned vessels

Technology enables and empowers frontline (ship & shore) to optimise performance and benchmark

Shore-based optimisation of assets and vessel performance through fleet wide real time & cloud connectivity

Assets and vessel performance optimisation through real time analytics ashore

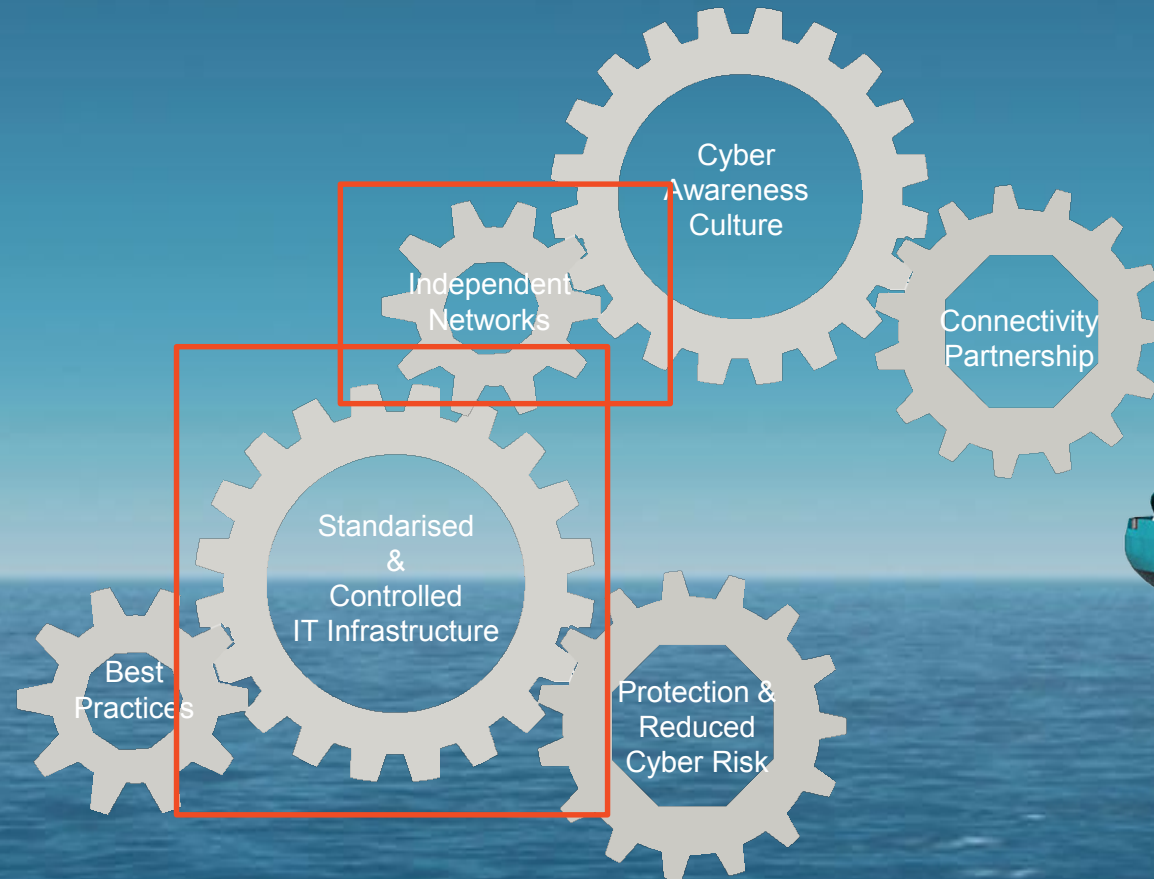
Autonomous vessel navigation and performance optimisation through real time analytics



Cyber Secured &

IT / OT Convergence

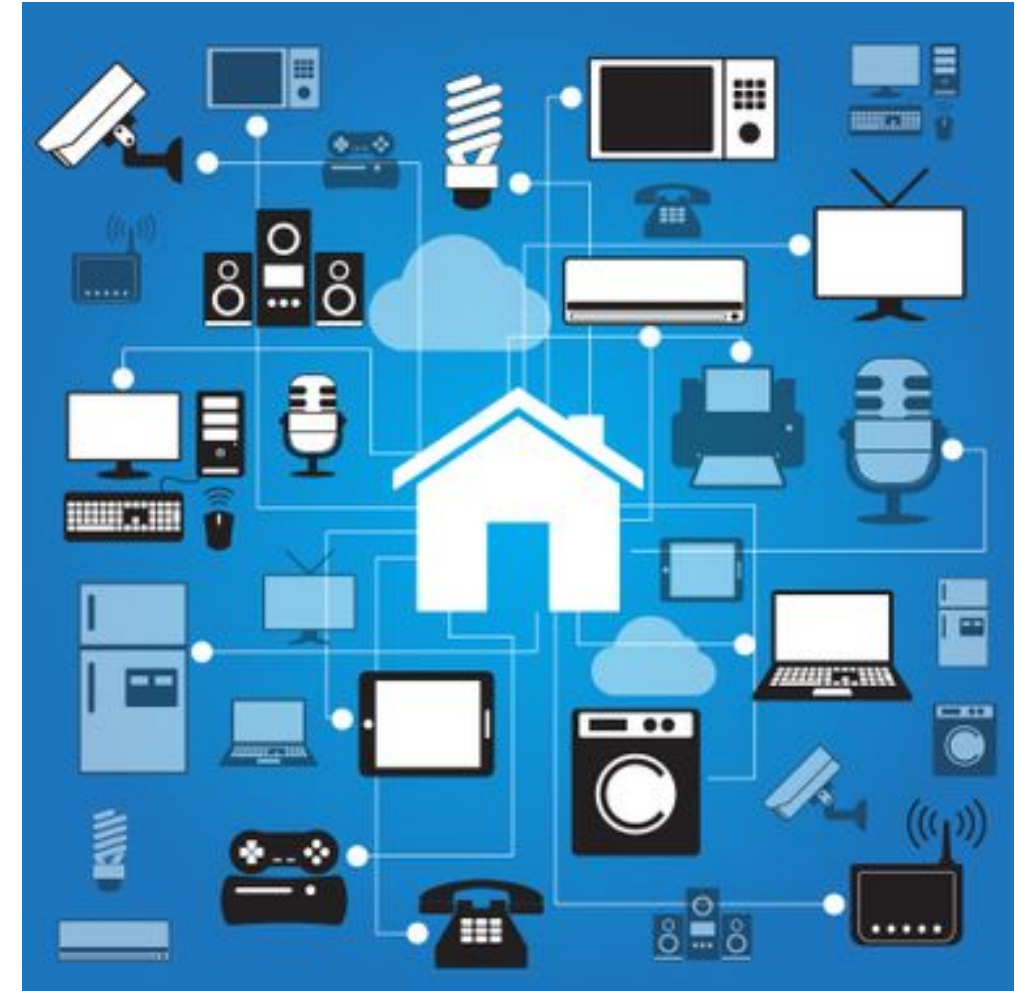
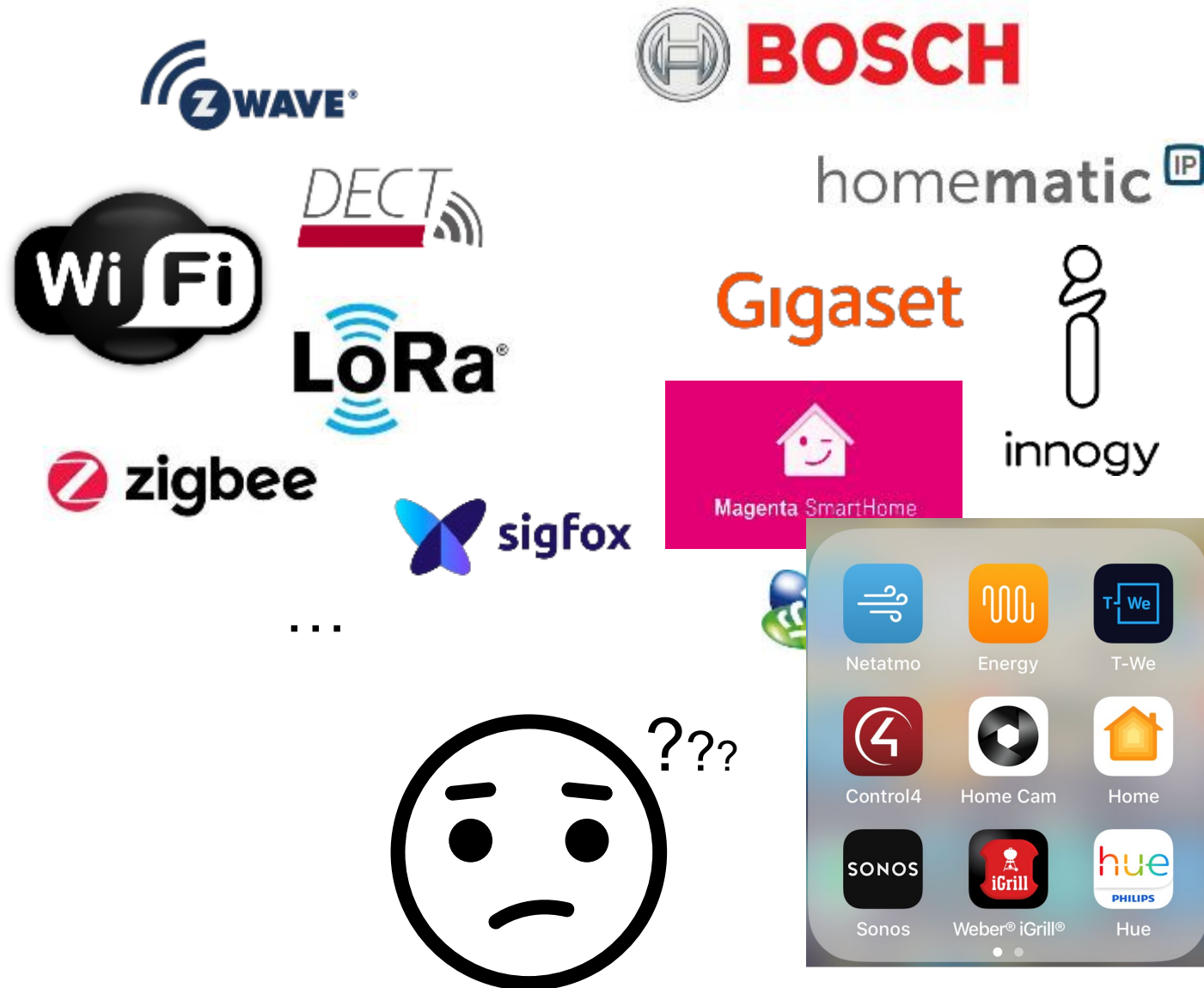
The Connected & Digital Ship



Example: Integrated Bridge

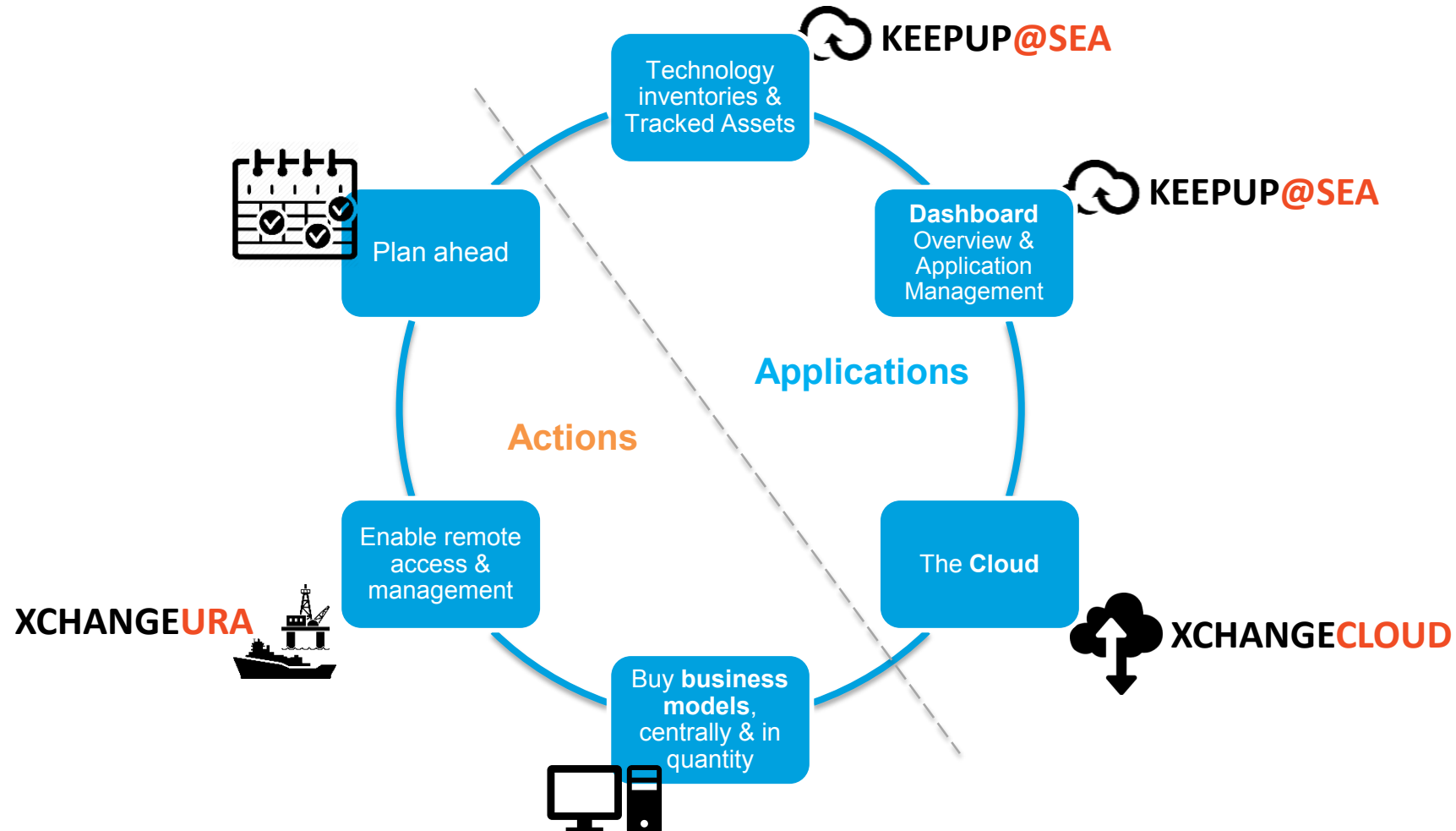


Analogy: Smart Home

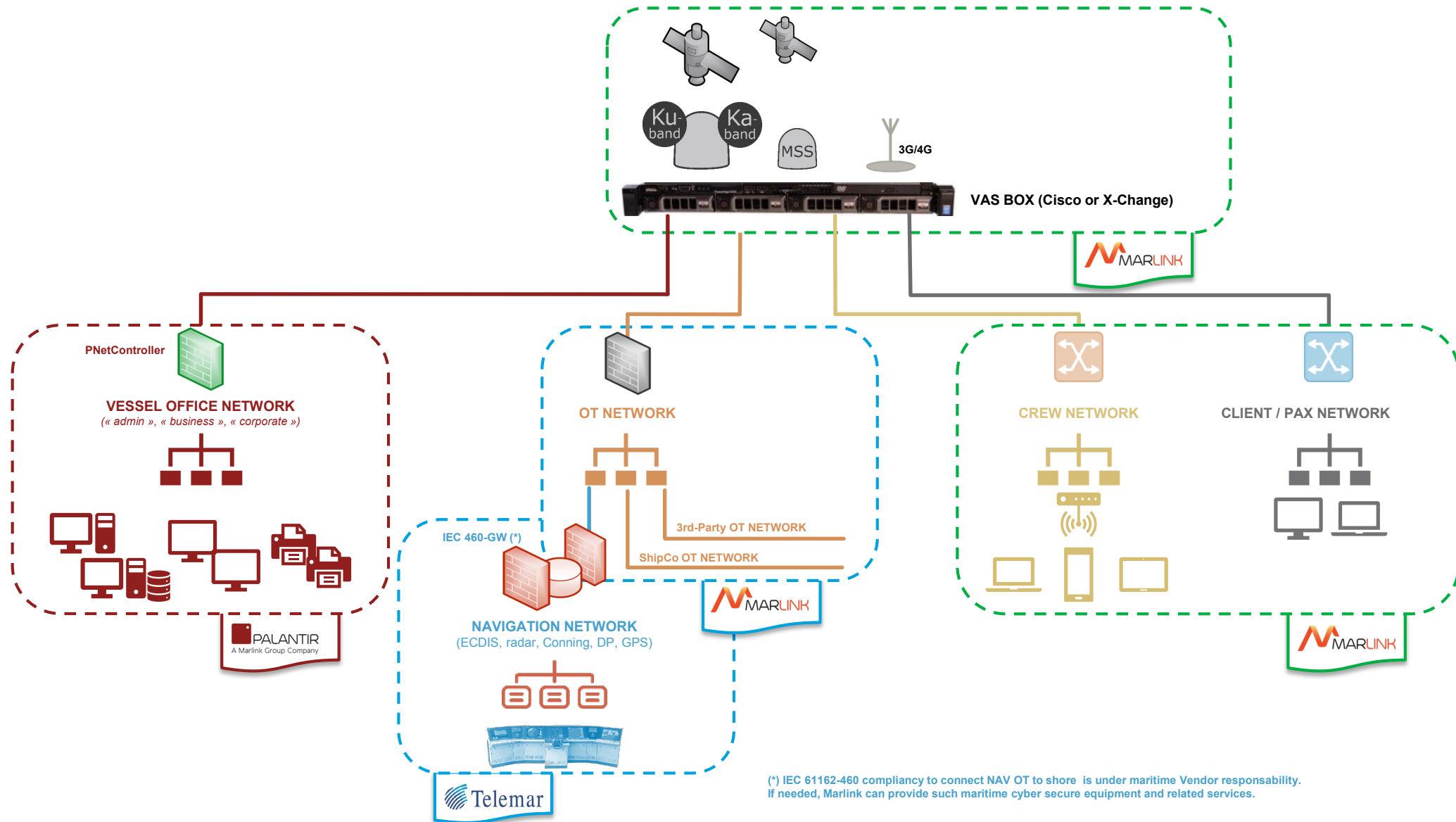


Standardise & Control the IT/OT Infrastructure

How can IT standardisation be achieved?



Secure OT Access Management



Separate Networks & Define Policies



How should your network be split and prioritised?

- The most basic configuration is to split the crew LAN from the corporate LAN
- Would you benefit from further divisions?
- What applications will you prioritise?
- What policies will you set for each network?
- Within the crew network, will all users have the same entitlements, or different?



MARLINK CASE STUDY:



The Challenge:

- 33 Vessels, approx. 700 crew members

The Objective:

- Enabling crew connectivity while maintaining control

The Solution:

- XChange

The Benefits:

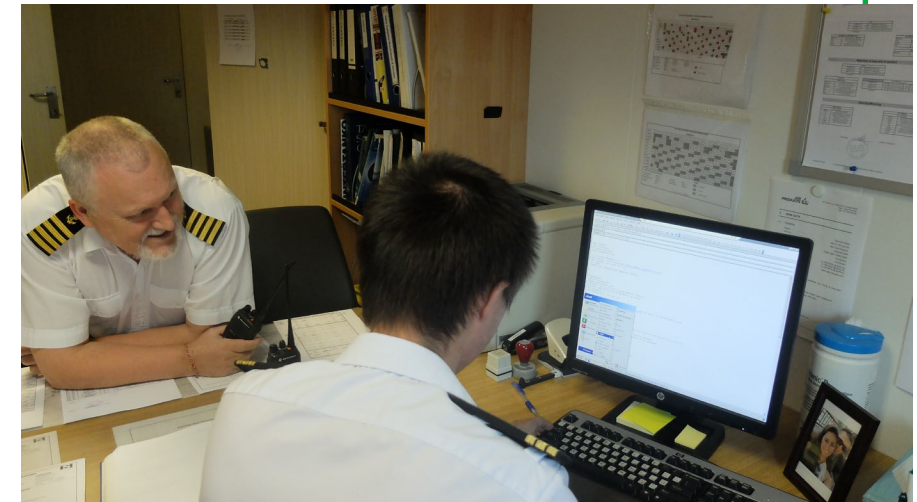
- Crew and business networks are separated, with the business network always getting priority
- An infected crew device will not affect the business network
- XChange user management provides the means to control:
 - Appointed prepaid credits per user or user group
 - Which applications each user can access
 - Restrictions based on volume-based and/or working hours (time-based)
 - Black listing and application filtering

Standardise & Control the IT Infrastructure

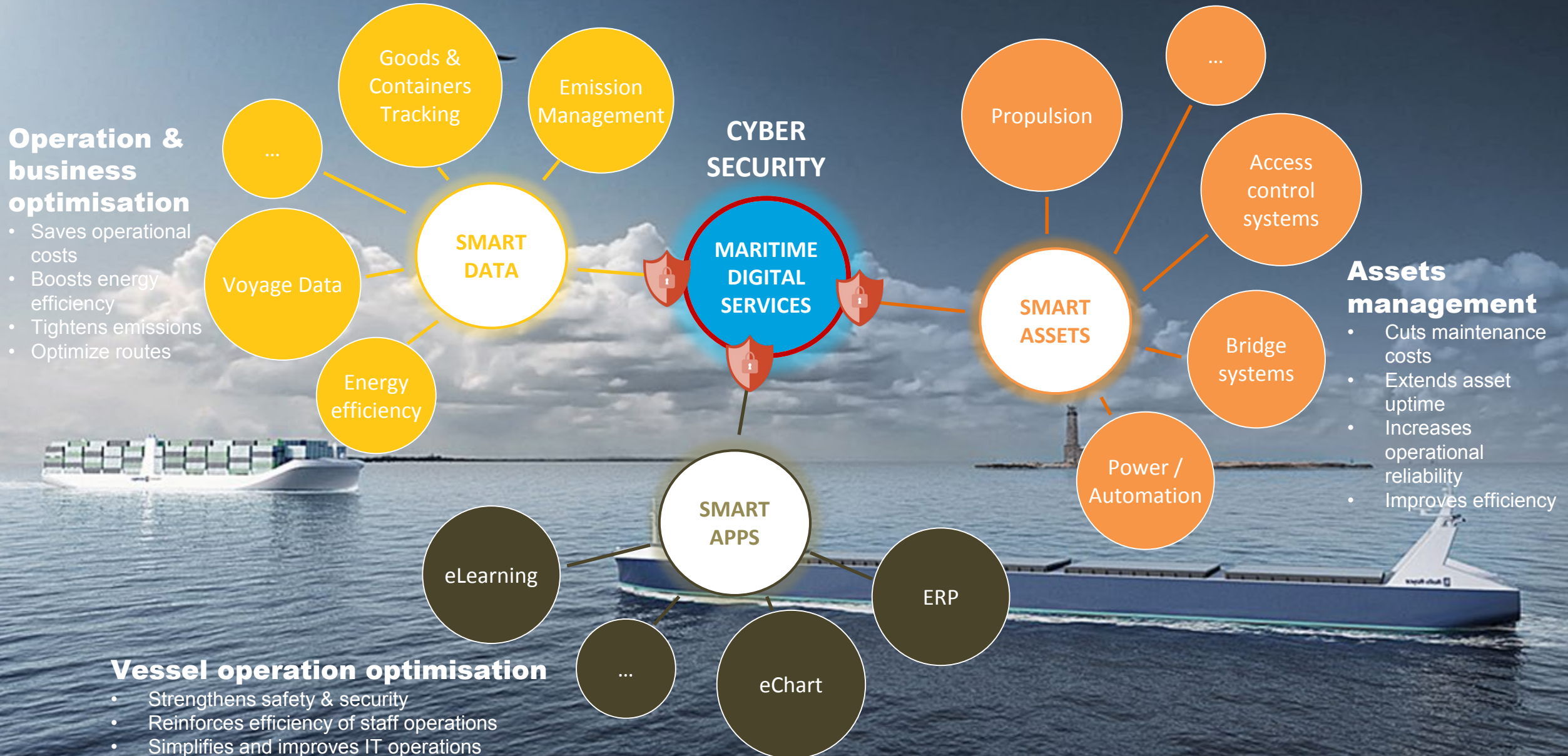
MARLINK CASE STUDY: Stolt-Nielsen Limited

- **The Challenge:**
 - 80-90 vessels (3-15 years old)
 - All serving different markets with different solutions
- **The Objective:**
 - Standardisation & better control
- **The Solution:**
 - Upgraded to deploy standardised Sealink VSAT across all vessels
 - XChange with Universal Remote Access (URA)
 - KeepUp@Sea comprehensive IT solution
- **The Benefits:**
 - Quicker to deploy connectivity & upgrades
 - Straightforward remote troubleshooting (one-time setup)
 - Remote access to any device on the network, for managing & updating applications
 - Stronger IT competence
 - Less IT training
 - Simpler management of maintenance, spares & repairs
 - Reduced cyber risk
 - 30% cost reduction in deploying IT updates and patches

Stolt-Nielsen Limited 



The Pillars of our Digital Innovation



EXAMPLE

Seagull Training Solution (today) – Manual Process

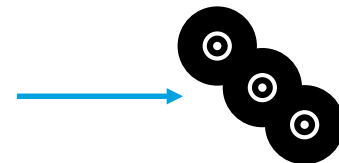


- ShipCo HR/Crew Department: Assessment



Every month

- Seagull center: DVDs training updates



SHORE

- X Shore-Ship operational costs
- X Non-regulatory compliancy and security risks



Unsecured, asynchronous, email loss
Data usage costs

High security risk
Operational costs

ADMIN LAN



Connected



eLearning PC



Offline



Every 6 months delivery
Logistics costs



SEALINK AND XCHANGE PLATFORM

SHIP

EXAMPLE

Seagull Powered by XChange – Content Distribution



- **ShipCo HR/Crew Department:**
Assessment



- **Seagull center:**
Digital training updates



Weekly transfers



Daily transfer

- **Marlink Teleport:**
Data Center

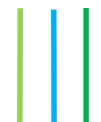


SHORE

- ✓ Real-time crew information at shore
- ✓ Seagull System always up-to-date

Daily transfers

Administration
Configuration
SCORMs



MARLINK DIGITAL INFRASTRUCTURE

SHIP

Administration
data

Admin or Crew LAN

STA and training updates

Configuration files

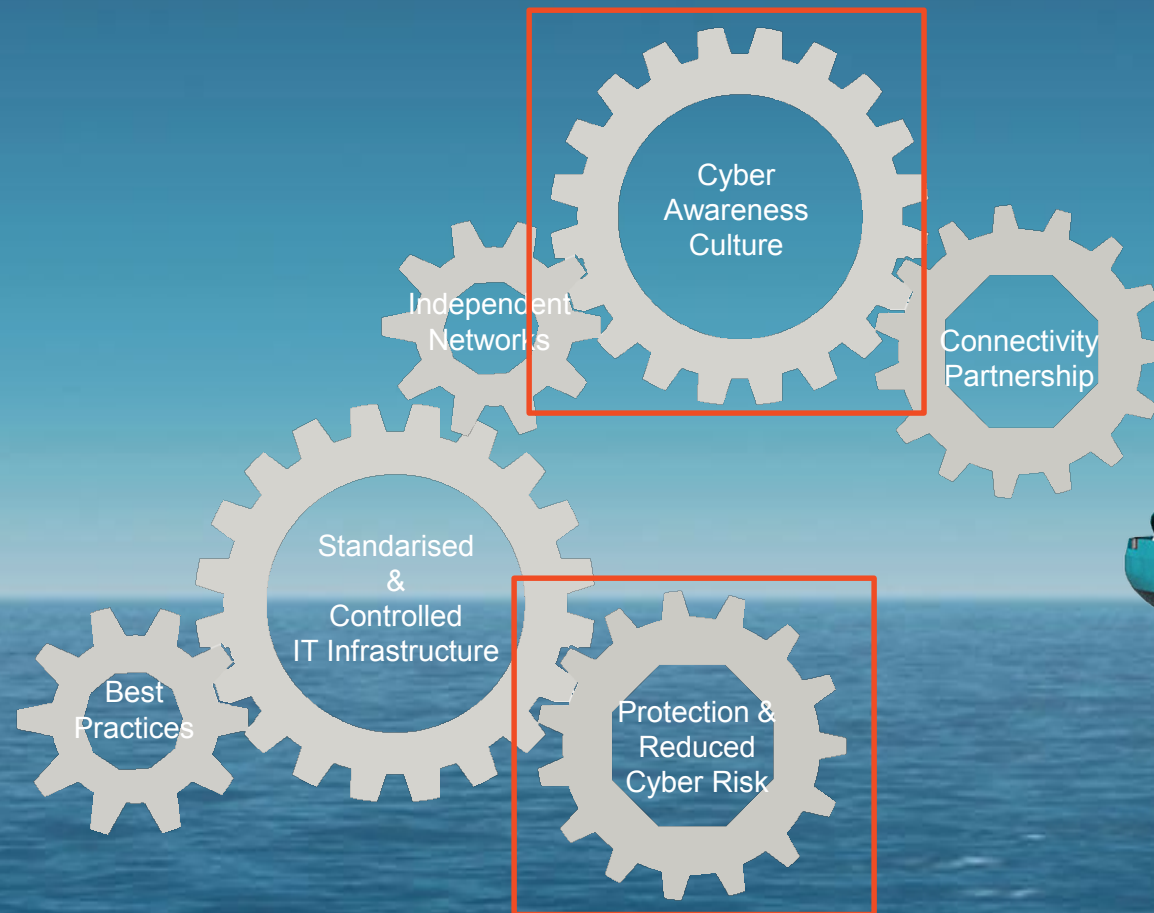
eLearning Server



Seagull server



The Connected & Digital Ship



Digital Dilemma



WIRED: The Untold Story of NotPetya, the Most Devastating Cyber attack in History

THE COST OF NOTPETYA

In 2017, the malware NotPetya spread from the servers of an unassuming Ukrainian software firm to some of the largest businesses worldwide, paralyzing their operations. Here's a list of the approximate damages reported by some of the worm's biggest victims.

\$870,000,000

Pharmaceutical company
Merck

\$400,000,000

Delivery company FedEx
(through European subsidiary
TNT Express)

\$384,000,000

French construction company
Saint-Gobain

\$300,000,000

Danish shipping company
Maersk

\$188,000,000

Snack company Mondelez
(parent company of Nabisco
and Cadbury)

\$129,000,000

British manufacturer Reckitt
Benckiser (owner of Lysol and
Durex condoms)

\$10 BILLION

Total damages from NotPetya,
as estimated by the White
House

Step 5. Create a Culture of Cyber Awareness



*“A leading cause of security breaches is a **basic human vulnerability**: our susceptibility to deception. **Hackers exploit this vulnerability** by sending phishing emails that induce users to click on malicious links that then download malware or trick the victim into revealing personal confidential information.”*

Journal of the Association for Information Systems

Make cyber security **everyone's** responsibility

Your cyber security strategy is only as strong as your weakest link.

In addition to technical cyber security solutions, creating awareness among staff through regular training and a clearly defined IT system usage policy is essential.

An holistic approach is needed towards:

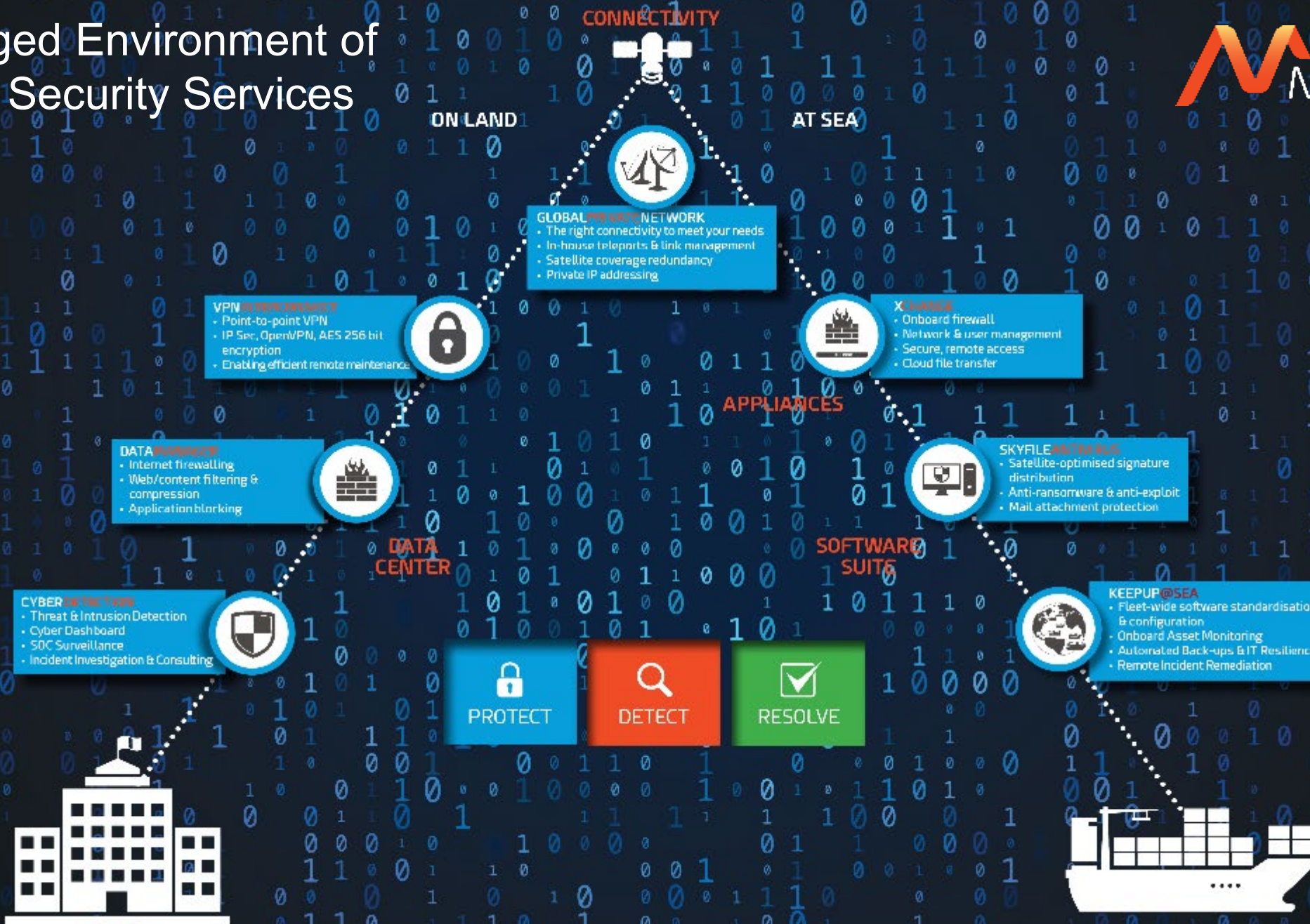
- Technology & solutions
- IT usage policy ('IT Charter')
- Access management (user authentication)
- Training
- Business processes



Cyber Security is not a Product



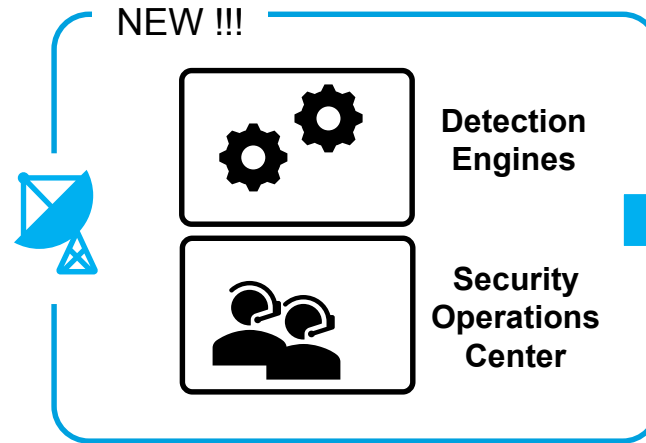
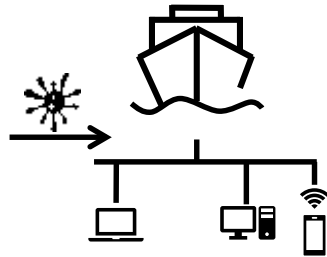
Managed Environment of Cyber Security Services



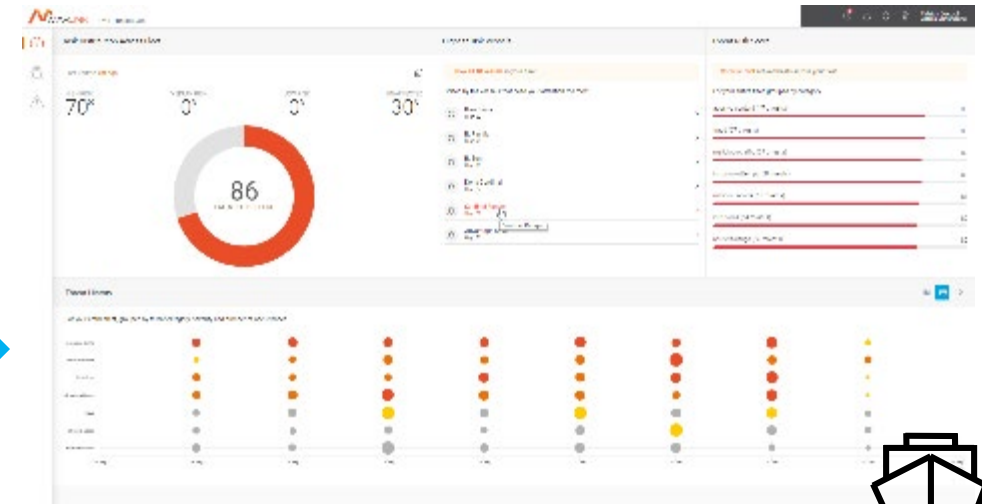
Latest Innovation: Cyber Detection (designed for Maritime!)



Intrusion



NEW !!!



Cyber Dashboard



Dynamic & Intuitive Cyber Dashboard



Actionable Alerts & Counter-Measures



No additional hardware deployed onboard



No additional satellite bandwidth used



Real-time Threat Signatures & Cyber Surveillance



Dedicated Maritime Cyber Surveillance Expertise



Subscription Model, NO CAPEX investment required

Cyber Security as a (Maritime) Service



Marlink proposes a large variety of standardised but also customised cyber security solutions

Multi-band services ensure redundancy in term of coverage and remote remediation at any time

Customers have no investment (no CAPEX) and fixed costs (OPEX control)

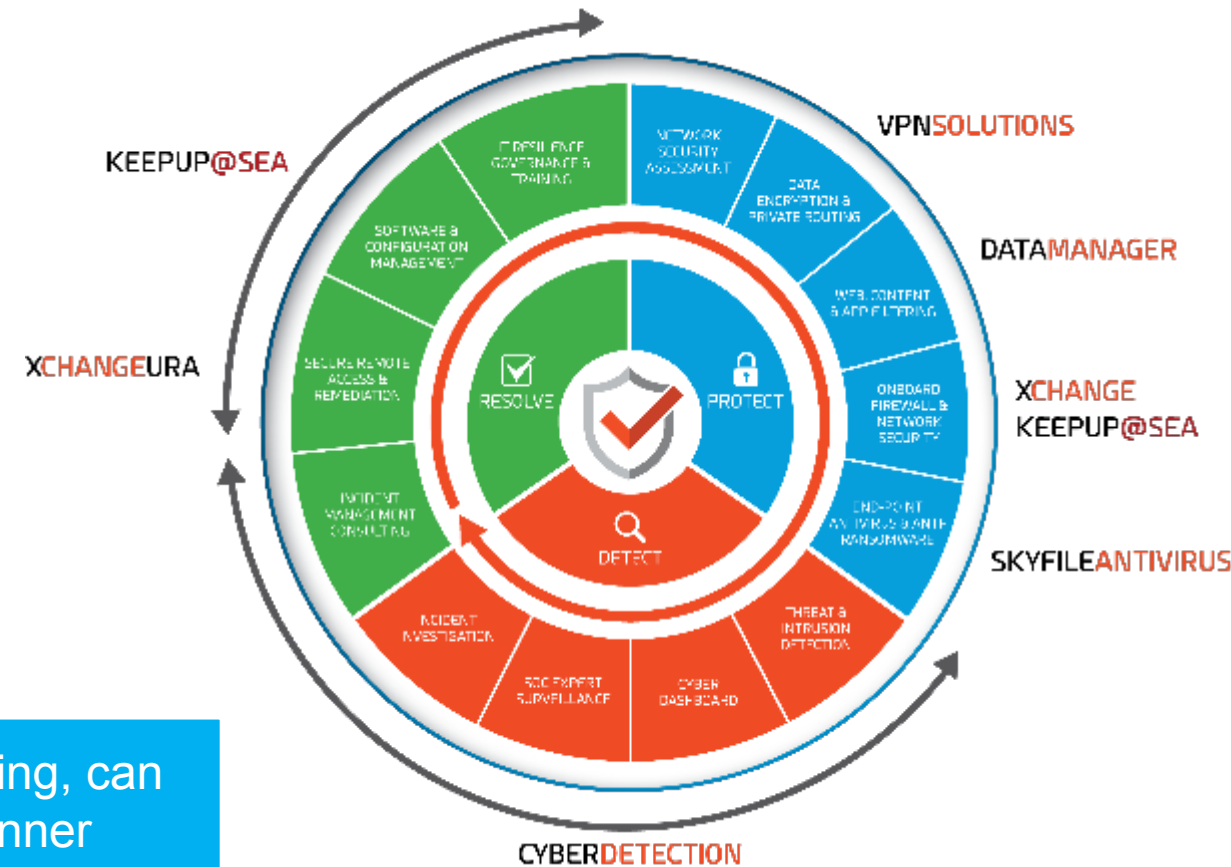
Technology is upgraded by Marlink as part of their service management terms

Self-Serve

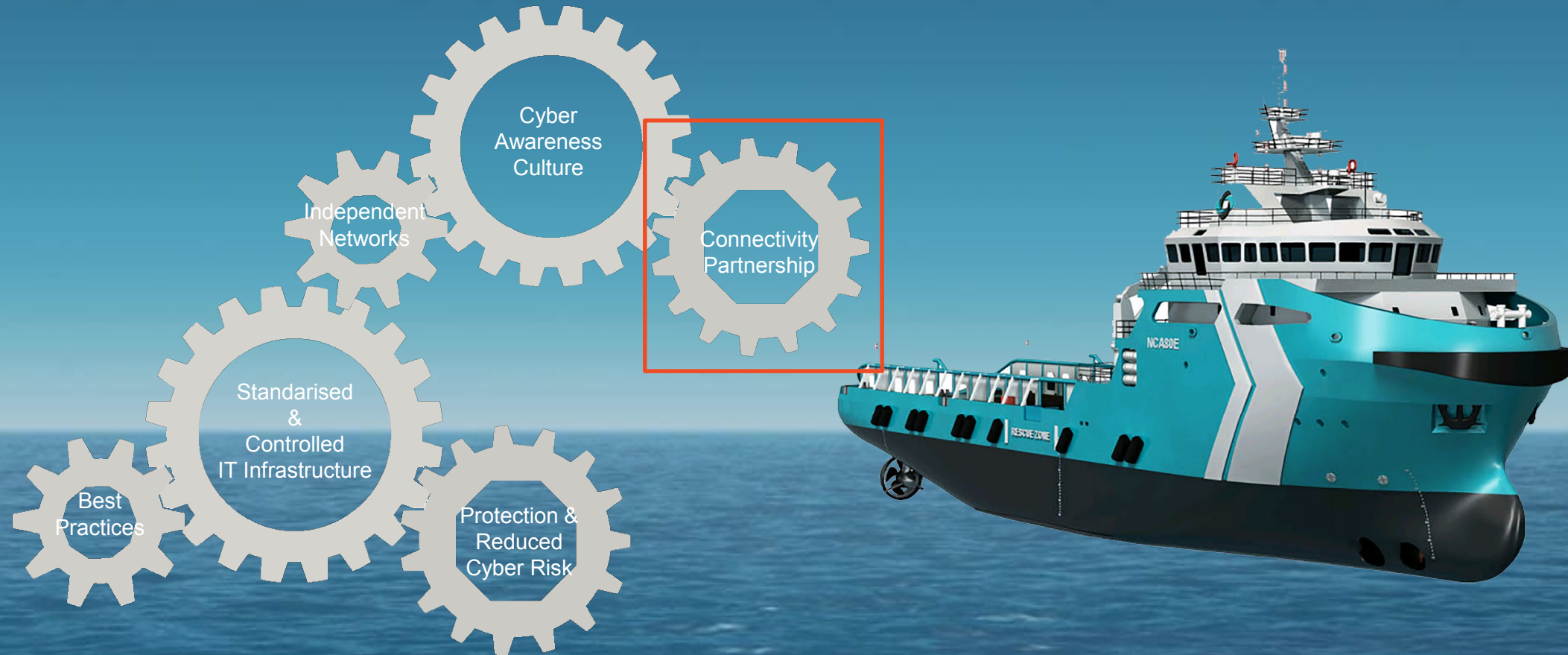
Customers, with appropriate internal staffing, can enjoy each solution in a self-serve manner

Managed Services

Customers can outsource dedicated part of their security management to Marlink



The Connected & Digital Ship



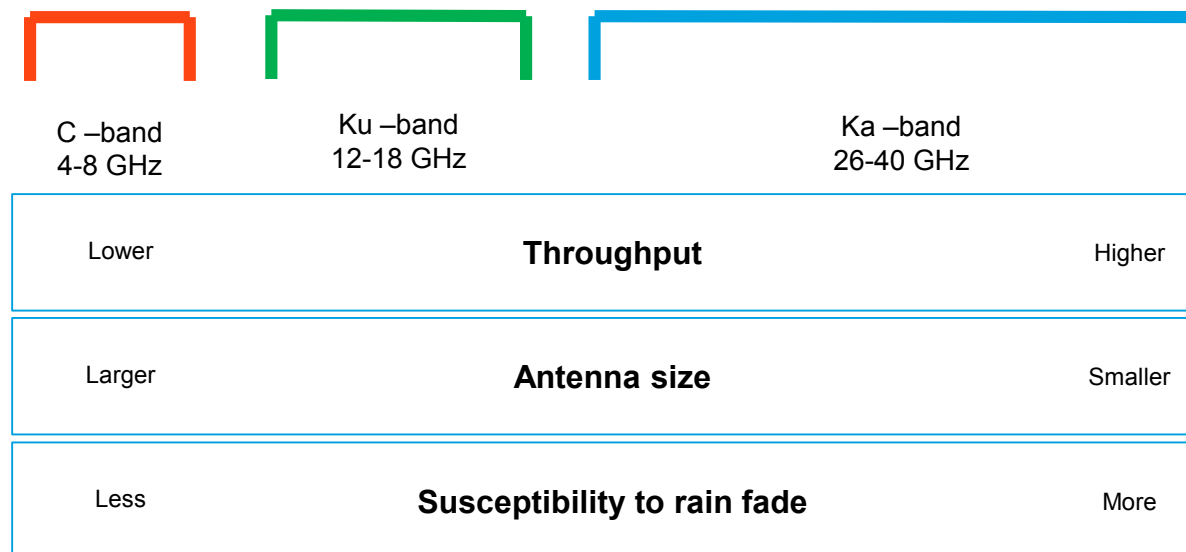
High Throughput Satellite



Spectrum

Satellite frequencies consist of several frequency bands used for satellite and telecommunications.

- ✓ As seen in the picture below, Ka-band have a substantial higher amount of available frequency than C-band.

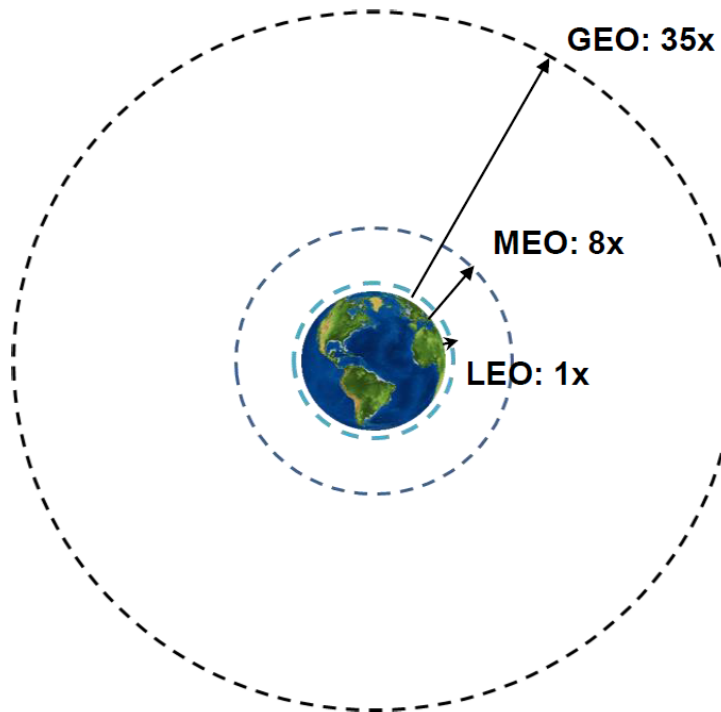


Frequency band	Frequency range	Uplink	Downlink
C-band	4-8GHz	5.850 – 6.425GHz	3.625 – 4.200 GHz
Ku-band	12-18GHz	13.75 – 14.50 GHz	10.70 – 12.75 GHz
Ka-band	26-40GHz	27.50 – 31.0 GHz	17.70 – 21.20 GHz

Further a satellite is from earth, higher the latency (round trip time)

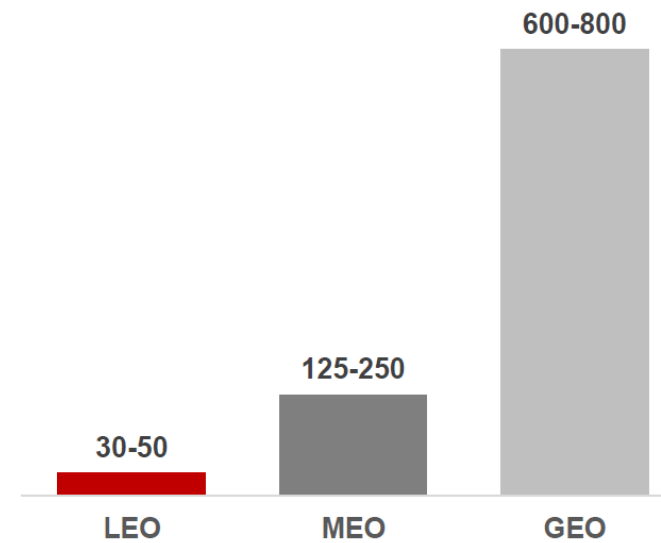
Relative distance of satellites from Earth

1x = 1,000 km



Round Trip Time

Milliseconds



High Throughput Satellite



GEO Satellites

Flexible High Capacity Satellites

- ✓ Respond to changing demands
- ✓ Reconfigure power, footprint, frequency and bandwidth

Ultra-high Throughput Satellites

- ✓ Larger HTS payloads
- ✓ Reducing price with up to 75% per Mbps*

MEO and LEO Satellites

✓ Provide lower latency for time-critical services due to the closer proximity to Earth's surface

✓ The closer proximity also allows the satellites to use less power

✓ LEO satellites have the ability to provide a truly global coverage depending on number of satellites and orbit around earth

✓ LEO satellites utilizes inter-satellite links, which reduces ground segment costs

MEO Satellites

O3b

- ✓ 450 satellite constellation

LEO Satellites

One Web

- ✓ 900 satellite constellation

LeoSat

- ✓ 108 satellite constellation

SpaceX

- ✓ 4000 satellite constellation

LEO Constellation

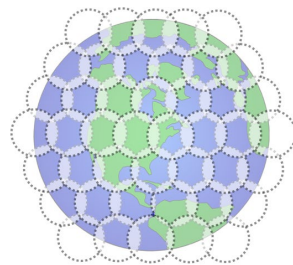


Low-Earth-Orbit Satellites Benefits

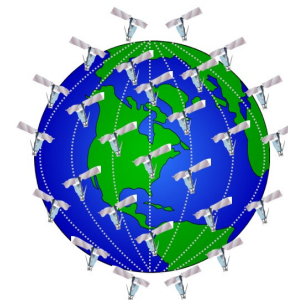
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Low-Earth-Orbit Challenges

- ✓ Short visibility from any point on earth - beam switching every few minutes
- ✓ High complexity due to satellite tracking and handovers
- ✓ Full network needed for absolute global coverage
- ✓ Short lifespan of satellites



Leo Satellite Footprints



Leo Satellite Orbits

LEO initiatives

Several companies are taking on the development of LEO satellite constellations.



Operator						
Orbit Type & Path Altitude	MEO Circular 8,063 km	LEO 780 km	LEO 800 and 950 km	LEO 1400 km	LEO	LEO 1100 km
Frequency Bands	Ka	L- and Ka-band	Ku-band	Ka-band	Ka-band	?
Coverage Areas	Global Limited to between 45°N and 45°S latitudes	Global	Global	Global	Global	Global
Initial Number of Satellites	8	66	900	78	117	4000
Network Architecture	Proprietary network	Proprietary network	Proprietary satellite terminals, but end user equipment may be LTE, 3G, 2G or WiFi	Polar orbit, optical inter satellite communication. Network compliance with 4G/5G/LTE.		
Advantages	Lower latency than Geo-satellites, 1.6 Gbps in one transponder. Owned by SES	Very low latency, global coverage, inter satellite connections (4 per satellite)	Very low latency, global coverage, inter satellite connections, 6 Gbps throughput per satellite.	Very low latency, global coverage, up to 1.6 Gbps throughput per remote	Very low latency, global coverage,	
Trade-offs	Limited coverage	Low data rates at L-band (max. 512/1536 kbps)	Disposal of satellites?	Disposal of satellites?	Disposal of satellites?	Disposal of satellites?
Anticipated Availability	2014	2015-2017	2019-2020	2021	2021	Initial 2020

“NSR estimates that if ALL constellations do go ahead as planned,
we are looking at capacity of the order of

20-30 Terabits

coming online in the next decade,
which is orders of magnitude higher than
the **2.5 Terabits** of GEO/MEO HTS capacity
that NSR expected by **2023**”

Reference: <http://www.nsr.com/news-resources/the-bottom-line/leo-hts-constellations-what-happens-if/>



Connect smarter. Anywhere.