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# OT Risk Management

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# Vessels: Floating Digital Offices

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Navigation Services (AIS, GPS, ECDIS)

Communication Systems

Bridge Officers

Operational Services

Cargo Management

Crew

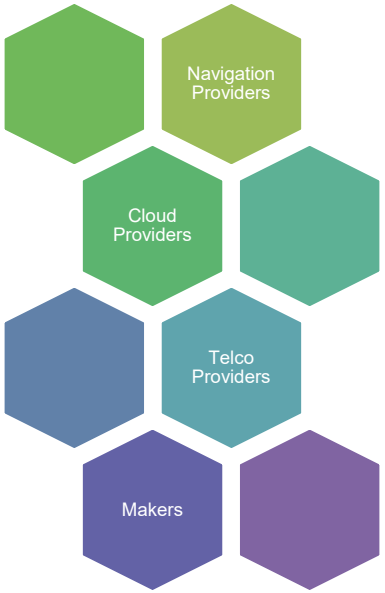
PMS

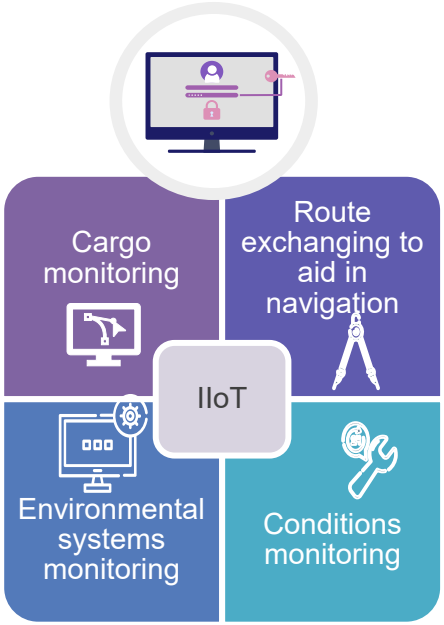
Maritime Company Users

Crew network

Inspectors

OT Equipment



# Connected Technologies: Advantages and Risks

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Advances in **digital** and **connected technologies** are transforming the global shipping network, **offering opportunities for greener, safer, and more efficient operations.**

**Cybersecurity Issues**

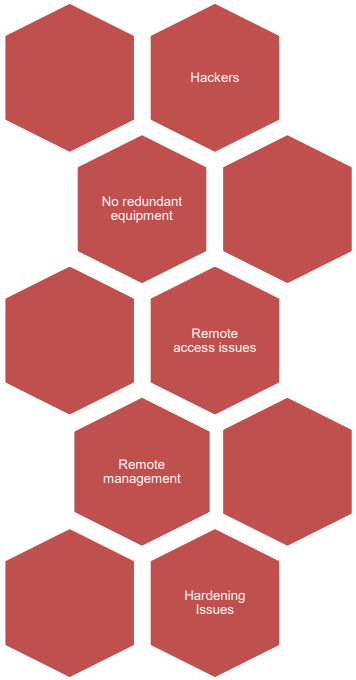
Digital technologies not only enhance sustainability but also **improve safety by automating complex processes, benefiting ports and sea safety**.

Digital technology is considered as a **key enabler for decarbonization plans**

Connected technologies are **crucial for reducing emissions through fleet and route optimization**

OT Systems: operate **semi-autonomously or fully autonomously**, enhancing efficiency and reducing human intervention.

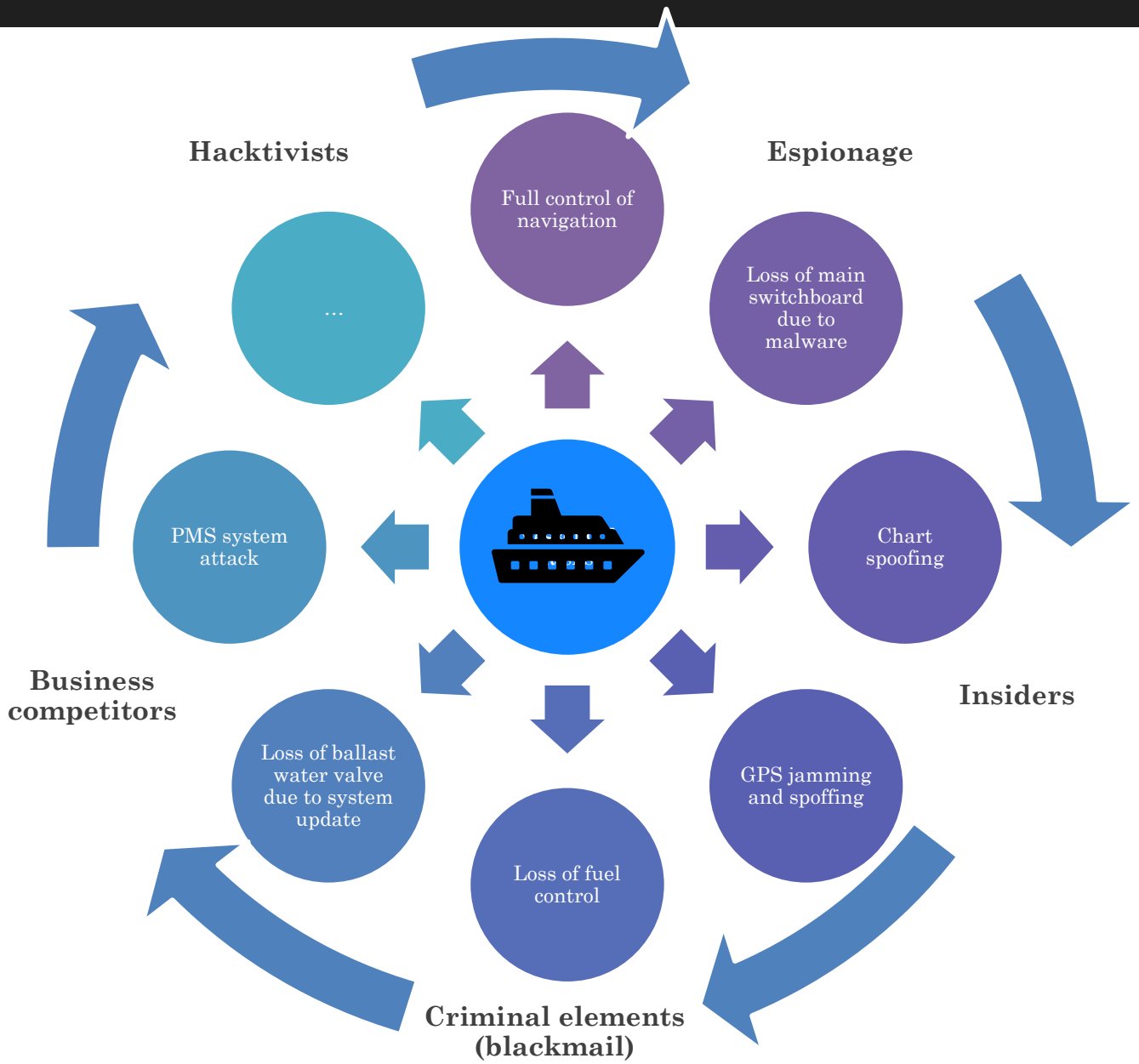
The increasing connectivity in the maritime **sector raises concerns about OT cybersecurity, with more connections increasing the likelihood and speed of breaches.**






References: “REVIEW OF MARITIME TRANSPORT”: https://unctad.org/system/files/official-document/rmt2022_en.pdf
DNV: “Maritime Cyber 2023”

# Risks and Attack Vectors



# Risk Scenario

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| THREAT | DESCRIPTION | VULNERABILITY | DESCRIPTION | Proposed Countermeasure |
|---|---|---|---|---|
| **Control Logic Manipulation** | Control system software or configuration settings modified, producing unpredictable results | **Insufficient configuration** | Improperly configured systems may leave unnecessary ports and protocols open. These unnecessary functions may contain vulnerabilities that increase the overall risk to the system. Using default configurations often exposes vulnerabilities and exploitable services. All settings should be examined. | Hardening based on best practices (CIS benchmark) |
| | | **Critical configurations are not stored or backed up** | Procedures should be available for restoring OT/ICS configuration settings in the event of accidental or adversary-initiated configuration changes to maintain system availability and prevent loss of data. Documented procedures should be developed for maintaining OT/ICS configuration settings. | 1. Procedures should be available for restoring OT/ICS configuration settings in the event of accidental or adversary-initiated configuration changes to maintain system availability and prevent loss of data.<br>2. Documented procedures should be developed for maintaining OT/ICS configuration settings. |
| | | **Slow / lack of updates** | Maintaining ICS/SCADA firmware and software up-to-date is not easy, and it can be very complex for critical infrastructure systems, as an update error could cause severe issues on the whole system. Cyber fragility results from applying a change to the system without having tested it beforehand and having foreseen its effects. | Software updates should be monitored and implemented as needed on time (after proper testing) |
| | | **SCADA Software features** | SCADA applications and software usually provides basic and modest security features. However, these are not always enabled by default, and could act as additional weaknesses if operators are unaware of the need of enabling these features. | Operators should be aware of the need of enabling features. |
| | | **Operating System Vulnerabilities** | The whole host of normal IT operating system vulnerabilities are present in SCADA systems.<br>The difference from an IT system is that patching may be performed less rigorously. It is usual for a SCADA system operator to have a running system that is expected to perform without interruptions. | It is usual for a SCADA system operator to have a running system that is expected to perform without interruptions. |



**Reference: SANS**: ICS Layered Threat Modeling, **ENISA**: WP2016 3-1 2 ICS SCADA Dependencies, **NIST**.SP.800-82

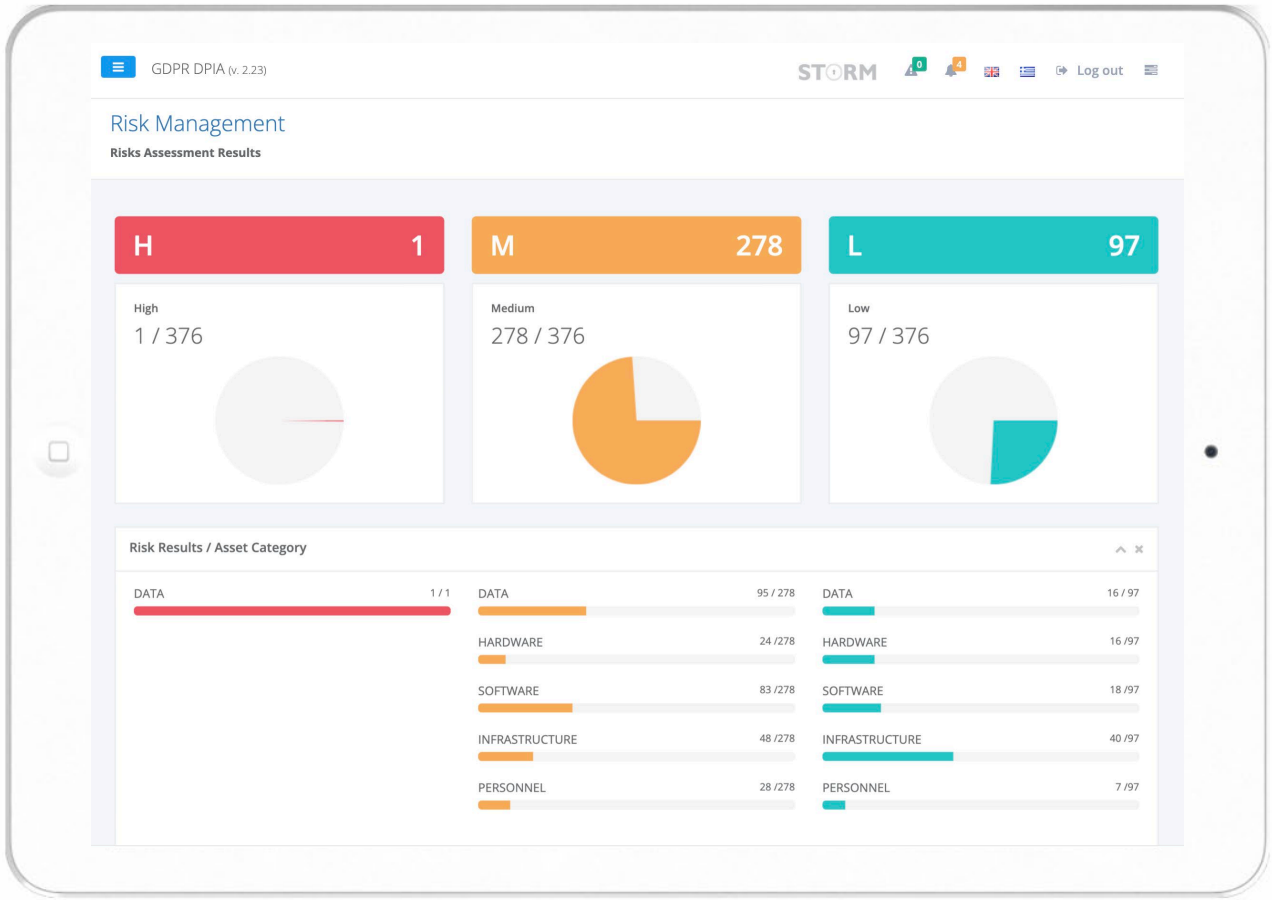
# Our Proposed Methodology



**Conduct Risk Assessment & Risk Treatment**

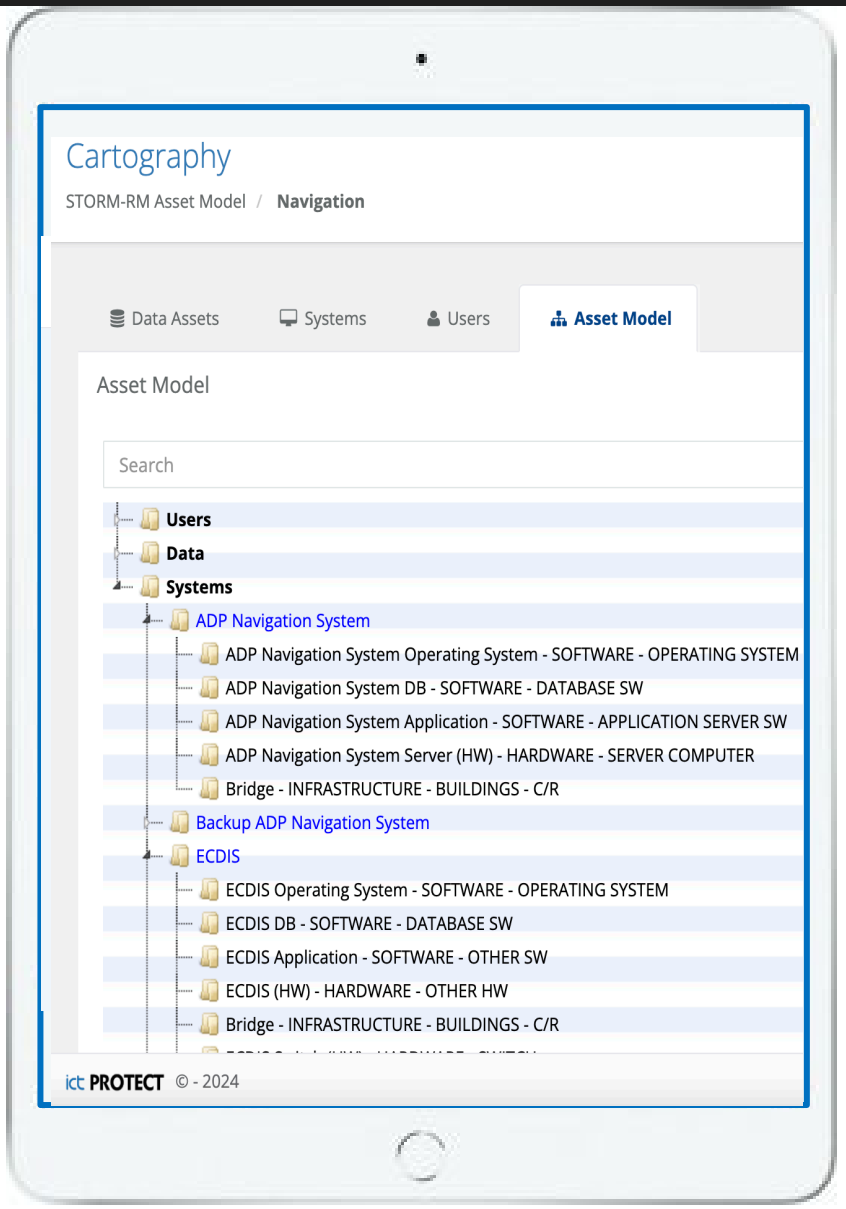
-- Identify IT & OT Assets
-- Identify assets' dependencies
-- Impact Assessment

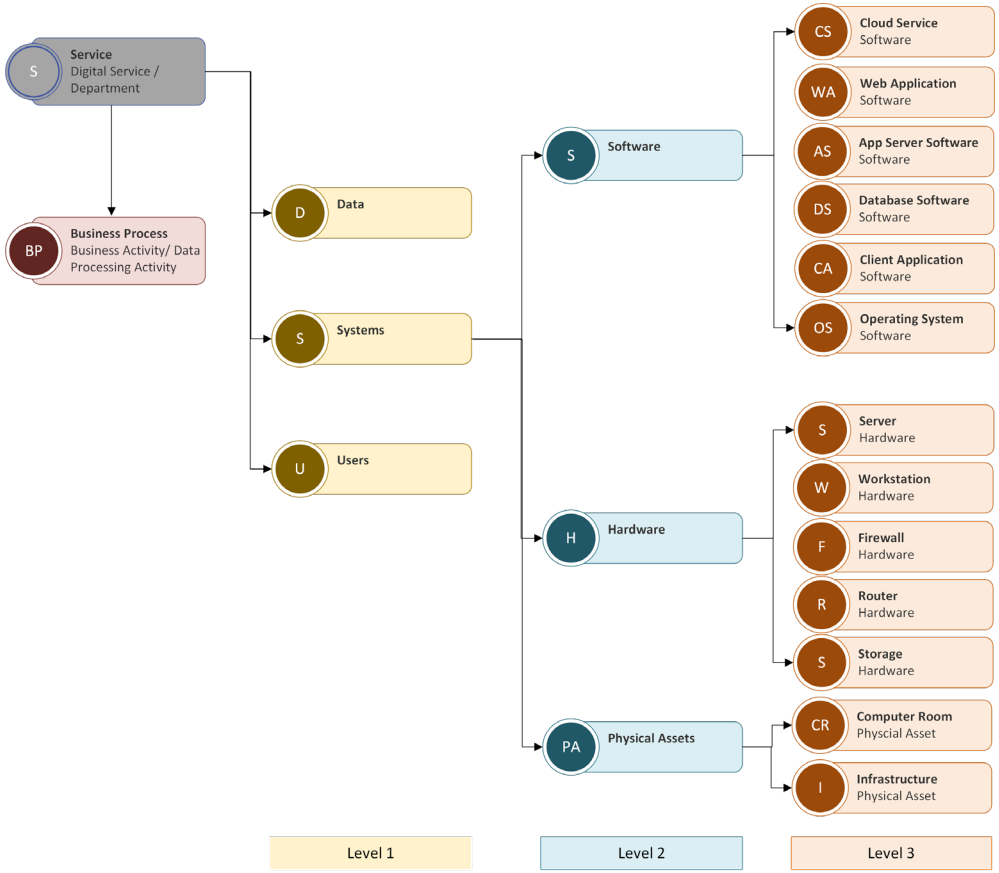
--Identify Potential Threats
--Evaluate Vulnerabilities
--Propose Mitigation Actions

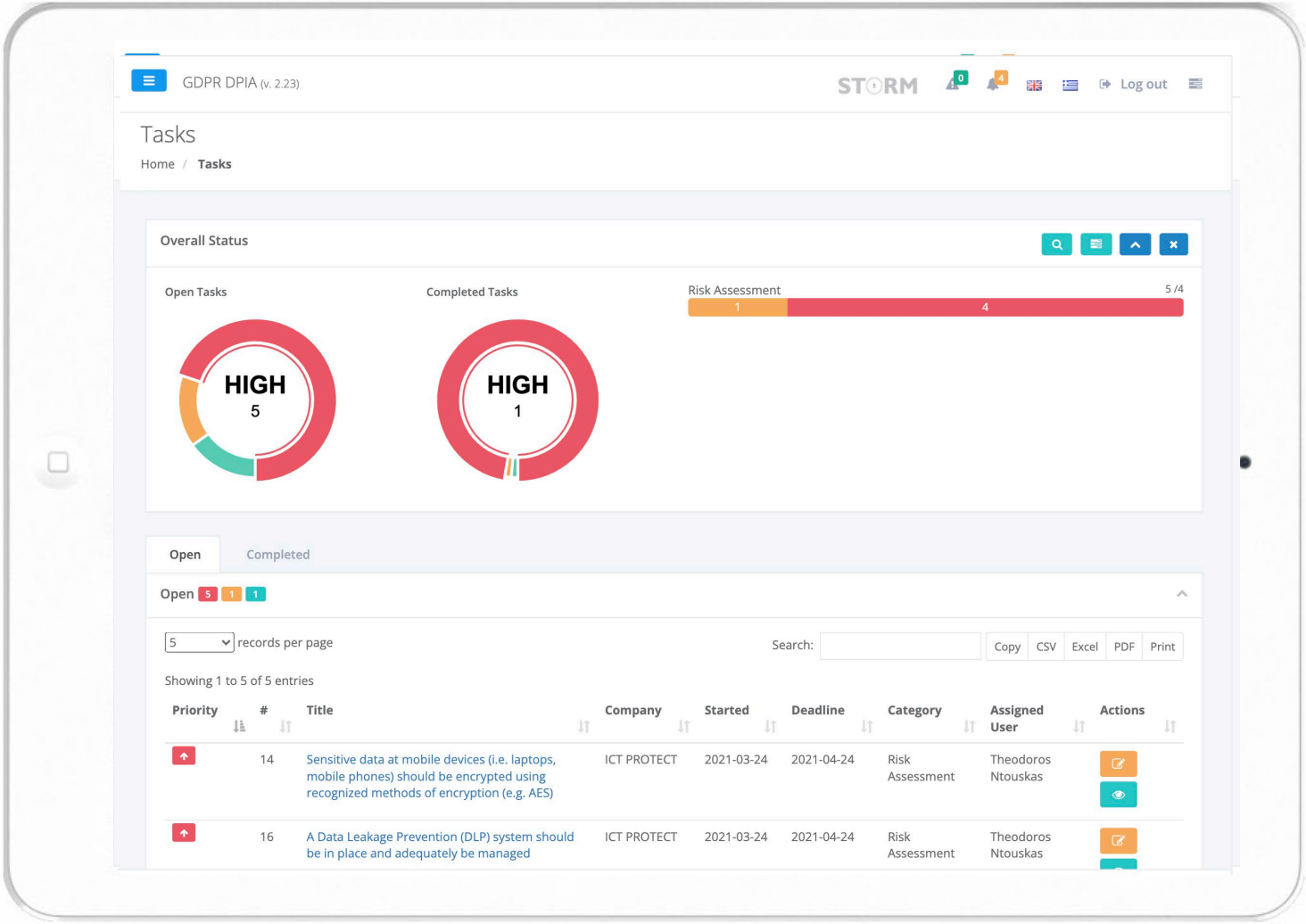


# Vessel IT&OT Asset Model







# Issues & «life jacket»

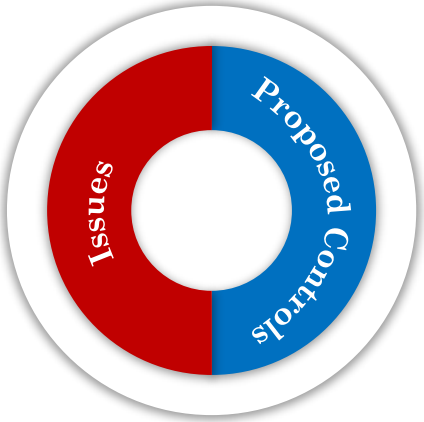
IT & OT Systems are increasingly exposed against cyber risks.

Cyber risks could be exploited either by **satellite networks**

either by the traditional communication channels

**significant impact** on all maritime entities affecting international economy

**Digital supply chain risks**
Gartner predicts that by 2025, **45% of organizations worldwide will** have experienced attacks on their software supply chains, a three-fold increase from 2021




**IT & OT Risk Assessment**
Risk Assessment should depict IT & OT dependencies

**Control Remote Access**
Remote access capabilities must be adequately controlled

**Vulnerability Management & Patch Management** Processes should be enforced

**Incident Management**
Incident response procedure must be in place and adequately followed.

**Secure Network Architecture**
**Network architecture** should be designed through the most secure and widely used architecture model for ICS/OT systems, the Purdue Model (ISA 99, IEC 62443).

# Architecture Levels – Purdue Model

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**Level 5: Enterprise (Enterprise Zone) - Shore Office Network**

- Internet
- Satcom

**Level 4: Site Business Planning and Logistics (Enterprize Zone) - Vessel Network**

- Ship Crew WiFi, Ship Guest WiFi
- Bridge Computers, Captain & Engineer Computers
- Monitoring Systems (Ballast, Cargo, Main engine)
- Ship Stability Program
- VDR

**Level 3.5 Industrial DMZ**

- Firewall
- Web Proxy (broker service for propulsion, ballast, cargo data)
- WSUS
- ECDIS Update Gateway
- Remote Desktop Gateway

**Level 3: Site Manufacturing Operations and Control (Manufacturing Zone) - Bridge-ECR**

- VDR (Data Collecting Unit)
- ECDIS
- CCR Computer and equipment
- ECR Computer
- SCADA/Shipboard Integrated Monitoring and Control Systems

**Level 2: Area Supervisory Control (Cell / Area Zone) - Bridge-ECR**

- Switches
- Firewall
- HMI Propulsion
- HMI Power Management

**Level 1: Basic Control (Cell / Area Zone) - Bridge-ECR**

- GPS, PLC, HMI
- CAN bus
- Echosounder

**Level 0: Process (Cell / Area Zone) - Bridge-ECR**

- Sensors
- Actuators

# References


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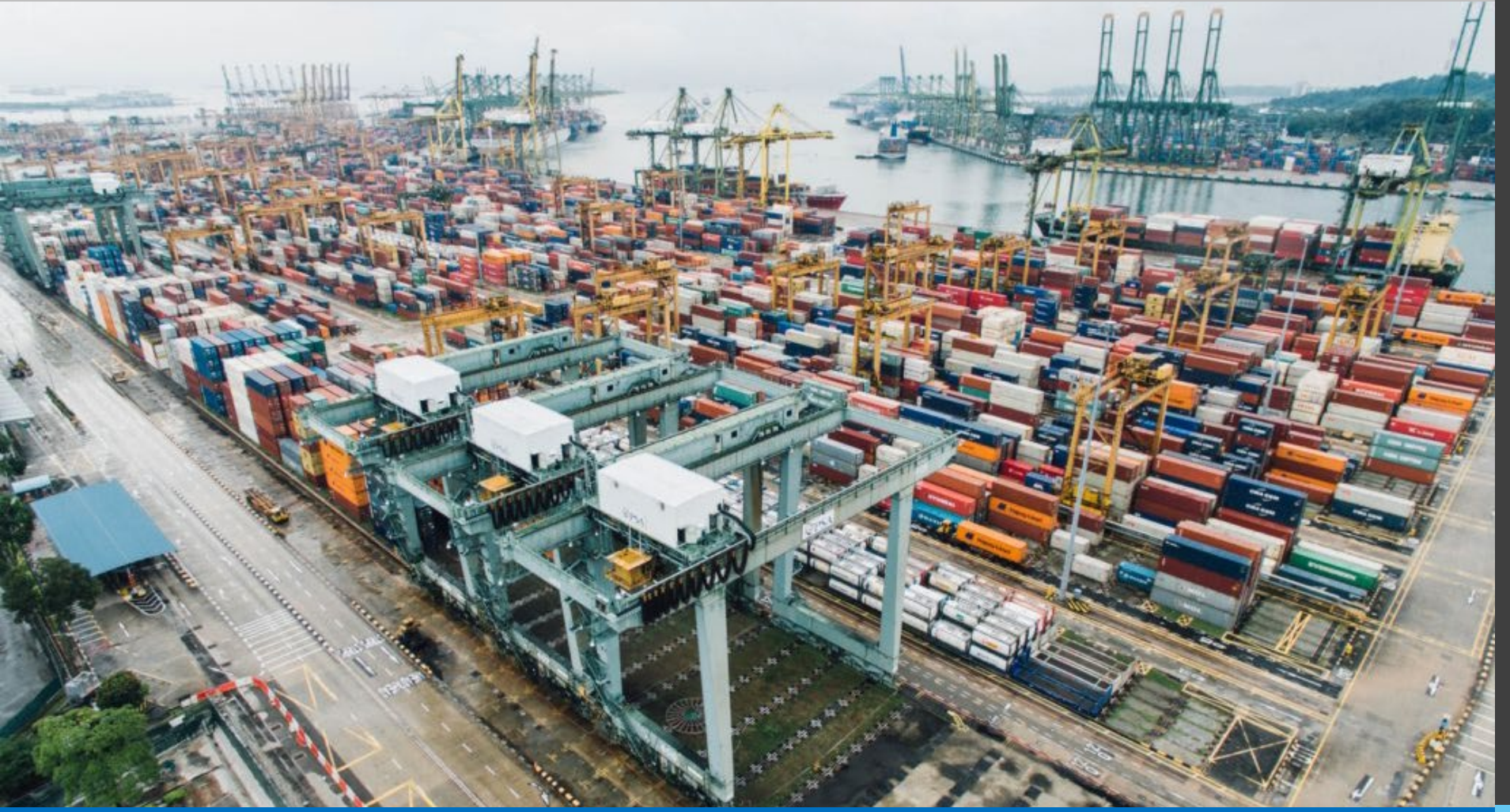
  - https://sustainableworldports.org/wp-content/uploads/IAPH-Cybersecurity-Guidelines-version-1_0.pdf
- ISA/IEC 62443 series of standards in order to address the need to design cybersecurity robustness and resilience into industrial automation control systems
  - https://www.isa.org/intech-home/2018/september-october/departments/new-standard-specifies-security-capabilities-for-c

# Our services



# Let’s do business

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# Commercial Ships & Cybersecurity Requirements

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IMO
IMO's MSC-FAI.1-Circ.3

Classification Soc.
Cyber secure class notation

TMSA3

BIMCO

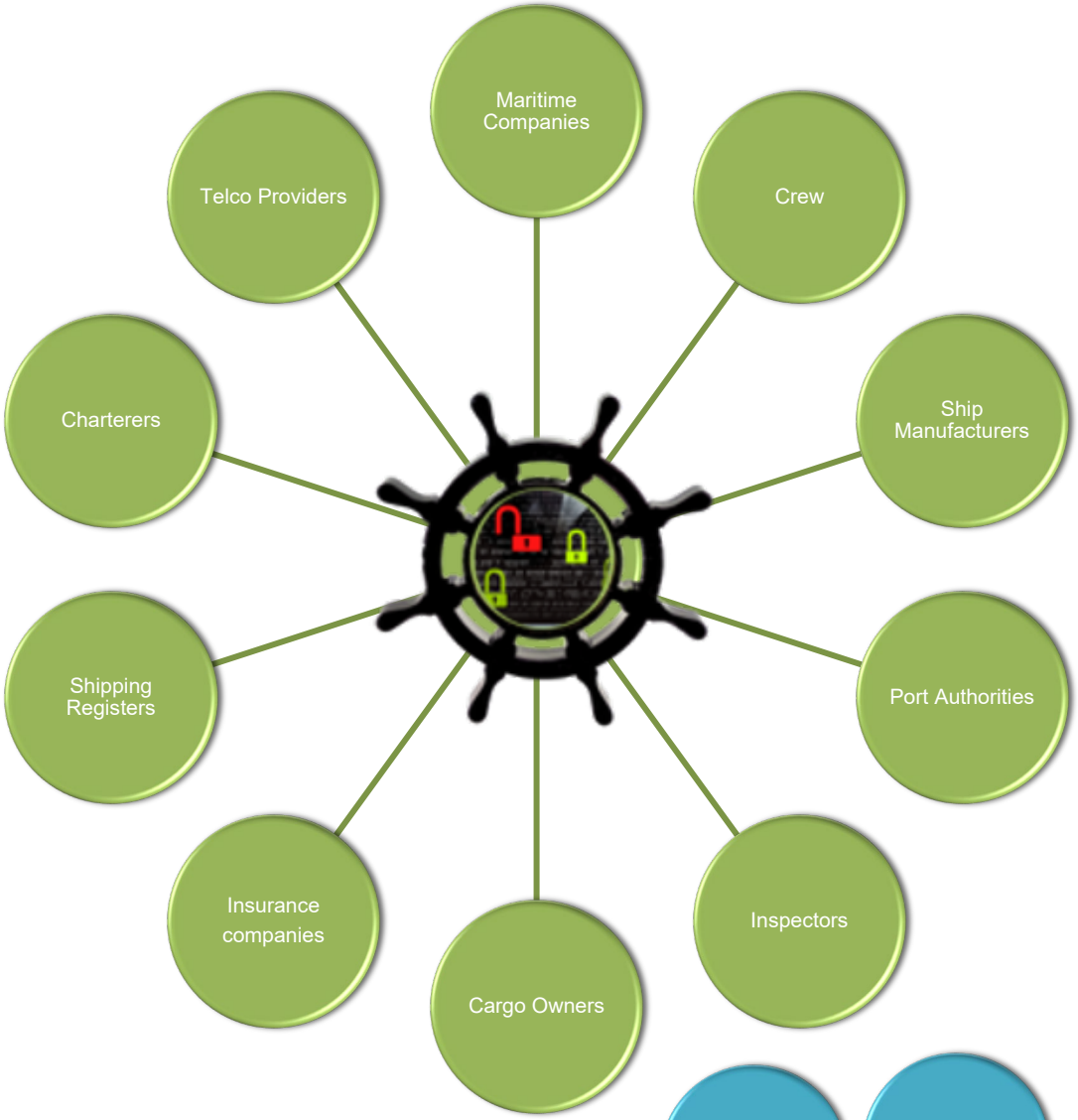
Us Coast Guard, Feb. 2020

IACS, rec.166

ENISA

UK DfT

IAPH




ISO 27001

ISO 22301

ISO 27701

SOC 2

GDPR

CCPA

ISO 27002

NIST CSF

- Requirement
- Class Notation
- Guideline
- Standard
- Port Guideline