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Cybersecurity in the Maritime Domain: Incidents and Best Practices

Brett van Niekerk

Introduction

- The purpose is to give an indication of current cyber incidents in the maritime domain, with some best practices, and legal perspectives
- The maritime domain is a critical infrastructure, and a potential target for economic information warfare and cyber crime
- Maritime domain = Ports + vessels + undersea infrastructure
- ‘Cyber incident’ vs ‘cyber attack’ vs ‘cyber warfare’

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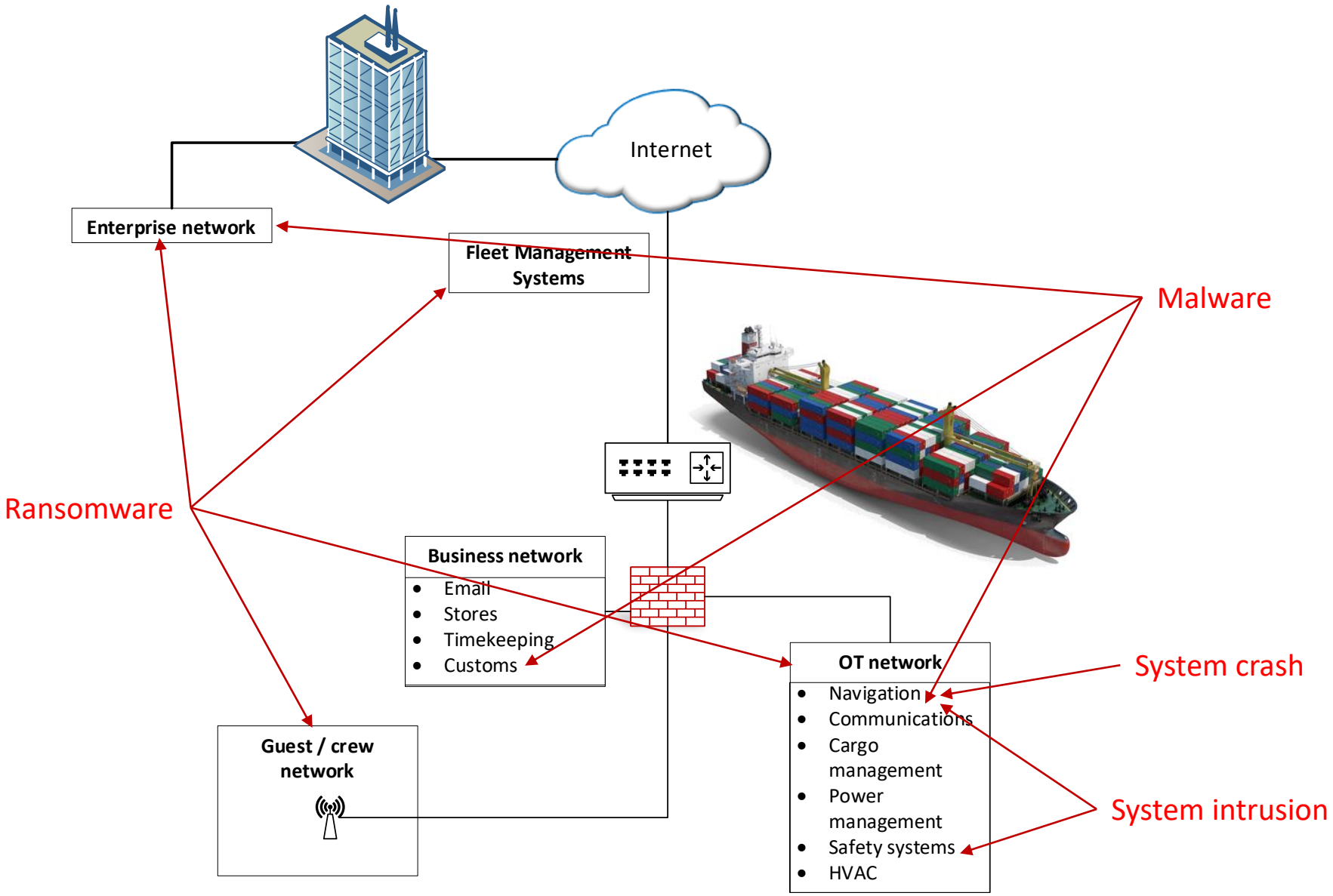
Ports

- Since the beginning of the pandemic, the Port of Los Angeles has seen incidents double, peaking at 40 million per month
- Ransomware
  - Transnet (2021), Nagoya (2023) resulted in operation disruption
  - San Diego (2018), Lisbon (2022) did not experience operational impact
  - NotPetya, reclassified as a wiper
- Cyber espionage (IceFog, Indian aircraft carriers)
- State actors: Iran, US Pacific command
- GPS and AIS jamming and spoofing
- Systems intrusions at customs
- ‘Normal’ cyber crime: phishing, scams, BEC, malware

Vessels


Internet
Enterprise network
Fleet Management Systems
Malware
Ransomware
Business network
Email
Stores
Timekeeping
Customs
OT network
Navigation
Communications
Cargo management
Power management
Safety systems
HVAC
Guest / crew network
System crash
System intrusion

Undersea Infrastructure

June 16, 2023 12:07 PM

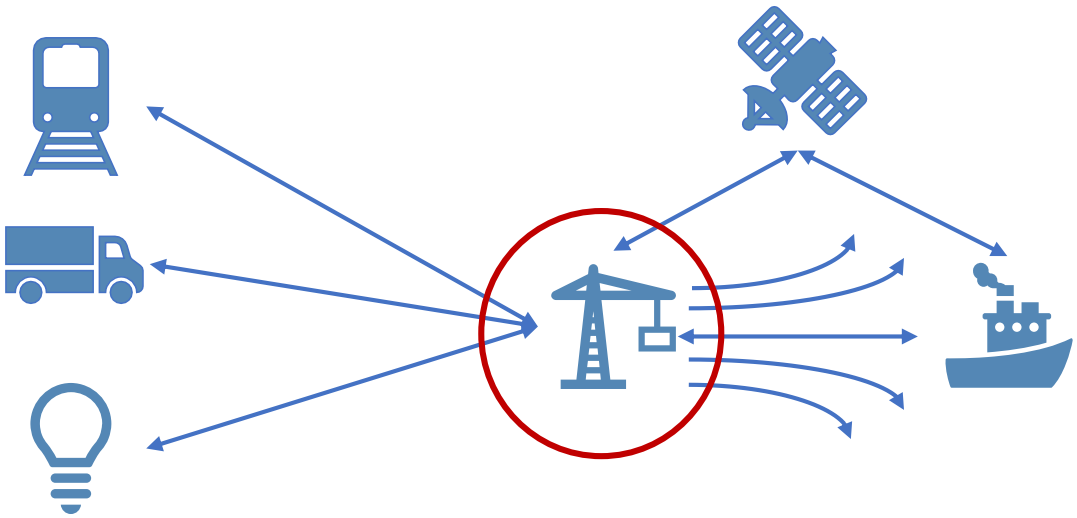
Associated Press

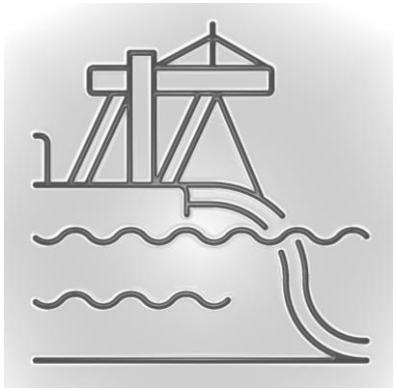
NATO Moves to Protect Undersea Pipelines, Cables Amid Concern Over Russian Sabotage Threat

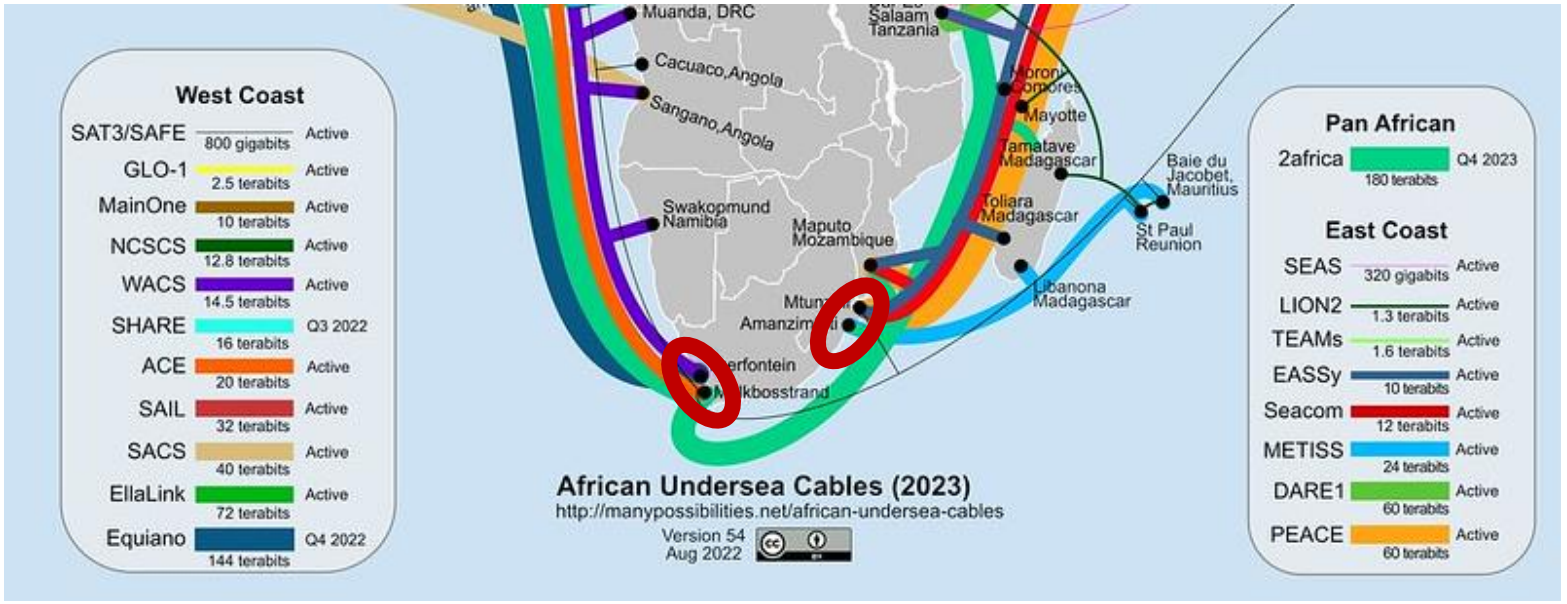
https://www.voanews.com/a/nato-moves-to-protect-undersea-pipelines-cables-amid-concern-over-russian-sabotage-threat/7140442.html

- Undersea cables
  - US prevented successful incident (2022)
  - Seacom ransomware (2023)
  - Undersea datacentres
  - Landing points – espionage & sabotage
- Undersea pipelines
  - Alleged physical sabotage in Baltic
  - Colonial Pipelines as an example
  - Account compromise used in both cyber & influence

Critical Infrastructure & Economic Information Warfare Perspectives







Hypothetical Scenarios

https://www.fleetmon.com/maritime-news/2017/20007/mayhem-durban-harbor-2-vlcs-aground-video/

- Spoofing GPS so:
  - automated equipment navigate into the water;
  - a ship runs aground in narrow channels;
- Malware interfering with:
  - HVAC systems in extreme cold/hot climates
  - the ballast tanks of a submersible;
  - automated mooring systems in heavy weather so ships break their moorings;
- Causing erratic behaviour in cranes or conveyer belts to force a shutdown;
- Using a time-activated logic bomb aboard a vessel to infect USB drives copying information to the port systems;
- Compromising fleet management systems to deliver malware to vessels;
- Affecting valves to fluctuate the pressure in undersea pipelines

Best Practices

- Identify single points of failure:
  - Key facilities in the infrastructure;
  - Key systems in facilities / infrastructure;

- Risk analysis of IT & OT
- Implement protective & detective controls
- Segregate OT / fibre network core from the corporate network & Internet

- Strictly control remote access
  - Strong authentication
  - Indirect access (jump box)
  - Regular reviews to remove unnecessary connections
- SLAs need to clearly indicate security requirements / expectations

Best Practices

- Security by design
- Incident response plans
  - Key stakeholders included (Corp comms, HR, Legal)
  - Training & practice;
  - Challenge for incident response on seagoing vessels?
- Awareness of **ALL** employees
- How to identify and report possible incidents
- Bridge crew to aid in incident response
- Make sure incident response is familiar to all those required to assist

https://hyperproof.io/resource/cybersecurity-incident-response-plan/

Best Practice Documents

- Maritime-specific documents
  - International Association of Ports and Harbors Port Community Cyber Security
  - ENISA report on Port Cybersecurity
  - IMO resolution MSC.428(98) Maritime Cyber Risk Management in Safety Management Systems
  - IMO MSC-FAL.1/Circ.3/Rev.1 Guidelines on Maritime Cyber Risk Management
  - BIMCO The guidelines on cyber security onboard ships
  - ENISA report on Subsea cables
  - MTS-ISAC
- Other cybersecurity documents
  - ISO/IEC 27001 Information security management systems
  - ISO/IEC 27032 Cybersecurity
  - NIST Cyber Security Framework
  - ISA/IEC 62443 standards for industrial automation and control systems
  - MITRE ATT&CK Framework for industrial control systems
  - GCSC Advancing Cyberstability
  - 2015 UN GGE Norms
  - Tallinn Manual 2.0

Conclusion

- Ports, vessels & undersea infrastructure impacted by cyber-incidents
- Cyber crime & state actors
- Trade in general can be disrupted; specific commodities can be targeted
- Need to ensure cybersecurity best practices are followed for IT and OT networks

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Legal Consideration for Maritime Cybersecurity

Trishana Ramluckan

Introduction

- Ports, ships, maritime supply chains and major offshore infrastructure including oil and gas installations are vulnerable to cyber-attacks.
- The international maritime industry relies on cyber systems for all aspects of operation and management and may face cyber-attacks from so-called activists, terrorists and transnational cyber criminals
- The IMO (SOLAS)
- UN Convention on Law of the Sea (UNCLOS):
  - Territorial sea 12nm
  - Exclusive economic zone (EEZ) 200nm
  - High seas >200nm
- Tallinn Manual 2.0
- 2015 UN GGE Norms – responsible state behaviour in Cyberspace
- GCSC – norms for protecting public core of the Internet

Introduction

- Some concepts from international law:
  - Sovereignty – applies to warships
  - Jurisdiction – flag nation for ships
  - Interference
  - Use of force
  - Armed attack – physical damage / injury
  - Attribution
  - Proportionality

Laws Related to Ports

- Local regulation/law
- Points to consider:
  - Who is responsible if a ship causes damage to a port due to a cyber incident?
  - Who is responsible if a ship is damaged while under pilotage / docked due to a cyber incident?
  - Ship can’t offload due to cyber-incident?

Vessels at sea

- Responsibility to deliver cargo
- Ship adrift if systems crash due to cyber incident
- Spoofed GPS: piracy / collision
- Tallinn Manual
  - Rule 45: Cyber operations in high seas allowable for ‘peaceful purposes’
  - Rule 46: Right to board if suspected using cyber for piracy, slave trade, unauthorised broadcasts

Undersea cables

- Tallinn Manual 2.0 – Rule 54
  - s(3-5): State sovereignty applies to cables in territorial waters – state laws and regulations apply to laying and maintenance. However, states need to respect existing cables in their waters, laid by others that do not make landfall.
  - s(6-8): States may lay cables in the EEZ & continental shelf of a coastal state with due regard to the rights and duties of the coastal state (who may not regulate or impede maintenance).
  - s(10): States have right to lay cables beyond continental shelf
  - s(11): Land locked states have right to access
  - s(15): It is prohibited for states to damage undersea cables
- GCSC – norms for protecting public core of the Internet applies as undersea cables a major component

Discussion

- Spoofing of GPS
  - In territorial waters or port, state legislation applies; responsibility difficult as any damage arising is not the fault of the ship operator or nation/port authority. Possibly considered an armed attack if serious damage/injury occurs.
  - On high seas can be considered interference or use of force; armed attack if damage or injury occurs. Potentially a breach of freedom of navigation.
- Malware impacting a ship in high seas affects freedom of navigation, puts lives at risk. Attribution problematic. Responsibility shipping operator
- Espionage or interference of undersea infrastructure in territorial waters is a breach of sovereignty

Discussion

- Currently South African maritime legislation does not explicitly consider cyber incidents
- Clarity/guidance is required for interference of navigation, responsibility and liability due to cyber incidents under South African law
  - E.g. reporting cyber incidents as a danger to navigation
- Critical Infrastructure Protection Act (also does not explicitly consider cyber) and the Cybercrimes Act can apply
- Responsibility for a cyber incident can include:
  - A malicious actor
  - Negligence of an insider
  - Failure of governance

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Brett van Niekerk – brettv@dut.ac.za

Trishana Ramluckan – ramluckant@ukzn.ac.za