IT / OT Convergence.

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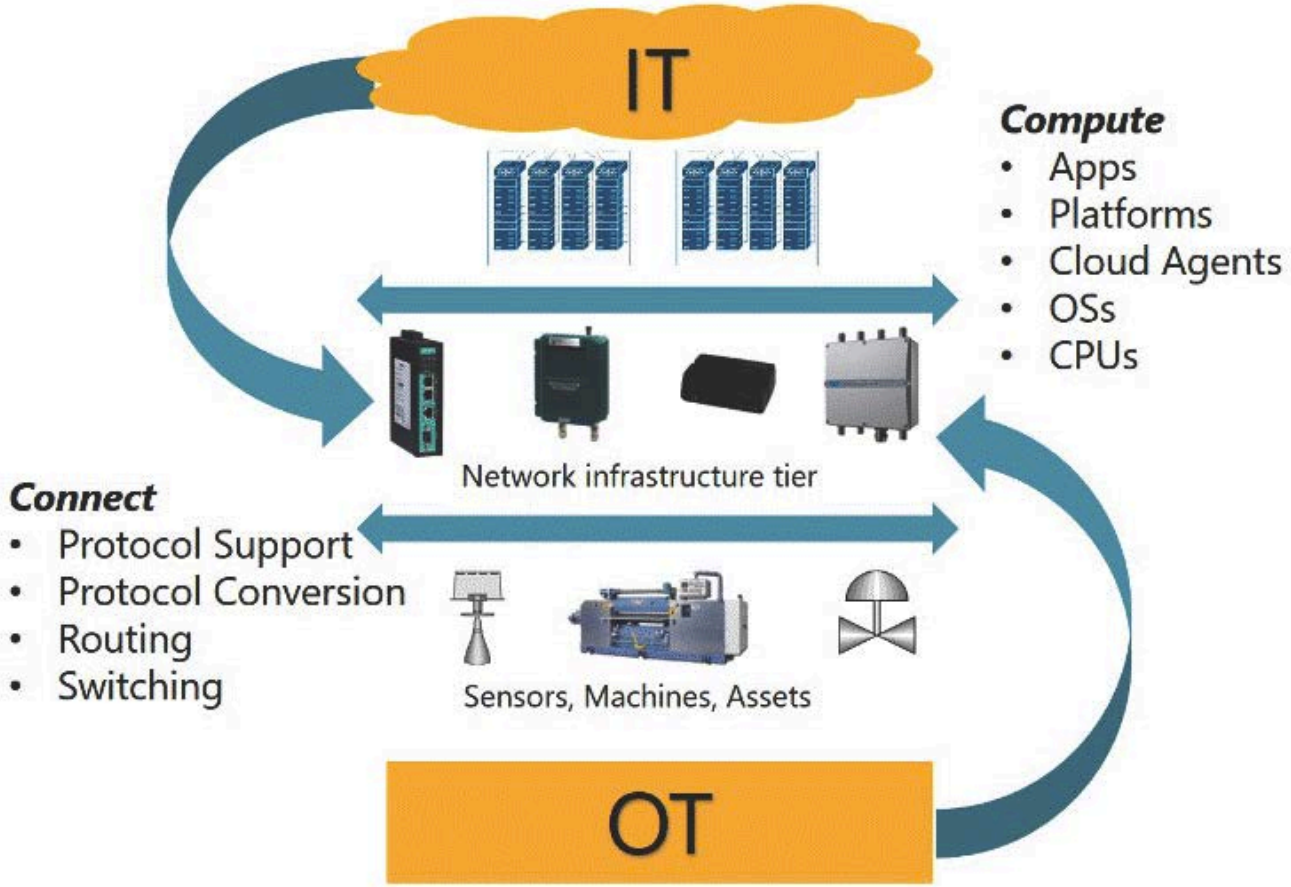
IT vs. OT – Definitions & Meaning.

- ✓ Information Technology (IT) is the use of any computers, storage, networking and other physical devices, infrastructure and processes to create, process, store, secure and exchange all forms of electronic data.
- ✓ Operational technology (OT) is hardware and software that detects or causes a change, through the direct monitoring and / or control of industrial equipment, assets, processes and events.
- ✓ Definitions are always useful but what is the actual meaning of each term?
  - ✓ IT is about Routers, Switches, Firewalls, PCs, Workstations, Servers & Storage Arrays allowing processing and distribution of Information within and between Organizations.
  - ✓ OT is about purpose & process Specific Industrial Control Systems (ICS) such as Programmable Logic Controllers (PLCs) and Supervisory Control & Data Acquisition Entities (SCADA).
  - ✓ Example IT systems in Shipping are ERP & E-mail as well as their supporting infrastructure.
  - ✓ Example OT systems are ER Alarm Monitoring System with its underlaying infrastructure sensors, Engine Management System – Electronic ME Cases & ECDIS.

IT vs. OT – Definitions & Meaning.



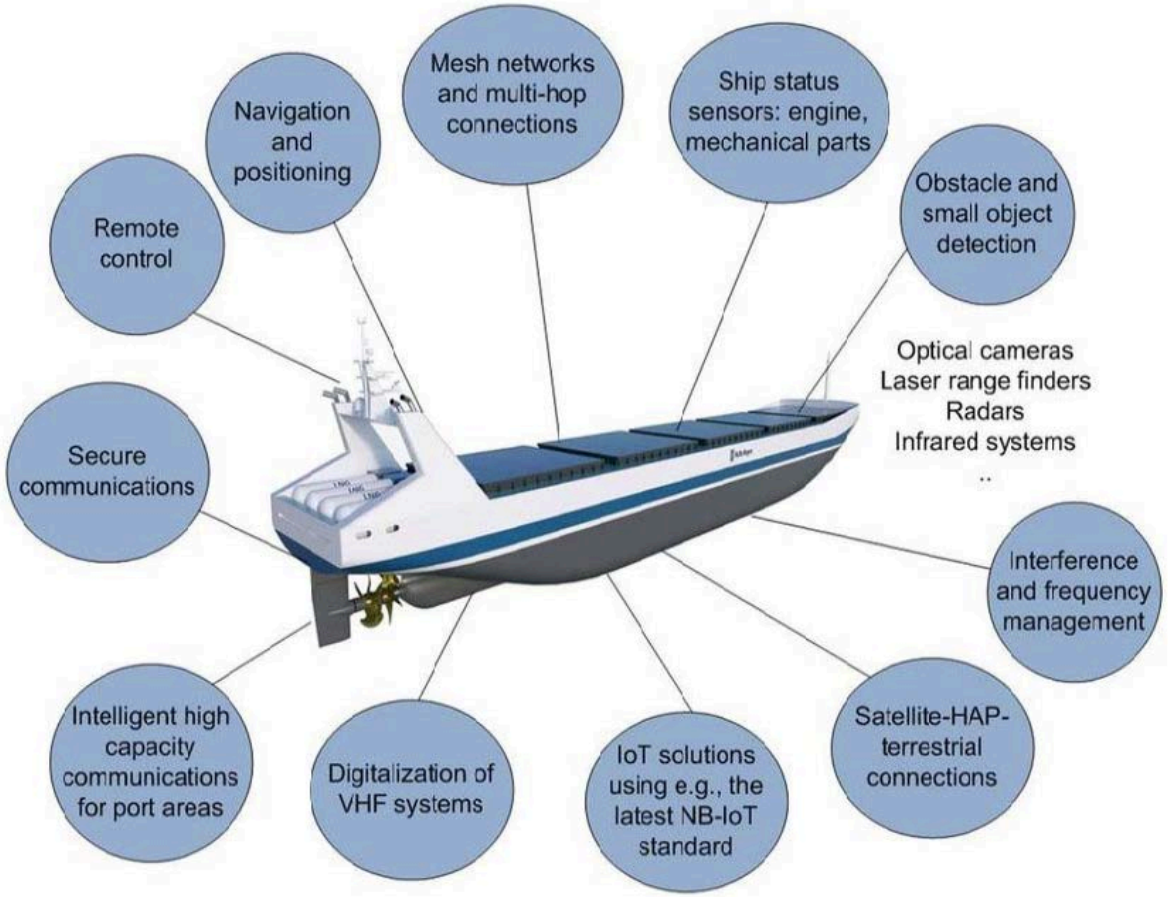
Need for Convergence.

- ✓ Until recently IT & OT systems were handled by different teams.
- ✓ IT utilised more mainstream and widespread systems and technologies e.g. Windows. Digitization was also the rule.
- ✓ OT on the other hand utilised proprietary and purpose – system – implementation specific technologies. Analogue Electronics were Vastly used.
- ✓ If scheme above works why change & converge?
- ✓ Answer has to do with Big Data!
- ✓ This implies needs for Digitalization & for the Industrial Internet of Things (IIoT).
- ✓ OT systems that were isolated need to be integrated and their data harvested.
- ✓ Data need to be communicated and post-processed and shared to provide added value.
- ✓ Thus IT & OT Convergence is necessary to allow for data sharing & interoperability.

Maritime Industry Convergence Drivers.

- ✓ Need for Digitization is not the only driver.
- ✓ There are Maritime specific need such a Regulatory Framework and Industry Guidelines.
- ✓ Tanker Management Self Assessment 3 (TMSA3) introduced common framework – need to address Software Management & Cyber Risk for IT & OT alike.
- ✓ ISM Code made Cyber Risk evaluation a regulatory requirement.
- ✓ ISM Code guidelines connected the dots between Industry Guidelines like those issued from BIMCO and standards like NIST & ISO-27001 with regulatory framework.
- ✓ Last straw are the new IACS Unified Requirements relevant:
  - ✓ E26 Cyber resilience of ships.
  - ✓ E27 Cyber resilience of on-board systems and equipment.
  - ✓ Both issued April 2022, come in effect 01/01/2024.
  - ✓ Mandate Cyber Security Class Rules for New Buildings as well as Cyber Security Type Approval for equipment.
  - ✓ A lot of focus is paid there-in regarding OT and their integration framework.

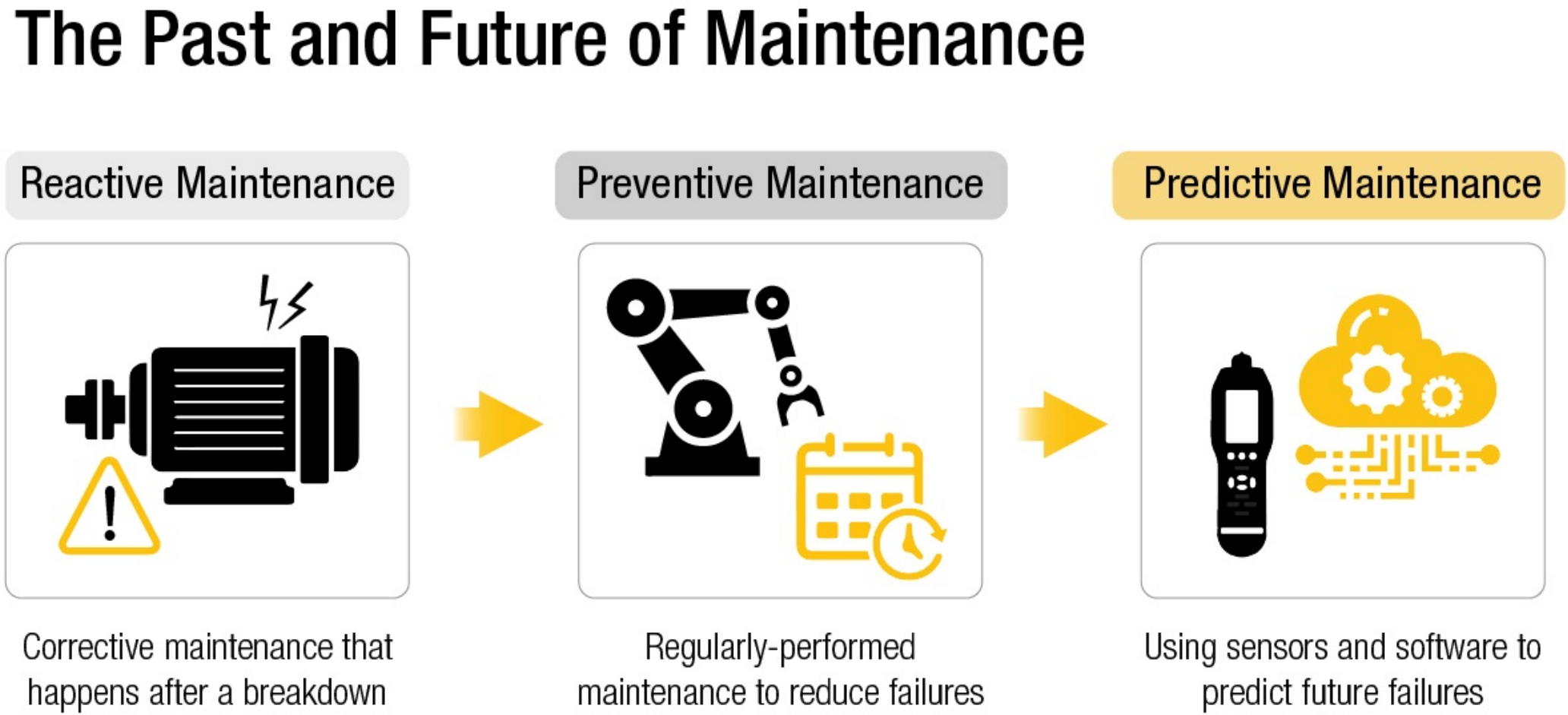
What Are the Benefits – Autonomous Shipping.



What Are the Benefits – Autonomous Shipping.

- ✓ Real Time Decision Making Facilitating Autonomous Shipping.
  - ✓ Autonomous Shipping is considered by many modern shipping's Philosopher's Stone.
  - ✓ To make this work you need to be able to make real-time decisions as if onboard remotely.
  - ✓ IT / OT Convergence provides support by enabling OT equipment as part of IIoT.
  - ✓ OT data can be collected and processed locally fast & reliably through Edge Computing.
  - ✓ This allows for SCADA legendary infrastructure to be replaced.
  - ✓ Processed Data can be shared promptly with remote Operations Center(s).
  - ✓ Decision making and actions – vessel commands – can be facilitated timely through above integration mechanism.
  - ✓ Data can be further processed, stored in the Cloud, harvested to support compliance needs as well as forensic evidence.

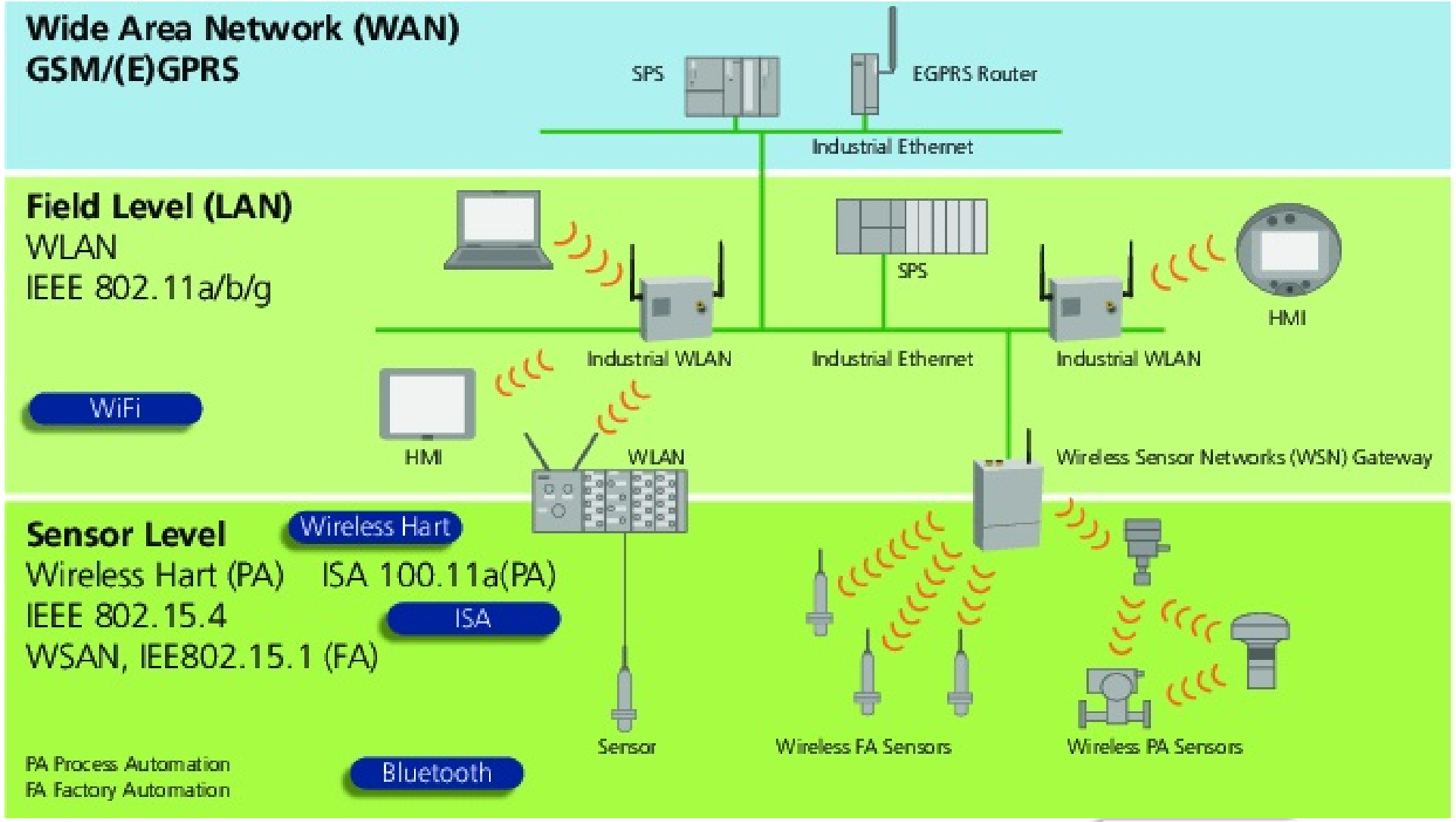
What Are the Benefits – Predictive vs. Preventive Maintenance.



What Are the Benefits – Predictive vs. Preventive Maintenance.

- ✓ Maritime Industry PMS is aiming for Continues Machinery Survey based on Preventive Maintenance.
- ✓ Equipment & corresponding downtimes are planned based on jobs that are based on condition review and running hours based on statistics provided by the maker.
- ✓ This is not always effective since it may turn that a particular equipment had extra hours ahead.
- ✓ Meanwhile defects still exist and cannot be predicted.
- ✓ Digitization allows collecting data from machinery.
- ✓ Analytics and AI Technologies are applied against collected data.
- ✓ Trends can be identified, machinery condition can be evaluated and maintenance can be planned optimally.
- ✓ Upcoming failures become apparent before occurring allowing troubleshooting before the fact!
- ✓ Overall result is Predictive Maintenance being targeted where and when needed.
- ✓ Benefits include decreased downtime, regulate spares cost by making best possible use of existing resources and avoiding surprises.

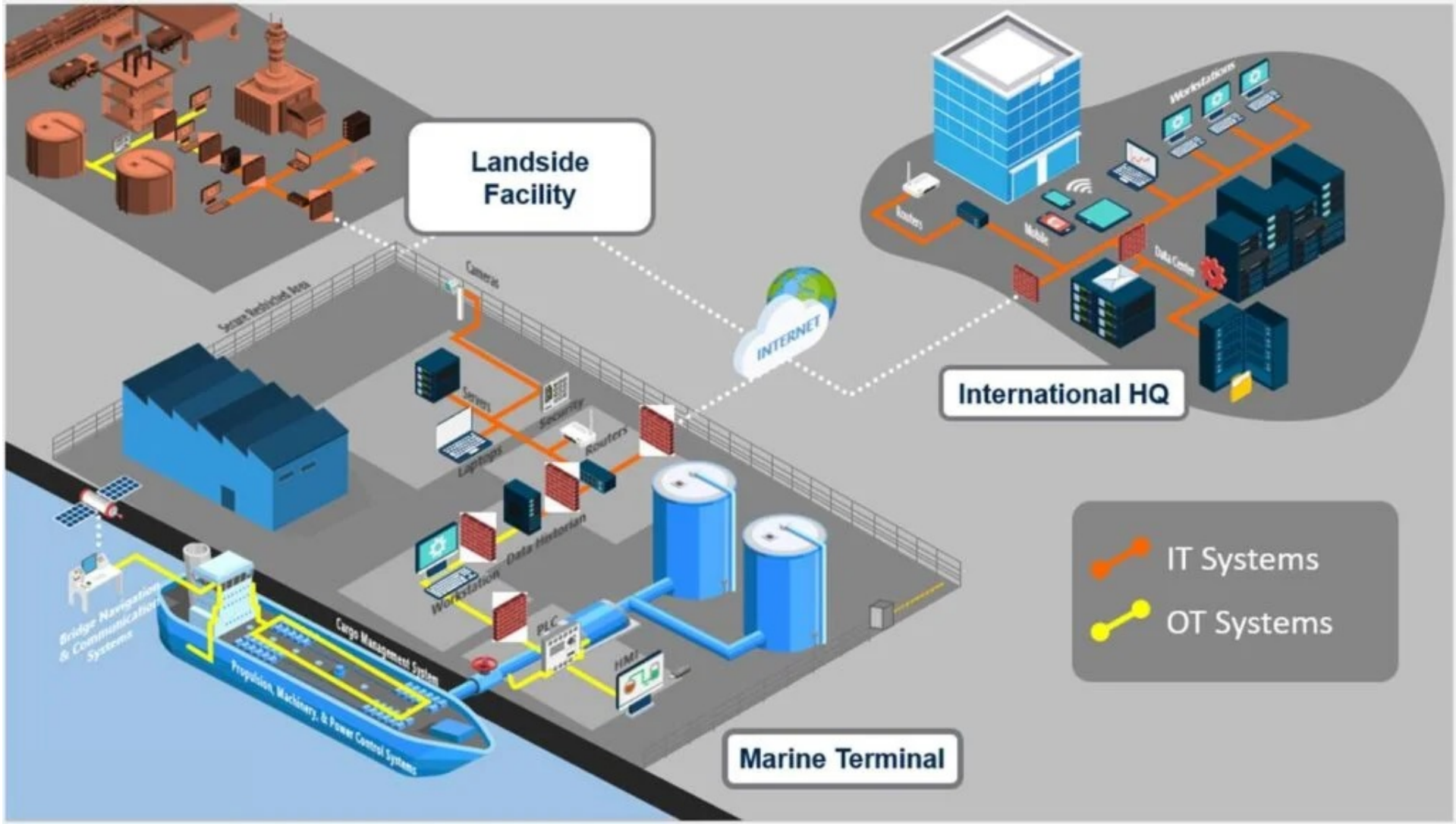
What Are the Benefits – Wireless Deployment.



What Are the Benefits – Wireless Deployment.

- ✓ Digitisation in older vessels is always a challenge.
- ✓ One of the main issues has to do with cabling installation.
- ✓ Practical problems such a cable ducts, penetrations, mapping and in case of issues troubleshooting act as a deterrent.
- ✓ IT / OT convergence allows introduction of wireless communications IT technologies in the OT Universe.
- ✓ Protocols that are well tested and hardened to withstand industrial environment are available to provide service.
- ✓ Cabling complexity can be avoided.
- ✓ This allows swifter deployment of retrofittings.
- ✓ Cost is reduced, complexity is controlled and troubleshooting becomes easier.
- ✓ Insight and sensors become available where traditional wired deployment was not feasible.

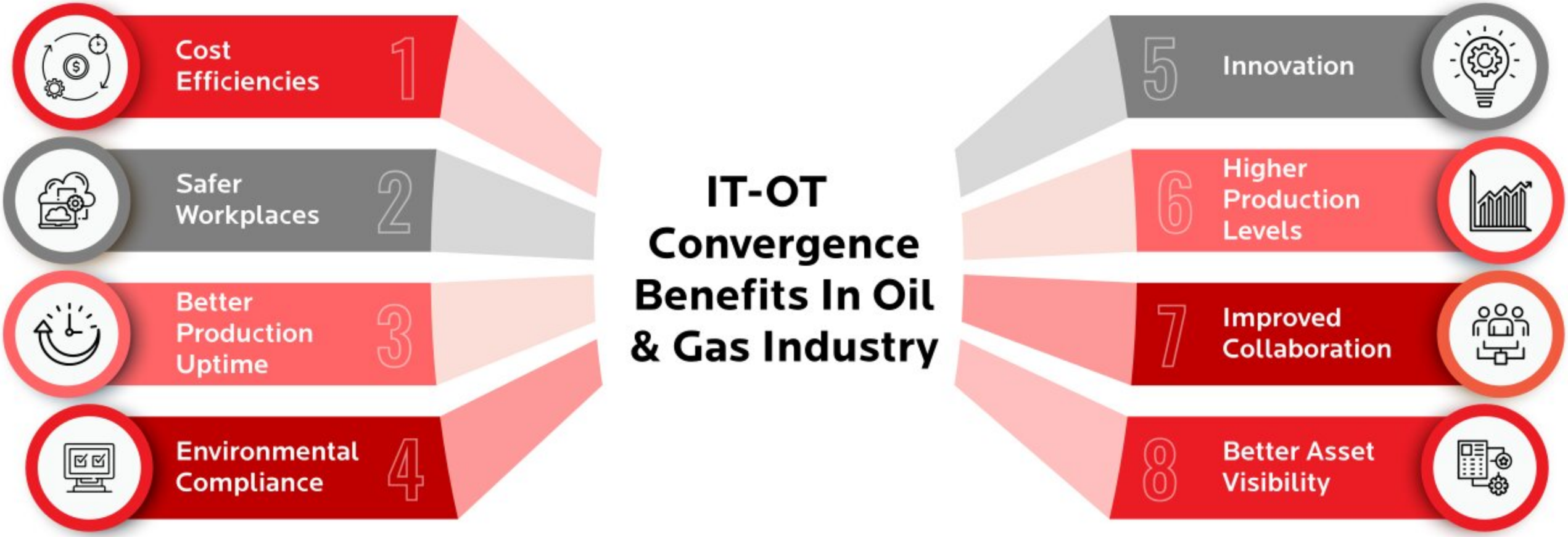
Is There a Catch – Cyber Security.



Is There a Catch – Cyber Security.

- ✓ OT systems used to be proprietary in design, protocol and communication as well as isolation.
- ✓ This was a very effective Cyber Security Control reducing OT exposure surface to a minimum.
- ✓ IT / OT convergence and particularly IIoT deployment renders OT integrated and supporting mainstream protocols.
- ✓ Security by Obscurity is no longer an option.
- ✓ Intrinsic OT Cyber Security capabilities are also limited.
- ✓ It is imperative to implement Security Mechanism to protected digitalized OT equipment.
- ✓ IT world Information Security experience and resources can provide solutions.
- ✓ Nevertheless, strong co-operation between IT & OT experts in necessary to adopt IT security solution to the OT ecosystem.

Are We Facing This Challenge Alone?



Are We Facing This Challenge Alone?

- ✓ While IT / OT convergence is a strong challenge also considering Maritime Industry particularities we are neither pioneers nor alone.
- ✓ Other Industries have faced similar challenges in the past.
- ✓ Telecom industry faced similar challenges in the early 2000.
- ✓ Proprietary Telecommunication systems had to be replaced to allow for increased capacity with decreased energy consumption as well as facilitate new functionalities needed to support Business Cases.
- ✓ Convergence towards IT protocols and core systems was necessary.
- ✓ Despite Telecom Company being involved in High-Tech challenge was grave.
- ✓ Infrastructure had to be rebuilt while professional with experience in legendary systems had to be retrained and often re-invent themselves.
- ✓ Investment both in people as well as in resources was necessary.
- ✓ Industry nature forced a rapid pace of change.
- ✓ However and due to decisive way forward transit was successful.
- ✓ It has allowed for the initial IoT deployment that is nowadays considered as granted.

Thank You for your Attention!
Any Questions?