"Data-centric Operations" in Nearshore Offshore Structure Network by the use of LAROS Remote Monitoring and Performance Analysis System.

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Abstract - **The promising features of the forthcoming 5th generation (5G) mobile networks (e.g., low energy consumption, reduced latency, increased efficiency) among with advancements in Machine-to-Machine communication and Cloud Data Storage that enhances Industrial Internet of Things technology assisting the aim of increasing safety and optimizing its performance. Based on the existing data flows from vessels, we are exploiting a unique business window opportunity for a platform architecture that allows a reliable, uninterrupted reception and management of data from a wide range of sensors within a near-shore structure network.**

Keywords - Offshore monitoring; Industrial Internet of Things; 5th Generation (5G)

I. INTRODUCTION

LAROS is a dedicated platform aiming at the continuous collection of critical information from the ship's inputs, the transmission of the data through a wireless network, centralization and homogenization of information in central computing, and analysis of measurements to support the decision-making mechanism of shipping companies. The system is using the vessel's communication systems (satellite) to transmit all collected & synchronized data to the Headquarters, in a very efficient manner in terms of cost, speed, and security. Transferred data are further processed using LAROS Data Analysis System.
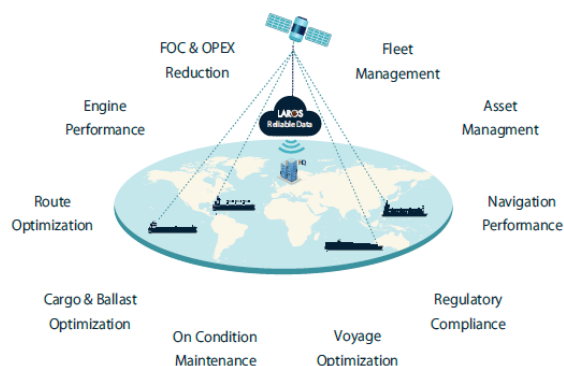

Figure 1. Laros Network on board

Figure 2. Laros Applications

II. DEMO SYSTEM DESCRIPTION

In more detail the Demo LAROS system planned to be deployed can be described as follows:

A. HW Configuration

LAROS Smart Collectors are connected using the appropriate interface to analog or digital signals coming from different sensors and instruments of the vessel. Smart Collectors analyze the signals and calculate the required parameters. Sampling rate as well as rate of the parameters calculations can be set from 100msec up to 30 minutes. Smart Collectors setup a wireless secure network inside the vessel to transmit the processed data to the Gateway with a user-defined sampling rate and ability to maintain and customize them remotely. The wireless protocol is based on IEEE 802.15.4 with additional layers and data format to cover the requirements of the vessel environment and increase the network's Quality of Service. Through the Gateway all the measured and processed parameters are saved in LAROS Server (onboard). All data are stored in LAROS server's database for a determined period of time (up to 1 year depending on the number of sensors and on sampling rate). In addition, there are options to forward the data to any

third party system on board avoiding costly cabling or other infrastructure implications. LAROS On board Server periodically produce binary files and compresses them in order to reduce the size of the data to be sent via normal satellite broadband. The compressed files are transmitted through FTP to the data center that will be selected by the operator. In the data center there is a service that decompresses the incoming files and stores the new measurements in the main data base. In case the system is connected to a weather site, the weather data are stored in the main data base in the same format.

B. SW Configuration

An advanced monitoring system, as the one described above, needs a fully optimized and dedicated software to display and process all the measurements which obtained by the LAROS HW equipment:

LAROS DAS is an advanced software for data effective visualization and comprehensive analysis of performance. It is a powerful tool with a lot of modular options for displaying dynamic technical and operational indicators and graphic representation of the data in multi-dimensional time series featuring parameter vs parameter analysis, interactive maps, statistical analytics, datum filtering, data mining and much more. DAS is the key for entering Advanced Analytics.

Figure 3.   DAS collected data for real performance monitoring

Figure 4.   Laros Reports & Dashboards

LAROS DAS features a rich library of industry forged KPIs plus additional user parameters for analysis of the vessel's performance. DAS also allows the setting of specific alerts when multiple (combination) of parameters are violated resulting in effective event detection.

DAS is part of the extended model of LAROS solution as it allows for the creation of new functions for calculating performance indexes. Its tools facilitate the construction of new tailored dashboards that permit an efficient fleet performance monitoring.

III.   CASE STUDIES

Examples from experience on vessels, for the exchange of data between nodes at short distances will be presented. It will be shown that an advanced monitoring system, as the one described above, enables the following core functionalities:

Efficiency control

The platform provides the necessary tools that allow managers and operators to measure in detail the efficiency of every asset on board.

Centralized monitoring

The operational and performance parameters of each asset can be individually tracked and analyzed using a single reporting system accessed from anywhere in the world using simple Web services.

Expandability

The platform is expandable and adaptable in order to cover any future needs and required measurements. This is easily done by connecting additional sensors to the installed LAROS Collectors or by adding extra Collectors with 5G network capability.