LL #10 Hermes Fleet Performance Monitoring System

FACTSHEET

10 MARCH 2022

A. GENERAL (Business case)

1. Objectives

- Transport, Container and Cargo Tracking
- Platform/System interoperability for operations management. Thanks to the Hermes living lab Grimaldi will reache the following objectives:
- Smart data handling - IoT applications
- Enabling supply chain and ships' visibility (own and chartered ships);
- Enabling digital data sharing to align the customers and the vector (Grimaldi);
- Capitalising on shared data for enhanced use of sea transport, reduced administrative burden by means of digital technologies, enhanced planning horizons for involved transport operators, and provision of carbon footprint dat (Compliance monitoring).
- Provide a service centre for managing the fleet as well as the interface to its clients through digital means;
- Asset optimization - Enhanced better information services to its drivers and clients.
- Enabling supply chain and ships' visibility.

2. Main emphasis

To establishes smart data sharing throughout the supply chain enabling supply chain and ships visibility of Grimaldi operated ships).. The various parties in the logistics chain especially data providers can identify and chose the single data to share, a simple data or a smart data (Vessel type, AIS or ECDIS data and the frequency of timeframe in case of a dedicated IoT Hub, with personal parameters defined on board of each ship selected). Different users can use it to check the vessel position, ETA and ETD of ships in order to plan car handling and assure a best door-to-door service to the end user).

The communication between different systems can be applied through the API technology already in place. Grimaldi installed the Hermes system on board different ships of the Group considering also controlled companies. The network of sensors installed on board is shared-interface ready because of the IoT Gateway already installed on board. A primary key (ship identity) generated from the software installed on board means that the system can be interfaced to all ships and relevant equipment in the existing fleet. The system could be used by all customers through a simple user account with key parameters well defined or a dedicated IoT Hub. The communication between different systems can be applied through the API technology already in place.

A practical example is the existing interface between Grimaldi and Marin Traffic that shares AIS data in real time with a double scope of having the ships position in deep sea provided by AIS installed on Grimaldi ships and the chartered ship positions of vessels without the Hermes living lab installation provided by Marin Traffic.

The results of the Hermes LivingLab will be applicable on a larger scale than only the participants in the project.

3. Challenges

- Many stakeholders to align the customers and the vector (Grimaldi), as the initiator of the transport, with other transport actors and infrastructure owners (such as car manufacturer Fiat Chrysler Automobiles (FCA), terminals, ports and all stakeholders involved in the commercial chain).
- Grimaldi operates approximately 150 ships, which only 90 of them are equipped with IoT devices, and provides a service centre for managing the fleet as well as the interface to its clients through digital means.
- To become more efficient and be able to provide better information services to its drivers and clients, Grimaldi will increase its integration and information exchange with other transport producers and infrastructure owners.

4. Transport mode

Sea

5. EU Map Focus

North Sea - Baltic; Mediterranean; Scandinavian - Mediterranean; Rhine - Alpine; Atlantic; North Sea – Mediterranean

6. Geographical coverage

The Hermes living lab is installed on board ships that sail between different countries in the world:
Angola,Argentina,Belgium,Benin,Brazil,Cameroon,Congo,Côte d'Ivoire,Cyprus,Egypt,France,Gabon,Germany,Ghana,Greece,Guinea,Israel,Italy, Lebanon,Liberia,Libya,Malta,Montenegro,Morocco,Nigeria,Portugal,Senegal,Sierra,Leone,Slovenia,Spain,Sweden,Syrian, Arab Republic, Togo, Tunisia, Turkey, United Kingdom of Great Britain and Northern Ireland, United States of America.

The Grimaldi ships touch 140 ports of 50 countries in 4 continents. The Hermes living lab covers a large part of above mentioned countries.

7. Actors/SMs

- FCA Group (car manufacturer),
- FEDERICO II University of Naples,
- Italian Naval Register (RINA),
- Terminal San Giorgio
- Marin Traffic
- Atena Research Center
- University Parthenope
- Antwerp Euro Terminal
- Finnlines OY
- Kongsberg Maritime
- Alleantia
- IoMote
- Wartsila OY
- Ecospray
- VI.SA.TECH
- DELL
- Circle
- Brolich
- Krohne
- Endress+Hauser

8. Forecast scaling outside LL

The Hermes living lab could be scaled interfacing the port terminal management systems installed in our terminals giving to all stakeholder a 360° view about all terminal operations. Will be possible to have all informations related to charging and discharding operations of a ship in one platform (providing an estimation of ETD considering the volumes to be charged and discharged). Over 90% of the world's trade is made through the sea. Therefore, our terminals deal with enormous amounts

of data. The innovative software solutions for terminals will be able to process all the information in real time.

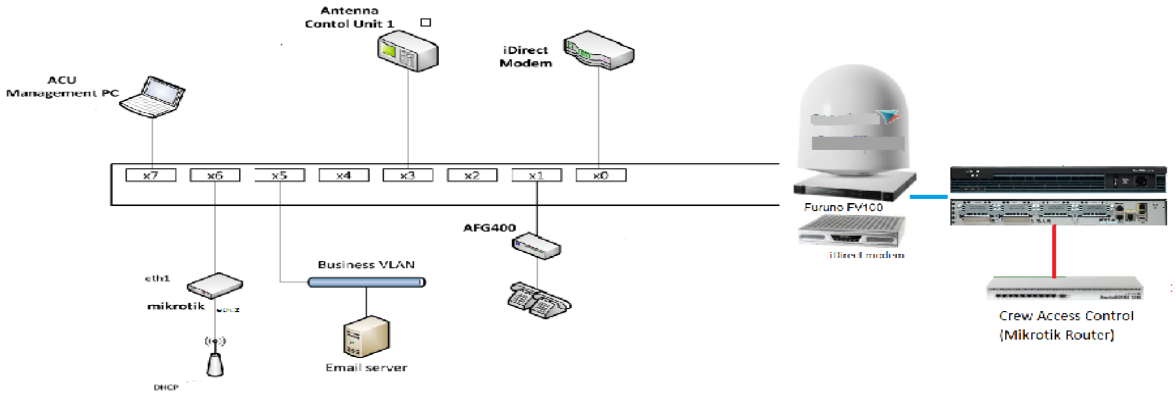
The results of the Hermes LivingLab will be applicable on a larger scale than only the participants in the project.

B. TECHNICAL SETTING

9. ICT vs physical

Grimaldi installed the Hermes system on board different ships of the Group considering also controlled companies. The network of sensors installed on board is shared-interface ready because of the IoT Gateway already installed on board. A primary key (ship identity) generated from the software installed on board means that the system can be interfaced to all ships and relevant equipment in the existing fleet.

Considering the FEDeRATED building blocks our living lab focuses on Plug and play. More specific, to enable individual stakeholders in the private sector to connect to our platform in order to access available (pre selected) data via API based on a federation of platforms (platform interoperability) approach, harmonized connectivity and interoperability of different solutions (platforms) between customers and Grimaldi.



The functional blocks are:

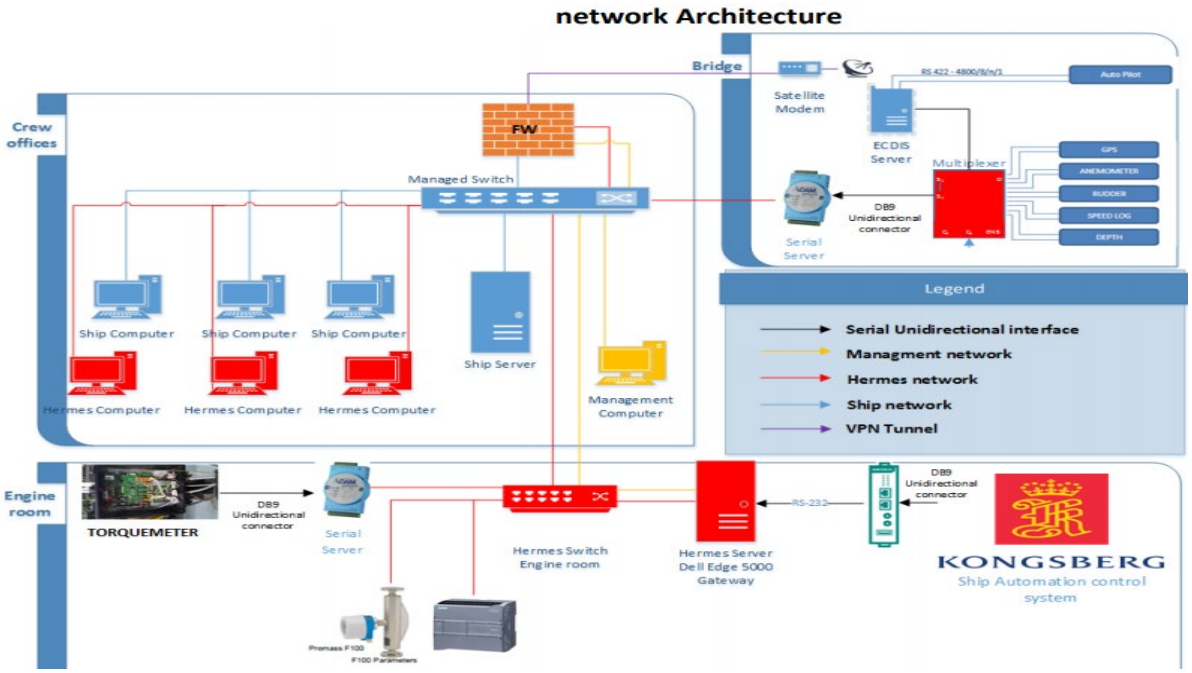
- IoT Hub; Standard component of Microsoft Azure for data ingestion. Implement the bidirectional communication with gateways on ships. Communication between gateways and ioT Hub is based on MQTT or AMQP protocol, both made secure through TLS 1.2.
- IoT Hub reader; Reads incoming data from IoT hub and sends messages from the cloud to the gateways. It also takes care of routing the sensor and positioning data to the respective services bus (standard Microsoft Azure components).
- Weather reader; Module for reading weather data by interfacing with the StormGeo service once data has been read (with REST HTTPS interface) makes it available for telemetry update service.

- Telemetry/Location/LocationH ingest – Telemetry update; Once the data from the relative service buses have been received, they update the telemetry data and positioning in the database (CosmosDB, NoSQL database offered by Microsoft Azure) and / or in the Cache Redis (also offered as a service managed by Microsoft Azure).
- Data analyzer; Analyzes the telemetry data arriving from the relative service bus and checks if it has occurred some error condition, checks the triggers, which vary from user to user and for each single variable. If it detects any possible alarm, it routes it on the relative service bus.
- Gateway Manager; Timed function (Function component of Microsoft Azure) that periodically check that the gateways are communicating correctly. If it detects any malfunction, sends the alarm on the related service bus.
- Alarm Manager; Once it receives an alarm from the relative service bus, it verifies that the notifications for that alarm are activated, and in that case it sends the email to the address of the user associated with the alarm.
- Web App;
    - Web application that deals with:to serve the web pages for the use of the service
    - manage access to the system API, both for web pages and for the application mobile

  It is the application that manages user data and inserts it in the SQL database and associates them with groups. It has not yet been defined how much and what data will be associated with users. Users' access to the system will take place through authentication with username and password to be inserted at the beginning of a session. Authentication will then be managed through JSON Web Token (JWT). The passwords will not be kept clear in the DB, but will come used an appropriate hash algorithm (Bcrypt or alternative).

- API Manager; The API manager is a standard Microsoft Azure service, which allows you to map the API of the application on an external API, on which it will be possible to set both the rules of use such as maximum daily / monthly quotas. In this way it will be possible monitor and possibly limit / count the use of APIs by third parties, especially to prevent an individual user from making excessive use of this tool, going to compromise the quality of the service for other users, or involving a cost excessive for Grimaldi.
- Key and Password Management; Access keys to various Azure services will be managed through the Key Vault service, HSM service made available to the same Azure platform to make it safer and quick management of all security keys. This allows the access keys to the various services (IoTHub, DB and more) will not be inserted in the application code, but will come associated with it at runtime, so that system developers / maintainers don't they will become aware of these keys, which can be managed with greater security by the IT department of Grimaldi.

Each single installation is different ship by ship but the output of data is perfectly the same. Below is showed the hardware and network architecture for a single ship case.



This Living Lab deals with the following FEDeRATED global features:

- Language - a JSON common language used in our Living lab.
- Access - for each Ship a DevID is designed to be used for sharing data between vessel and ashore and for each API endpoint.
- Identity - Each IoTGateway installed on board of a ship has an own identity identifying a single ship)

10. DTLF implementation option: TBD

C. Multiple platforms

C. ORGANISATIONAL ASPECTS

11. Success factors

- Departure delay
- Manoeuvring time
- Miles travelled
- Average speed

- Consumption/mile
- Consumption/h
- Consumption/voyage.
- Powers in port
- Battery usage in port
- Electrical load.

12. Risks

- Cyber security (limited due to already conducted risk assessment).
- Lack of internet connectivity considering VSAT satellite connection.
- Lack of digital competence of the stakeholders (evaluated as low risk).
- Are all participants fully connected to the Internet provisions (evaluated as low risk).
- Lack of knowledge on how to do data sharing (evaluated as low risk).

13. Timing

LL#10	2019				2020				2021				2022				2023			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Preparations																				
Planning and scoping																				
Stakeholder engagement																				
LL infrastructure development																				
Testing & piloting																				
Iteration & process analysis																				
Operational trials																				
Feedback & scaling																				

14. Contact

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