An End to end Interoperability Framework For MaritimE Situational Awareness at StrategiC and TacTical OpeRations

Reporting

Project Information

EFFECTOR

Grant agreement ID: 883374

Project website

DOI
10.3030/883374

Project closed

EC signature date
30 April 2020

Start date
1 October 2020

End date
30 September 2022

Funded under
Secure societies - Protecting freedom and security of Europe and its citizens

Total cost
€ 5 882 380,00

EU contribution
€ 4 999 529,50

Coordinated by
Secrétariat général de la mer
France

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22 November 2024

Periodic Reporting for period 1 - EFFECTOR (An End to end Interoperability Framework For MaritimE Situational Awareness at StrategiC and TacTical OpeRations)

Reporting period: 2020-10-01 to 2022-09-30

Summary of the context and overall objectives of the project

An efficient combination, processing and information sharing of multiple sources and types of information is required in order to achieve an enhanced maritime surveillance picture for a better decision support and improved collaboration. Although the maritime surveillance sector has been enriched in the last decade, new and novel surveillance concepts are still underutilized both in terms of integrated surveillance systems and/or in terms of efficient processing and knowledge extraction. To achieve the integration and inter- and intra-operation of various surveillance data sources and decision support systems, different data formats, communication protocols and data exchange mechanisms need to be managed and controlled in a comprehensive manner; hence interoperability standards play a crucial role towards this direction. This becomes even more evident when it comes to strategic and tactical mission planning, command and control and intelligence reporting.

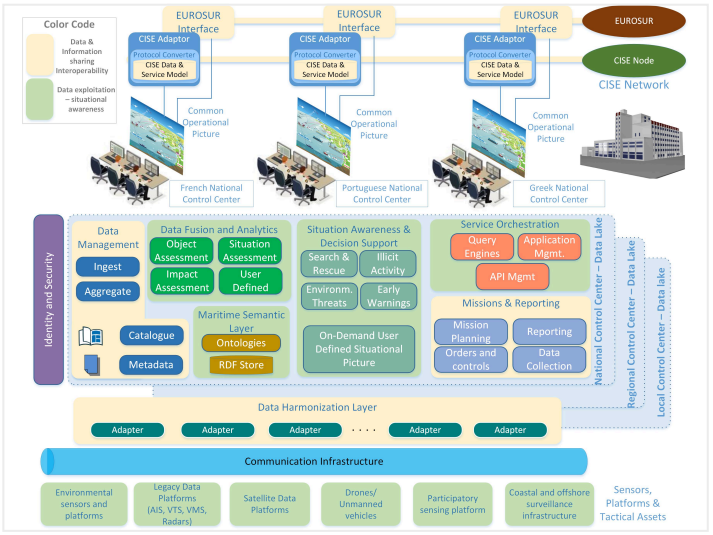
The EFFECTOR project is a 24-month project funded by the European Commission which aims to unlock the full capabilities of maritime surveillance systems and data sharing at tactical and strategic level by introducing applied solutions for enhanced border and external security. In the past, the focus has been mainly on the data exchange aspect, however there is still a technological gap present within Interoperability Framework that EFFECTOR wants to address. The project leverages on previous research studies to further develop on their ideas whilst the final solution is to be tested, validated and demonstrated in real operational scenarios together with maritime authorities, end users and practitioners.

Work performed from the beginning of the project to the end of the period covered by the report and main results achieved so far

1. French Data Lake: Platform based on big data technologies allowing aggregation and analysis of large quantities of heterogeneous data related to maritime surveillance
2. SEAMIS: An operational system for search and rescue at sea
3. ENGAGE C3i Maritime Edition: Software suite for Surveillance, Command, Control and Coordination of Maritime Incidents fully compliant with the CISE Service and Data Model
4. Triton for Abnormal Vessel Behaviours: Abnormal Vessel Behavior Engine compatible with the CISE Data Model
5. Greek Data Lake: A collection of technologies to ingest, adapt, route and ultimately store large amounts of streaming high-volume data
6. InSyTo - semantic fusion of trajectories: Software module for information and trajectories fusion
7. Alert & Anomaly Detection Module: Software suite supported by AI for Anomaly Detection and Vessels Behaviour Analysis, route prediction and complex scenarios processing
8. INUS Platform: Visual camera for vessel detection & tracking
9. CIMAS: Participatory Sensing based on SCENT toolboxes, that involve citizens in environmental monitoring
10. Early Collision notification: A collision notification system exploiting AIS information to detect, at an early stage, possible collision between ships.
11. Ontology design: Sets of modular ontologies allowing reusability. Extension of existing standards (geoSPARQL)
12. Ontology alignment: Prototypes that performs ontology alignment to ensure broader data ingestion and querying
13. Query on heterogeneous data: Querying heterogeneous data from multiple sources based on modern NoSQL data store architectures
14. Weak Signal Detection: Weak signal detection algorithm
15. Forecasting services: Leveraging the Copernicus data and CLS own networks of oceanographic platforms (collecting different kind of environmental data)
16. Maritime Awareness System: Provision of vessel detection report, systematically generated from Sentinel 1 images associated with AIS
17. CLS Satellite Services: Provision and processing of satellite information, such as: EO (radar/optical), VMS, LRIT, AIS/SAT-AIS, ELINT / TCP IP protocol
18. Portuguese Data Lake: The data lake combines fusion and analyse heterogeneous data to integrate a new source of information
19. Recognized maritime Picture: Information about vessels coming from different sensors are correlated and fused to create an aggregated view of information
20. Mission Planning: Support to the execution of tasking of tactical assets, mission planning and reporting of incidents etc.
21. MUSCA C2: A C2 for managing the situation awareness through the anomalies triggered by the analysis of the abnormal behavior and the missions

Progress beyond the state of the art and expected potential impact (including the socio-economic impact and the wider societal implications of the project so far)

A. Multi-layer Data Lake and common data sharing environment for Local, Regional and National coordination centres: The EFFECTOR Data Lake is a multi-layer Data Lake, deployed in the three national coordination centers (in France, Portugal and Greece) following common guidelines. Each national Data Lake consists of a core data lake and logical data lakes in order to support regional and local information and surveillance systems and data sources. The EFFECTOR Data Lake ecosystem is composed by several interconnected Big Data Open Source technologies that provide Extract, Transform and Load (ETL) capabilities.
B. Data Fusion and Analytics Layer for knowledge extraction and provision of situational awareness services: The Data Fusion and Analytics layer of EFFECTOR incorporates 3 different JDL levels of Data Fusion and is complemented with advanced (big) analytics services which build a set of dedicated situational awareness services for improved decision support linked to the EFFECTOR use cases.
C. The Data Harmonization layer for seamless integration of surveillance systems, sensors, platforms and data sources of interest: It decouples the data sources and systems from the communication technologies and removes barriers that appear from custom or proprietary communication protocols and data formats. The layer and the respective adapters support a multitude of existing interoperability standards.
D. Mission and reporting layer: the Mission and Reporting layer support the: a) execution of tasking of tactical assets, b) mission planning and execution of missions, c) reporting of incidents, collection of data, historical data management, mission debriefing, incident analysis reporting etc.
E. Maritime Semantic Layer: The Semantic layer of the EFFECTOR Data Lake platform facilitates the use of common vocabularies and shared taxonomies for reaching semantic agreements on common concepts between national coordination centres, and the use of Linked Data technologies as a means of facilitating the exchange and integration of maritime surveillance data across Member States and maritime end users.
F. The CISE and JORA Integration Layer for transnational information exchange: All three Data Lakes deployed in the National Coordination Centres of France, Portugal and Greece provide the means to exchange and share information with the CISE network. This is achieved by implementing CISE adapters. Furthermore, EFFECTOR developed a CISE Adaptor for JORA facilitating the integration of FRONTEX incedent and reporting system with CISE.
G. The Identity and Security Layer: The identity and security layer of EFFECTOR follows the security by design concept ensuring user and data security. All data exchanges are secured, an administrator console manages users/applications/services, authentication and authorization.



EFFECTOR System Architecture

Last update: 9 July 2023

Permalink: https://cordis.europa.eu/project/id/883374/reporting