ALFA Workshop

Brussels, 4th December 2018

Project Information

MARitime Integrated Surveillance Awareness (MARISA)

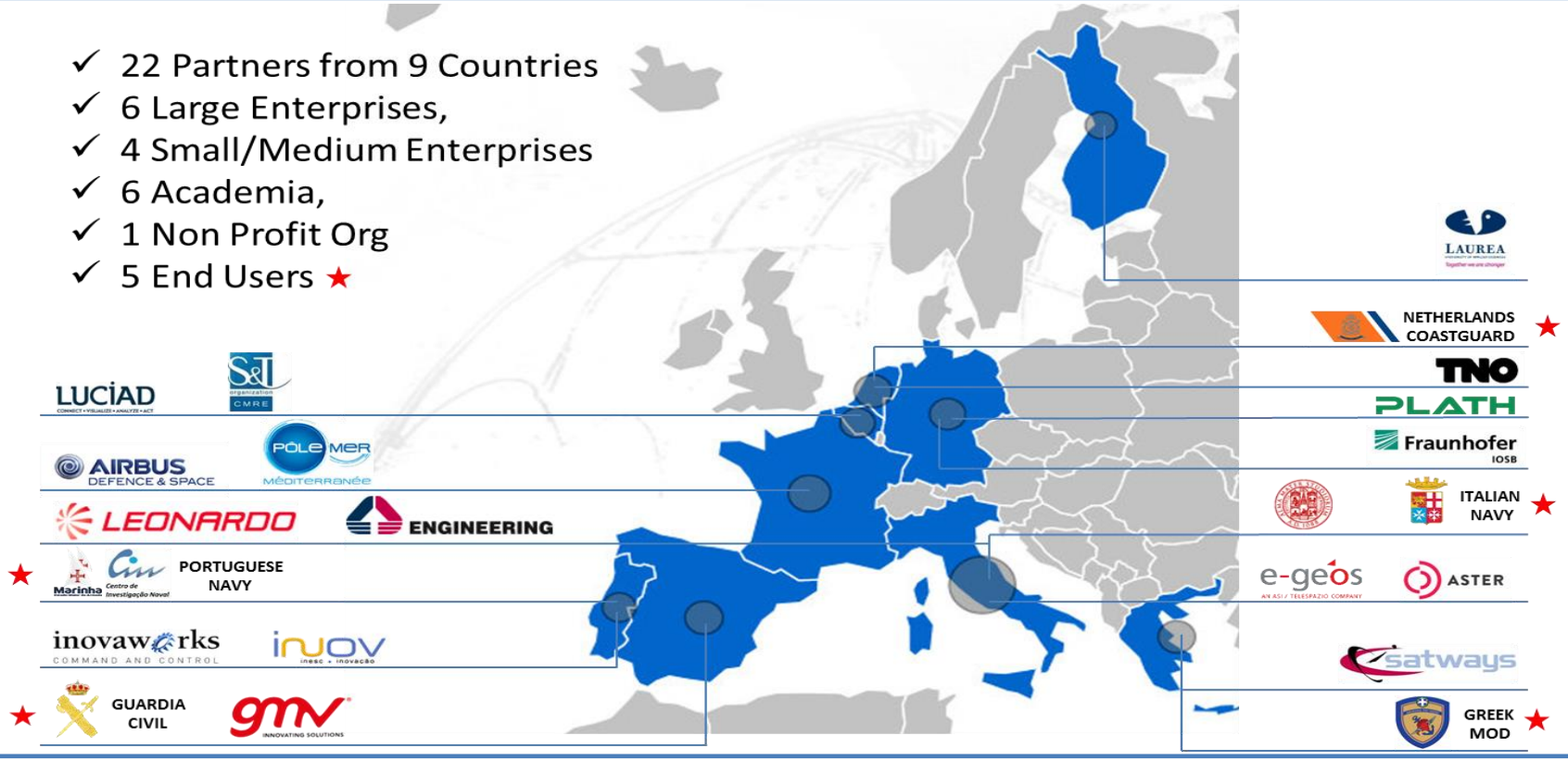
Coordinator: Leonardo

Project Costs: € 9.765.658,75

EU Contribution: € 7.997.492,50

Start 1st May 2017

End 31st October 2019



MARISA Consortium

Industry

- Leonardo (IT)
- Engineering (IT)
- Airbus (FR)
- GMV (ES)
- e-GEOS (IT)
- SATWAYS (GR)
- PLATH (DE)
- Aster (IT)
- Inovaworks (PT)
- Luciad (BE)
- Polémer Mediterannée (FR)

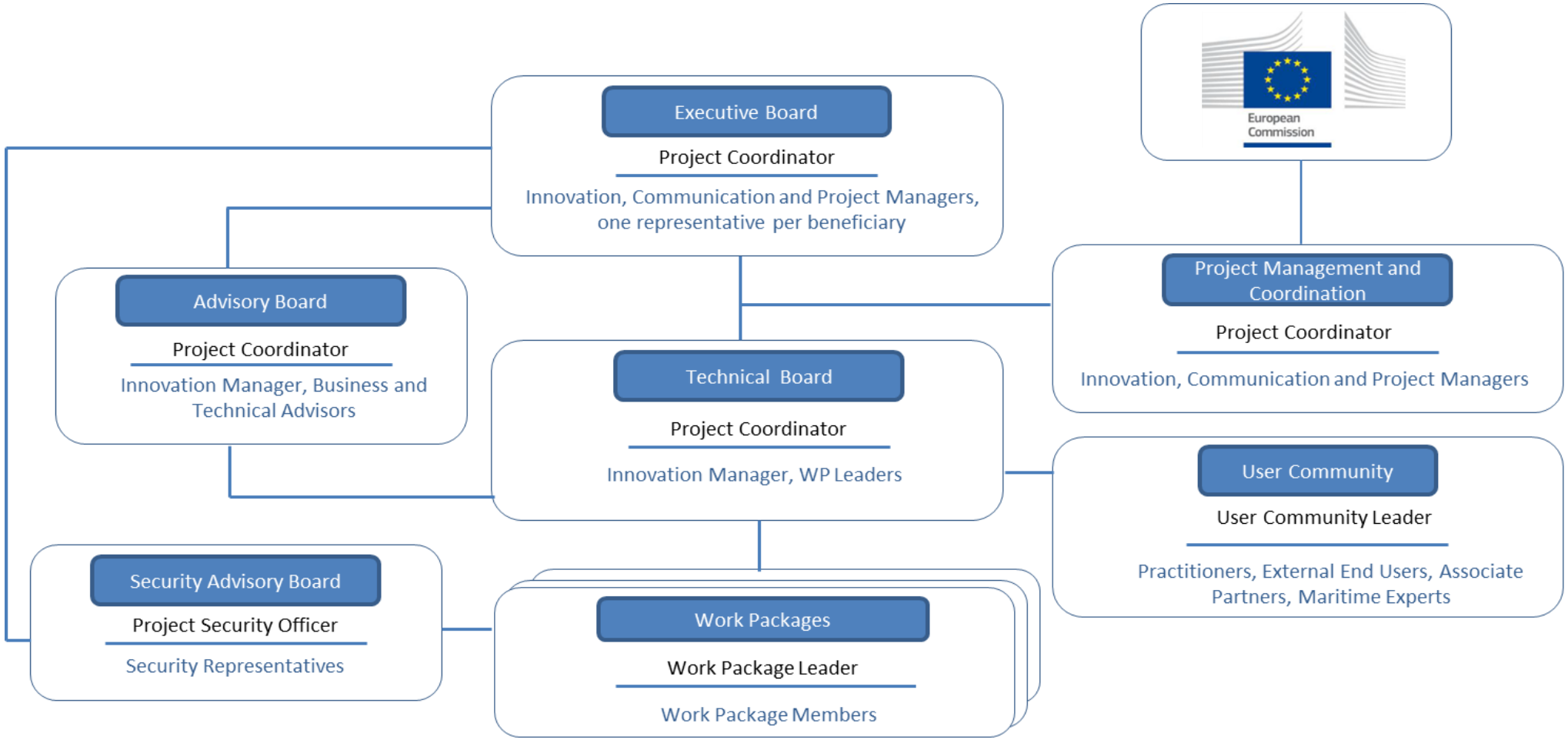
Research

- TNO (NL)
- University of Bologna (IT)
- Laurea University (FIN)
- Fraunhofer IOSB (DE)
- INOV (PT)
- NATO CMRE (BE)

End-Users

- Hellenic MoD
- Netherlands Coastguard
- Guardia Civil
- Italian Navy
- Portuguese Navy

Project Organization



Project Objectives

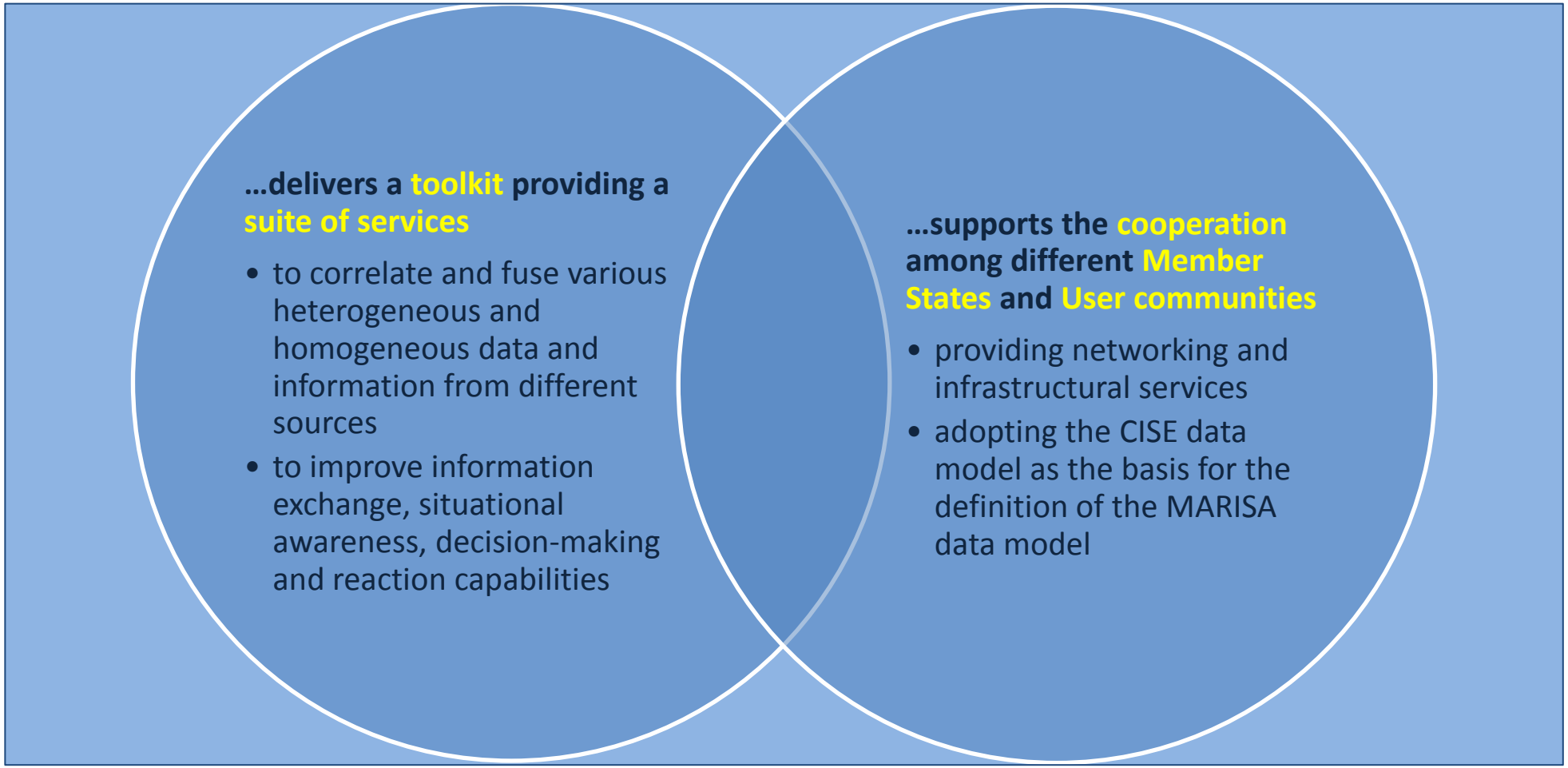
1. Create Improved **Situation Awareness**

2. Support the **practitioners** along the complete lifecycle of situations at sea

3. Ease a **fruitful collaboration** among adjacent and cross-border agencies

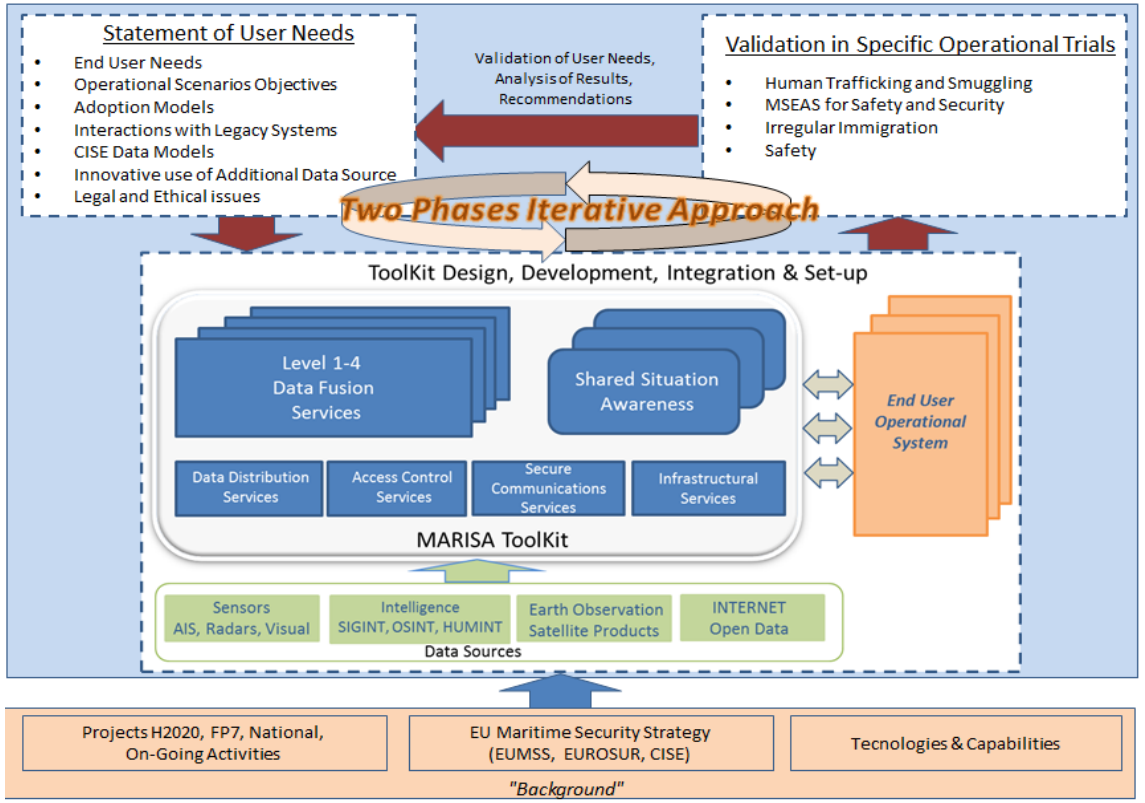
4. Foster a **dynamic eco-system** of users and providers

MARISA ….

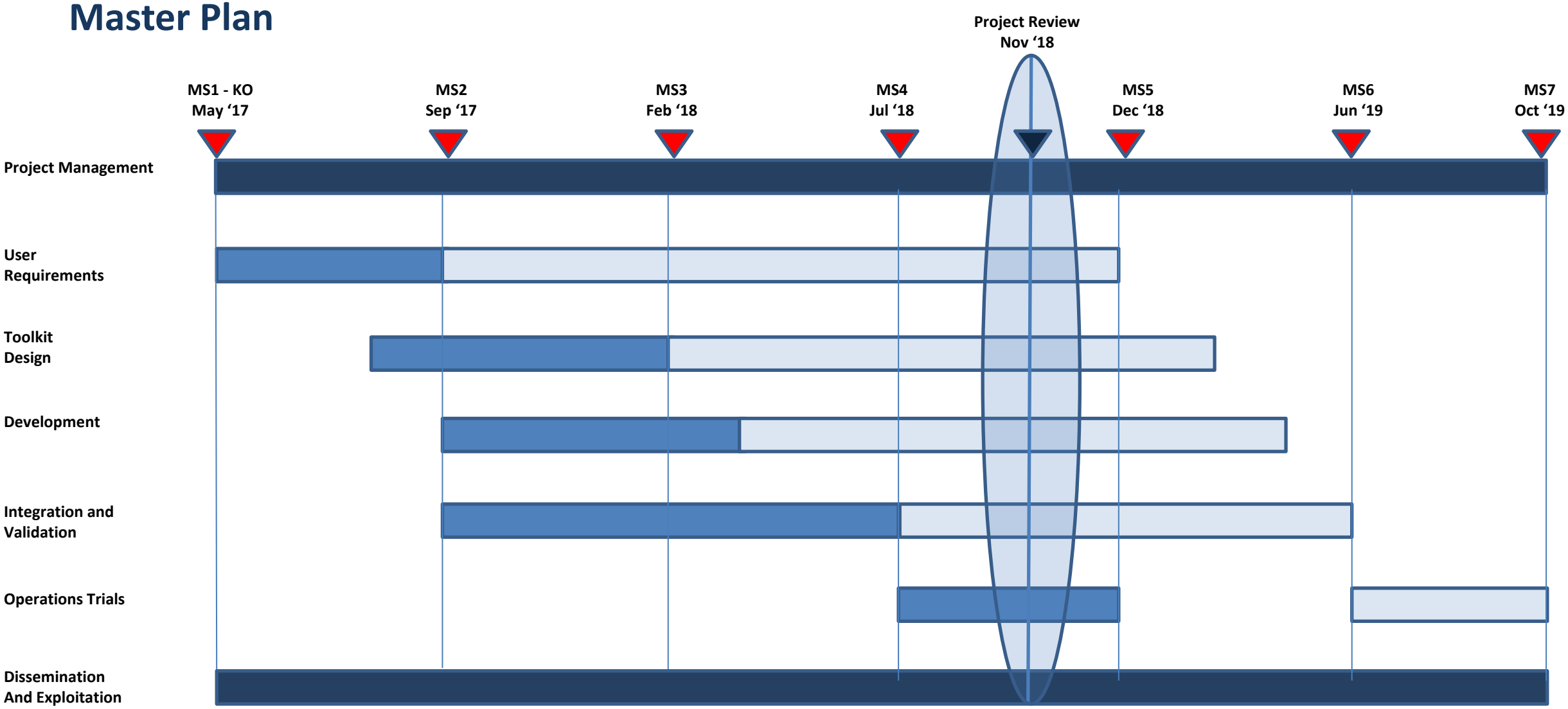

…delivers a toolkit providing a suite of services
• to correlate and fuse various heterogeneous and homogeneous data and information from different sources
• to improve information exchange, situational awareness, decision-making and reaction capabilities
…supports the cooperation among different Member States and User communities
• providing networking and infrastructural services
• adopting the CISE data model as the basis for the definition of the MARISA data model

Approach and methodology

- Attention to reuse capabilities and results coming from other European programs
- Compliance with European Maritime Security Strategy and CISE Data Model
- Strong Involvement of the User Community
- Protection of Data Fusion Products based on the "need-to-share" approach
- Validation of MARISA in specific operational trials
- Two Phase Approach



Master Plan


Project Review
Nov '18
MS1 - KO
May '17
MS2
Sep '17
MS3
Feb '18
MS4
Jul '18
MS5
Dec '18
MS6
Jun '19
MS7
Oct '19
Project Management
User Requirements
Toolkit Design
Development
Integration and Validation
Operations Trials
Dissemination And Exploitation

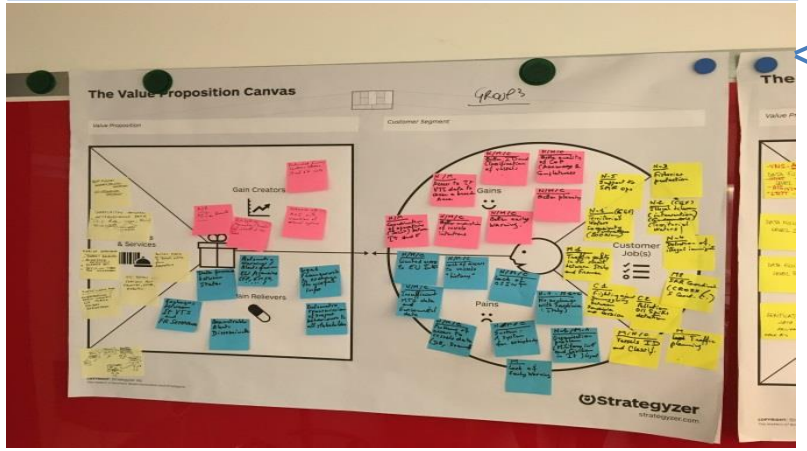
User Community

A Community of End Users interested in the MARISA project has been set-up and involved in the various initiatives organized during the first year

- **UC1 at LAUREA premises**, Helsinki, on 27th and 28th June 2017
  - Value Proposition Canvas with Customer Jobs, Pains, Gains
  - Products and services, Pain relievers, Gain creators
- **UC2 at GMV premises**, Madrid, on 16th and 17th January 2018
  - MARISA Services definition
  - MARISA Trials definition & exercises during these trials

Brainstorming workshop based on User-centered design methodology
User Community Meeting – Helsinki – June 2017

User Requirements Definition



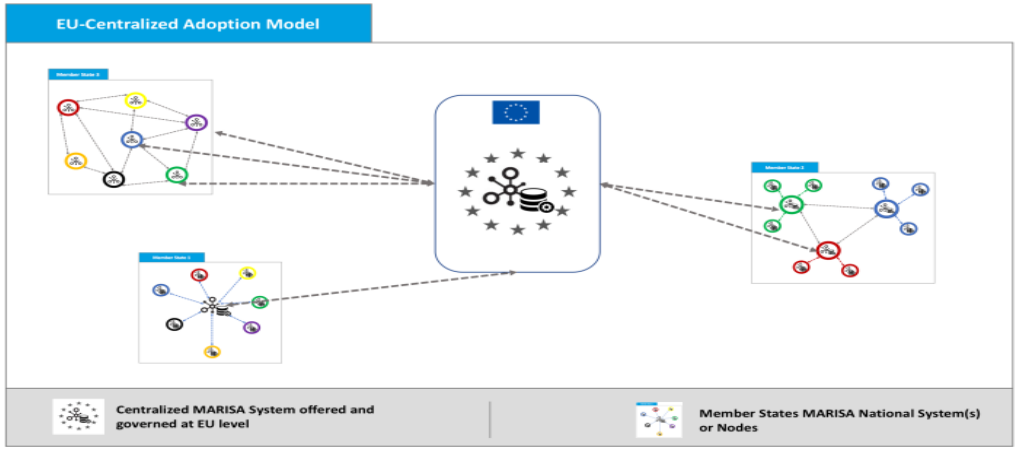
Brainstorming workshop based on User-centered design methodology

User Community Meeting – Helsinki – June 2017

Helped in brainstorming User Requirements

Contributed to MARISA Adoption Models

		T1	T2		T3	T4		T5
		NCG	GUCI	PTN	FRN	MMI	HMOD	HMOD
Level 3 Data Fusion Services		yes	yes	yes	yes	yes	yes	yes
MARISA_UR_DF3_300	MARISA Toolkit shall allow the **assessment** (e.g. seriousness and possible impacts, underlying problem that stimulated the threatening) **of detected threats** in the area of interest.	yes	yes	yes	yes	yes	yes	yes
MARISA_UR_DF3_305	MARISA Toolkit shall allow the **prediction in the area of interest of the evolution of vessel tracks** of non-cooperating targets (e.g. vessels with no AIS on-board or turned off).	yes	yes	yes	yes	yes	yes	yes
MARISA_UR_DF3_310	MARISA Toolkit shall allow the prediction of **potential threats and its evolution over a potential area of interest**.	yes	yes	yes	yes	yes	yes	yes
MARISA_UR_DF3_315	MARISA toolkit shall allow the prediction of the **evolution of the observed abnormal behaviour**.	yes	yes	yes		yes	yes	yes
MARISA_UR_DF3_320	MARISA toolkit shall allow **the mission planning** considering business intelligence information, METOC information, ship data cards of all vessels, navigational plan, automatic alarms already created.	yes		yes	yes			
MARISA_UR_DF3_325	MARISA Toolkit shall allow the planning of SAR operation planning considering METOC and drift information, available assets and search plans	yes		yes	yes			
MARISA_UR_DF3_330	MARISA toolkit shall allow the automatic optimal vessel **route planning** over the area of interest **considering extreme sea conditions** forecasted threats (e.g. significant wave height, wave direction, current direction, wind extremes, marine fog).	yes		yes	yes	yes	yes	yes
MARISA_UR_DF3_335	MARISA toolkit shall allow the automatic **optimal deployment of air and naval assets for Search and Rescue** operations over the area of interest **considering extreme sea conditions** forecasts (e.g. significant wave height, wave direction, current direction, wind extremes, marine fog).	yes		yes	yes	yes	yes	yes



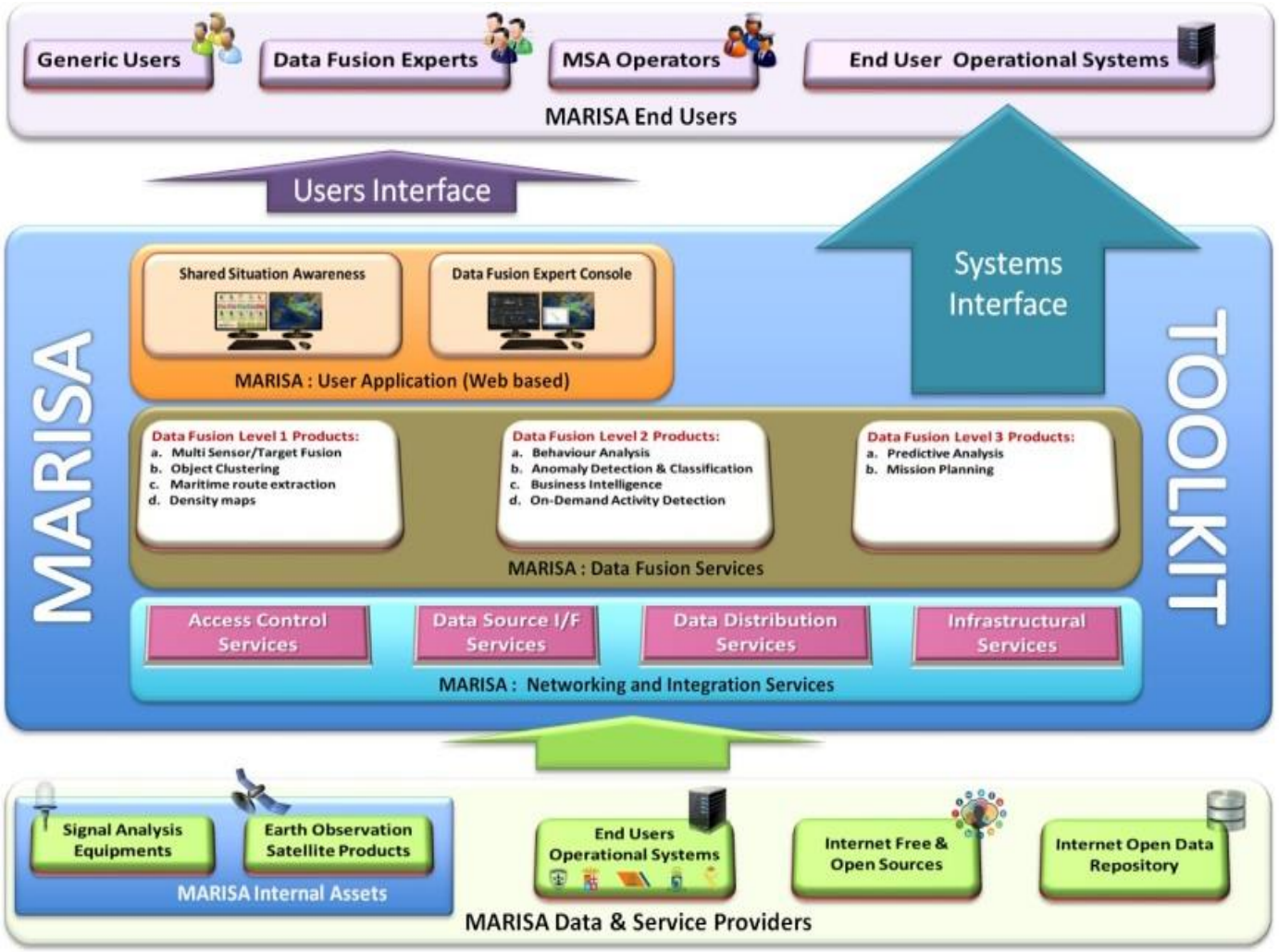
MARISA Conceptual View

Data Fusion Services

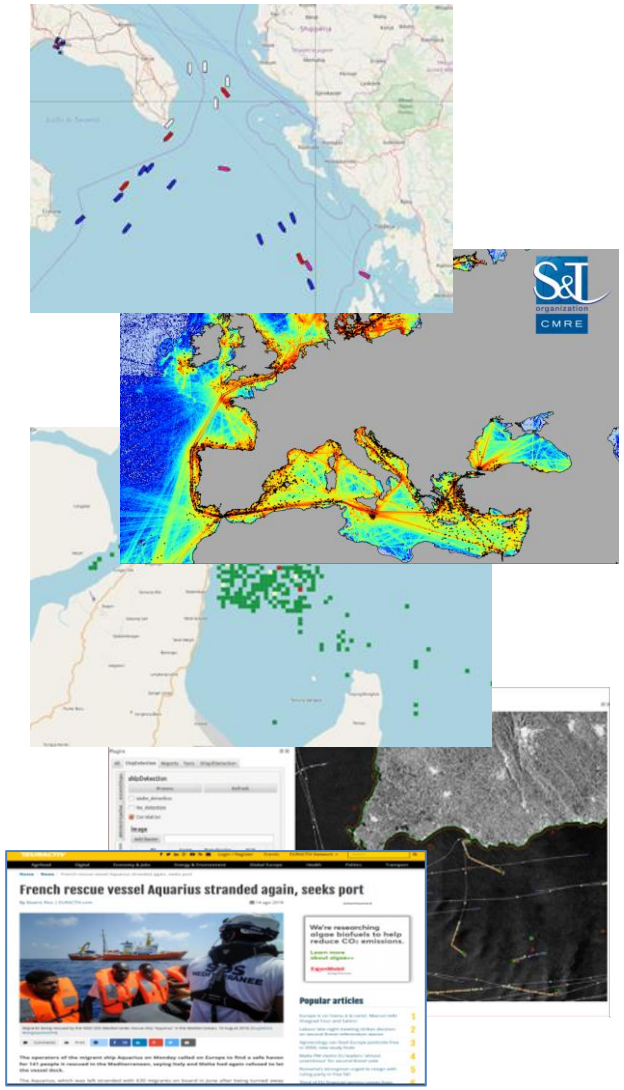
- Level 1 - Observation of elements in the environment
- Level 2 - Comprehension of the current situation
- Level 3 – Projection of Future States

Common Services

- Infrastructure Services
- Human Computer Interface
- Data Distribution Services
- Access Control Services

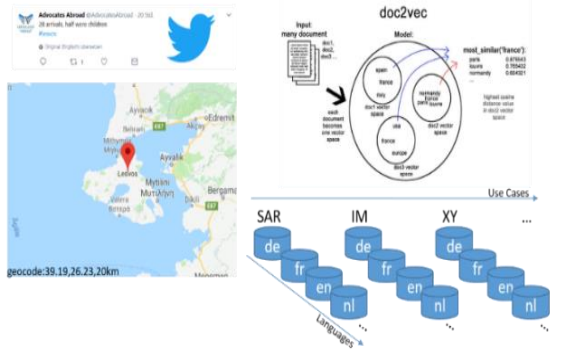


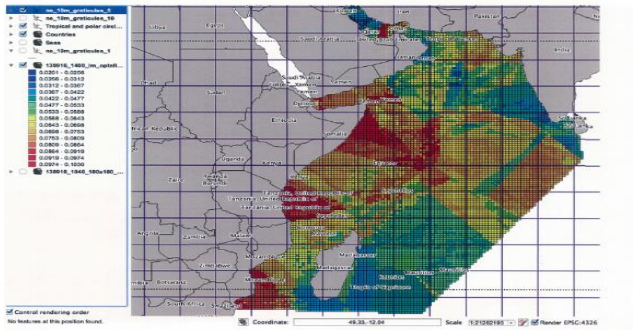
Overview of Level 1 Services: "Observation of elements in the environment"



- **Multi Sensor Track Fusion (GMV):** Fusion of track data coming from a variety of sensors (AIS Receivers and Radars) and Legacy Systems
- **AIS Verification (Plath):** Verification of the AIS reported positions against measurements provided by a radio locating system
- **Satellite Vessel Detection (e-GEOS):** Target detection by processing SAR and VHR optical imagery and ship parameters estimation
- **Density Maps (CMRE):** Density of vessel traffic in a given geographical area extracted from AIS historic data
- **Heat Maps (e-GEOS):** Heat Maps showing traffic patterns extracted from satellite VHR and SAR images
- **OSINT Integration (e-GEOS):** Extraction and integration of maritime security and safety events from open sources platform (Global Database of Events - GDELT)
- **COP Fusion (AST):** Fusion of surveillance pictures produced in different operational environment to generate a common operational picture without redundant objects/tracks

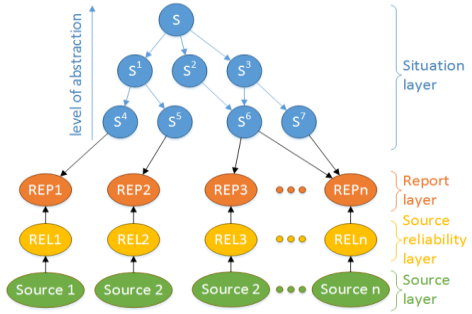
Overview of Level 1 Services "Observation of elements in the environment" (Cont'd)

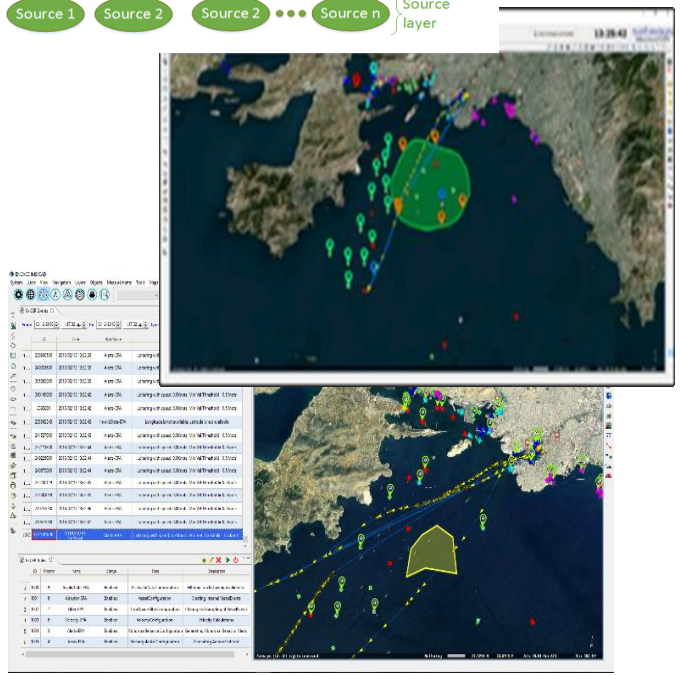




- **Twitter Services (IOSB):** Analysis of tweets for language and classification algorithms to assess the risk and relevance of the tweet in the intended context domain.
- **Recognized Maritime Picture (RMP):** Analysis and correlation of all information relevant to the observed object such as track data, anomalies, incidents, risks, …etc.
- **Ship Routes (CMRE):** Traffic patterns that are automatically learned from AIS data and suitably synthesized in a compact representation (routes, waypoint areas, navigational legs, stationary areas, ports, …etc.)
- **Risk Maps (NLCG):** Production of risk maps for collisions, penetration in dangerous/forbidden areas analyzing historical incident, weather and sea data by using different machine learning techniques and support to SaR operations

Overview of Level 2 Services: "Analysis and comprehension of the current situation"

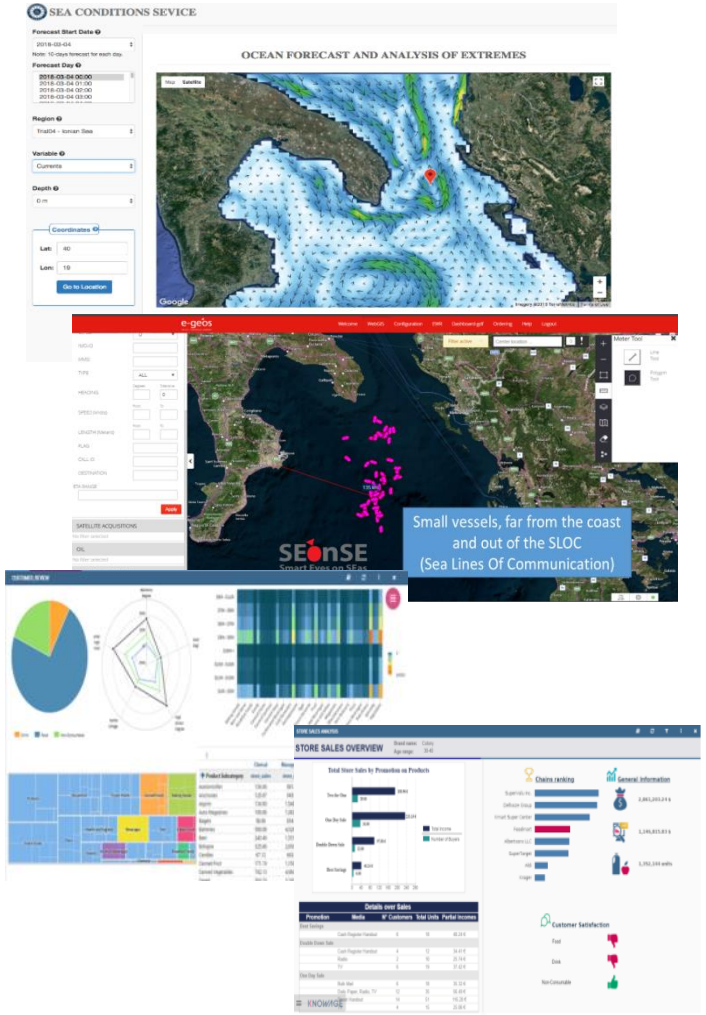




- **Behaviour Analysis and Anomaly Detection:** A set of services to detect anomalies and abnormal behaviour. Different technical approaches are used:

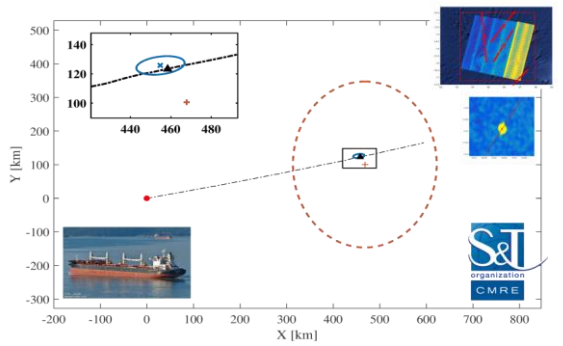
  - ✓ **Rule based:** built on end user's field experience
  - ✓ **Dynamic Bayesian Networks (IOSB/CMRE)**: use of probabilistic models of the vessel traffic parameters and their situational dependencies for vessel behaviours analysis and ship-to-ship interactions
  - ✓ **Geospatial Complex Event Processing (STW)**: Combines geospatial data analysis to infer events or patterns, to identify and analyze motion patterns of vessels that indicate an ongoing situation that needs attention
  - ✓ **AI & Machine Learning (INOV):** use of AI techniques and Data Mining to better detect patterns and "weak signals" patterns for analysis and prediction of abnormal tracks, movements or collective vessel behaviors.

Overview of Level 2 Services "Analysis and comprehension of the current situation« (Cont'd)



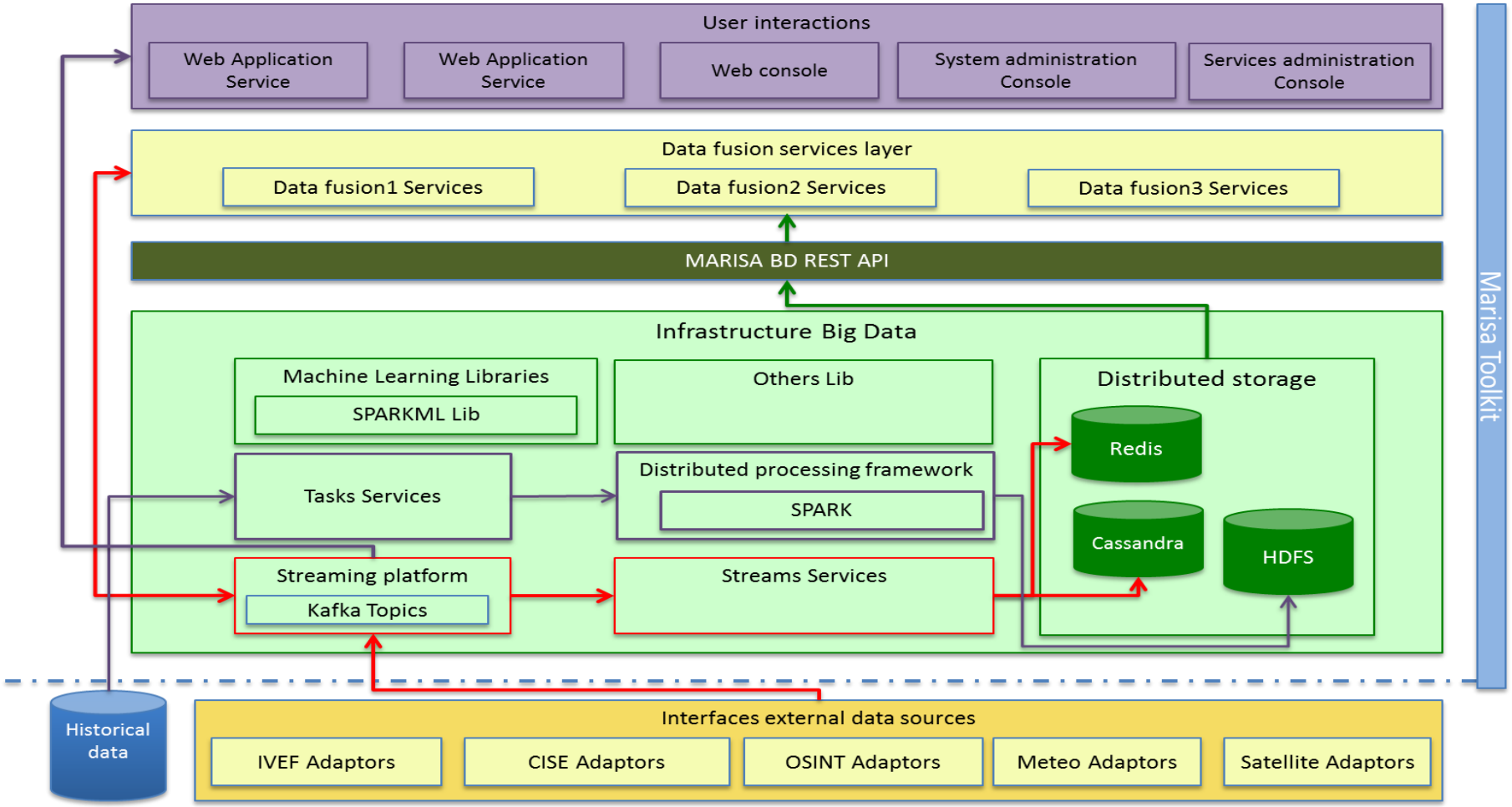
- **Sea Environment Awareness (UniBO):** production of detailed daily/hourly forecasts on surface currents, sea temperature, significant wave height and direction. Forecasts of field extreme conditions for users in selected areas of interest
- **Satellite Behaviour Analysis (e-GEOS):** vessel anomalies detected by processing and analyzing satellite VHR and SAR images
- **Business Intelligence Reports (ENG):** A set of analysis and reports based on managed data in support to operational assessment and decision making
- **Vessel Route Extraction (IW):** regular route extraction from AIS tracks and other spatiotemporal observations, allowing operators to identify recurrent behavior in vessels and the extent to which maritime traffic belongs to a given route.

Overview of Level 3 Services "Impact assessment and Prediction of future states"



- **Vessel Route Analysis (IW):** To fit, match and extrapolate whether a vessel route is being travelled according to nominal historic patterns, or is being abnormally deviated, in which case it will try to predict the future evolution.
- **Ship prediction (CMRE):** Accurate long term prediction in open seas and across sensor coverage gaps of future positions of a vessel on the basis of its AIS track.
- **IVEF Threat Analysis (TNO):** Analysis and assessment of an anomalous behaving object including the prediction of the object's future state such as its next position or anticipated behaviour
- **Complex Threat Assessment (ADS)**: Detection and assessment of potential threats from the combination of automated analysis capabilities using AIS, tracks from VTS/CSS systems and OSINT information, and providing rapid alerts to the user
- **Mission Planning (ENG):** Support in the optimal deployment of assets and graphical evaluation of an automatic optimal route vessel planning

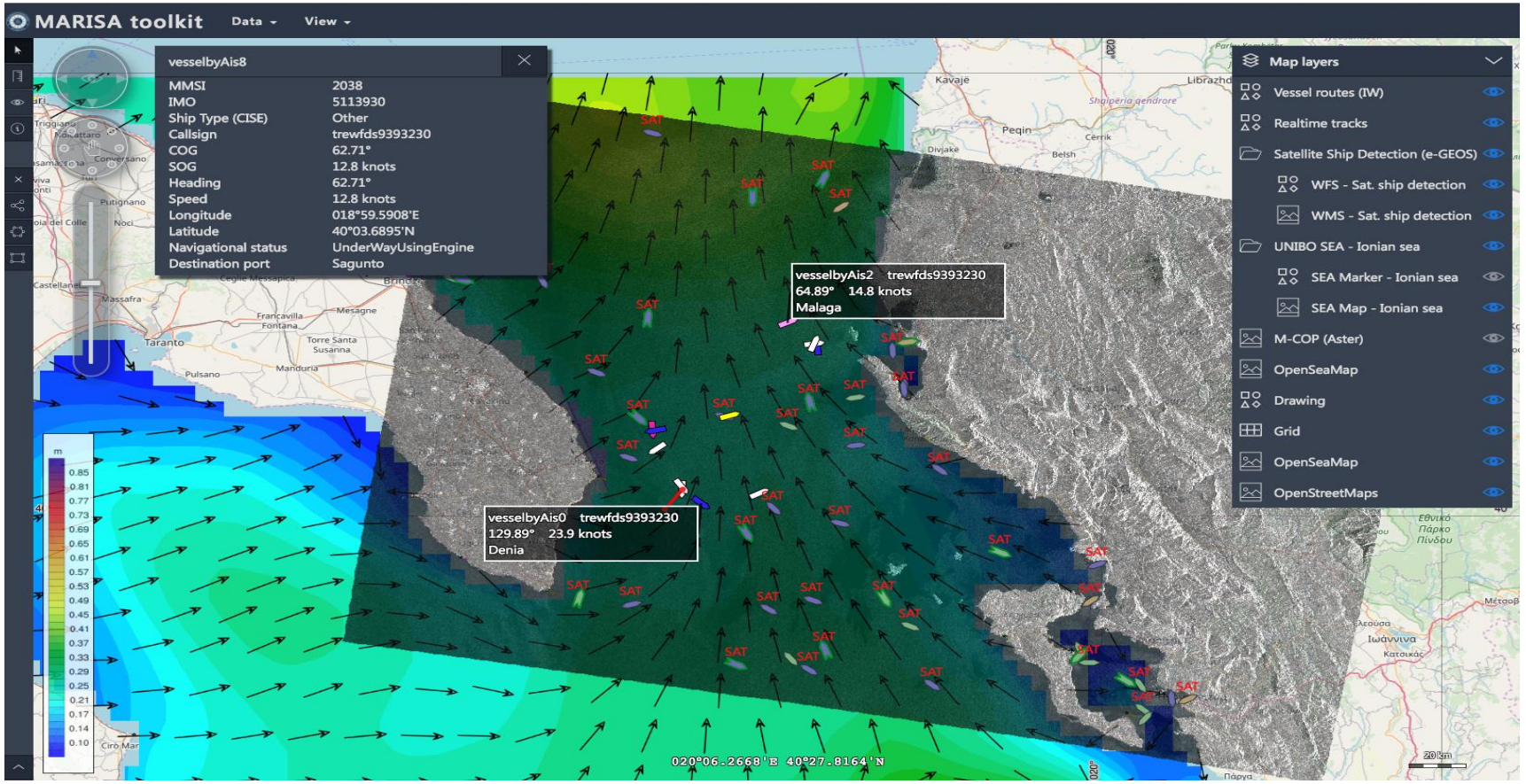
Big Data Infrastructure in MARISA



HMI – MSA Console

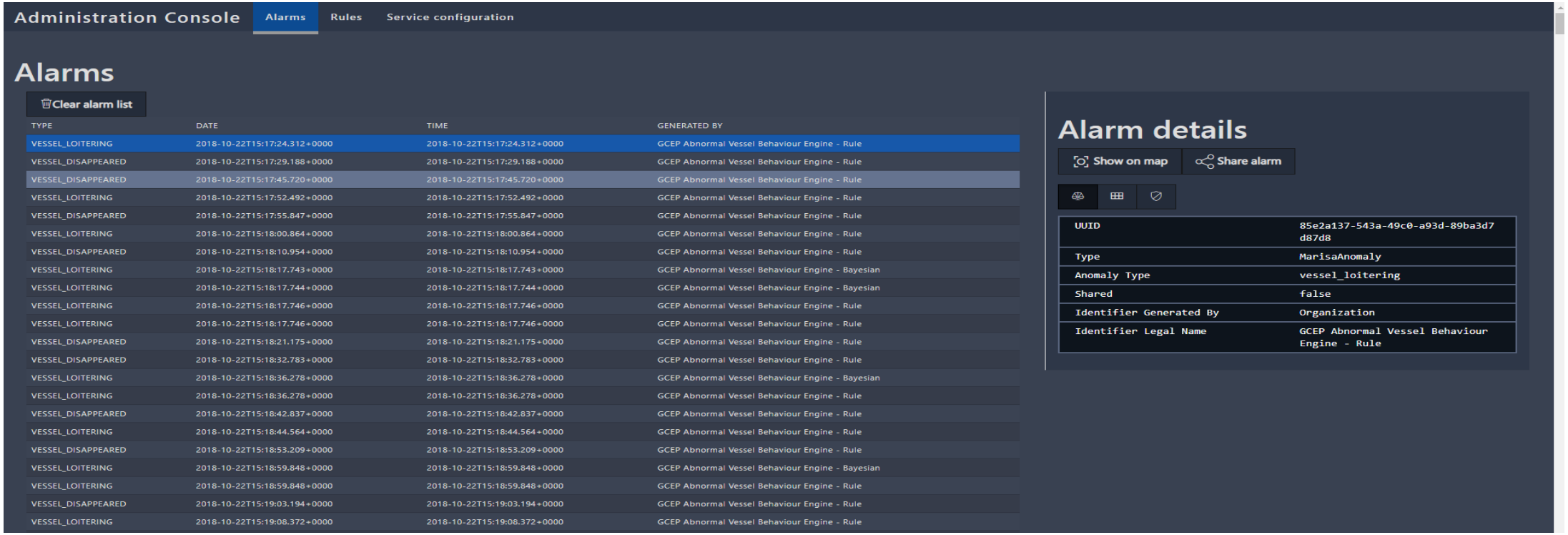
Showing:

1. Sea condition data from SEA service (wave height)
2. Realtime vessel positions (AIS, radar)
3. Vessels detected by Satellite Detection service



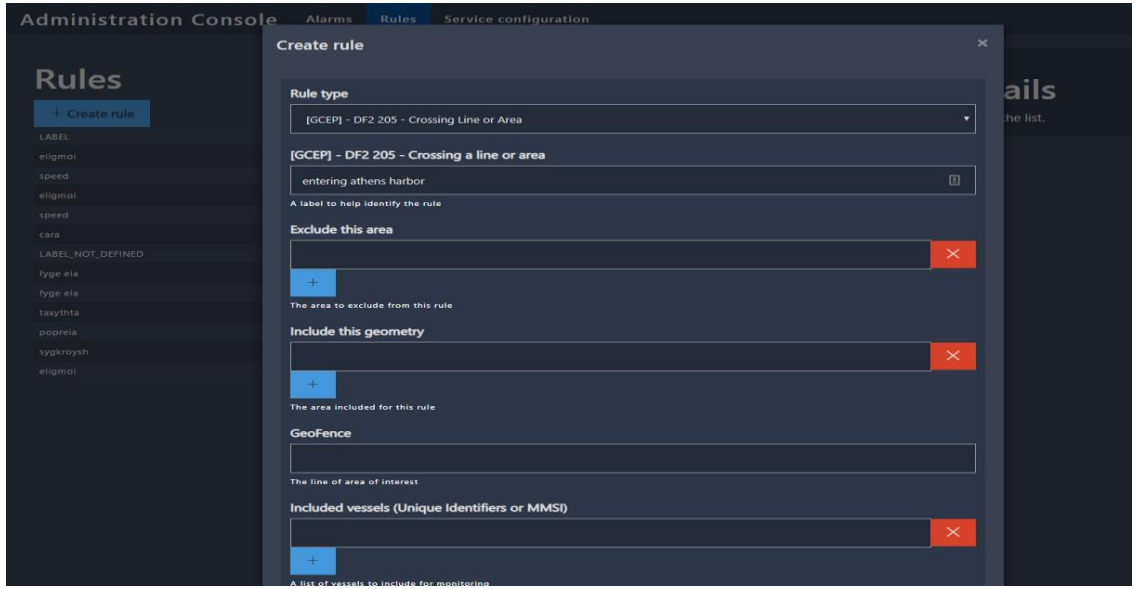
HMI - Administration Console

Alarms



HMI - Administration Console

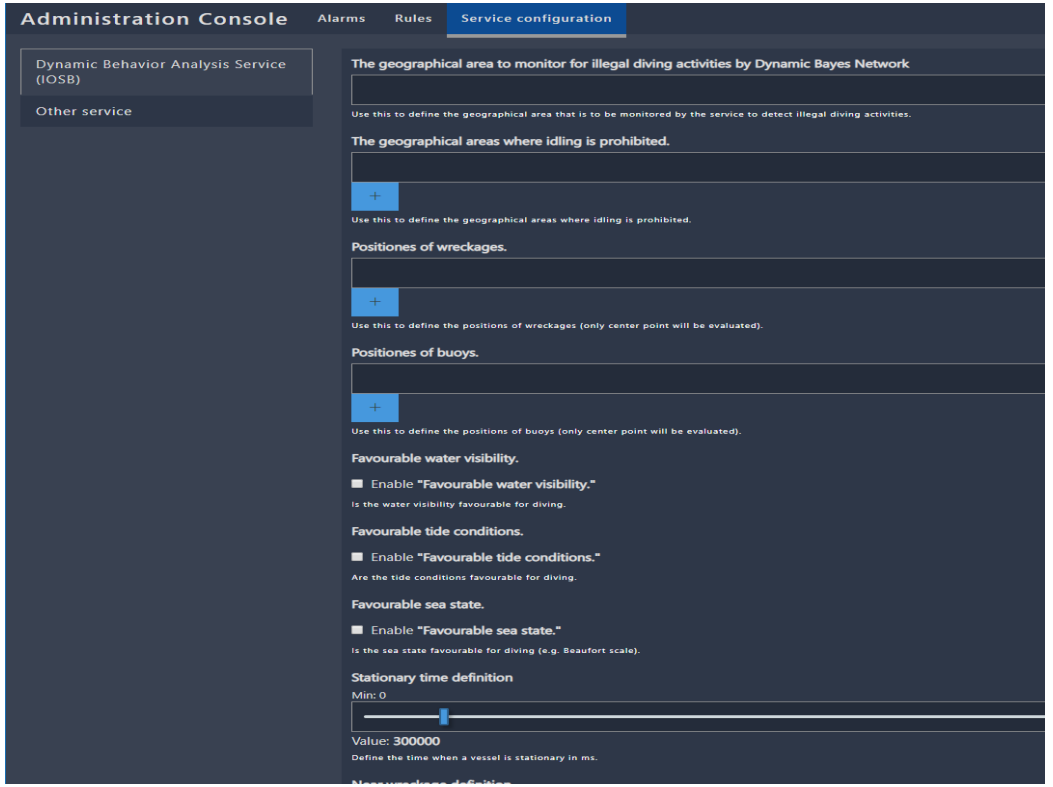
Rules of Alarm generation



Showing:

1. Rule creation
2. Service configuration

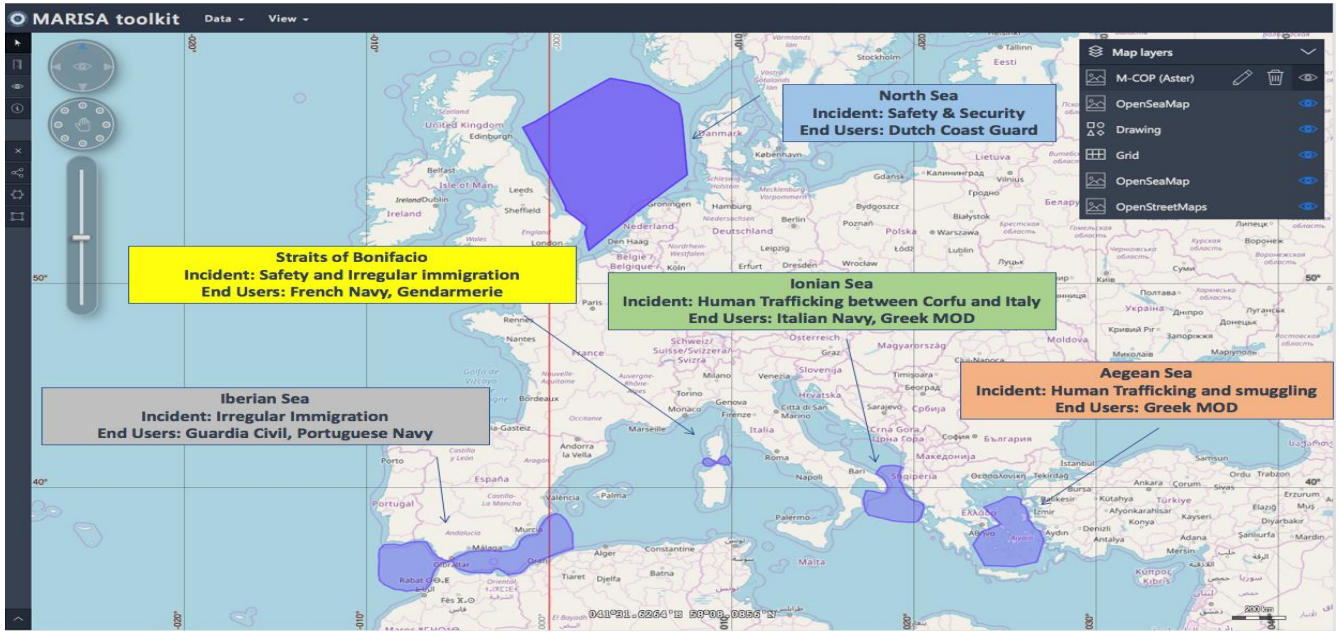
Service Configuration



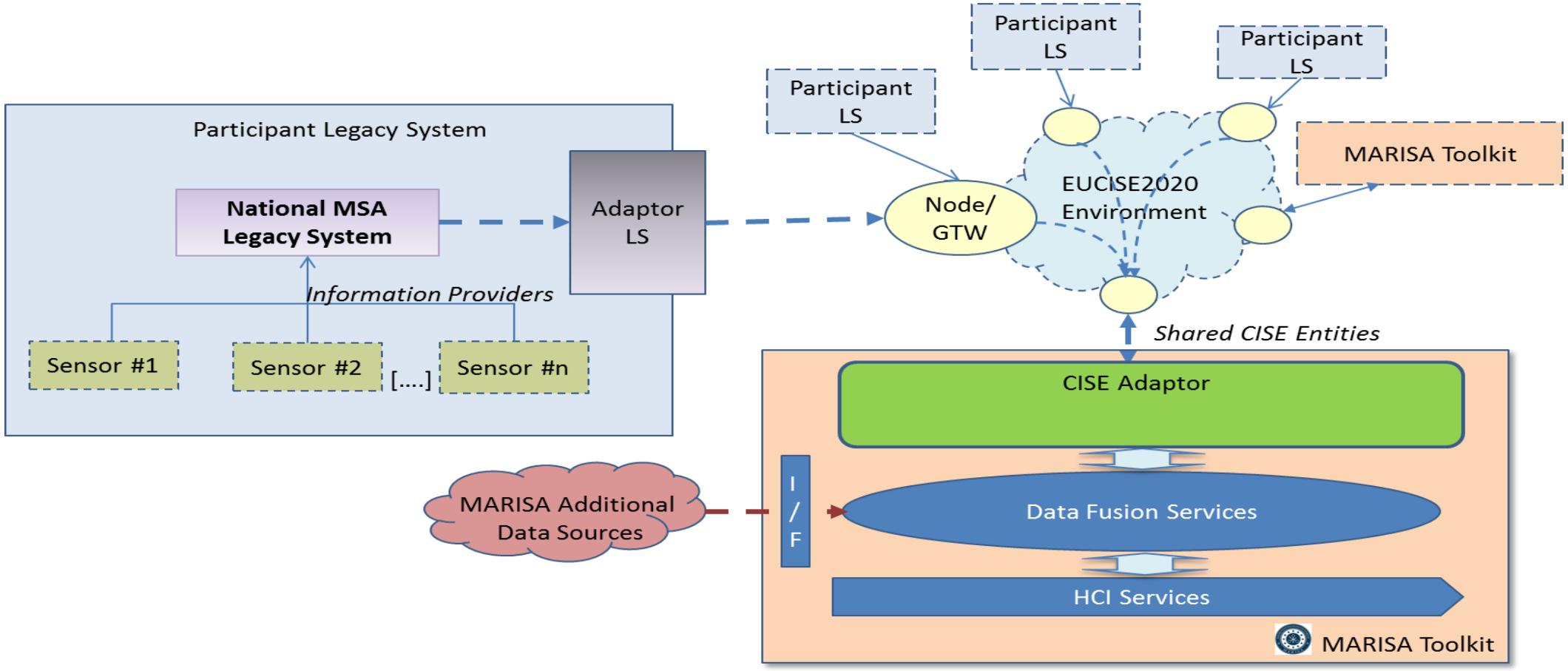
MARISA Operational Trials

Name	Output
Trial 1 – North Sea	Suspicious behaviour detection products, alerts from OSINT, risks and threat assessment, decision support products
Trial 2 – Iberian Sea	Shared situation awareness pictures, selected events, business intelligence products
Trial 3 – Strait of Bonifacio	Predicted behaviour products, possible threats and plans to coordinate the response
Trial 4 – Ionian Sea	Suspicious behaviour detection, threat assessment, predictive analysis products for suspicious vessels route, decision support and mission planning products
Trial 5 – Aegean Sea	Suspicious small and fast vessels detection, enhanced operational picture

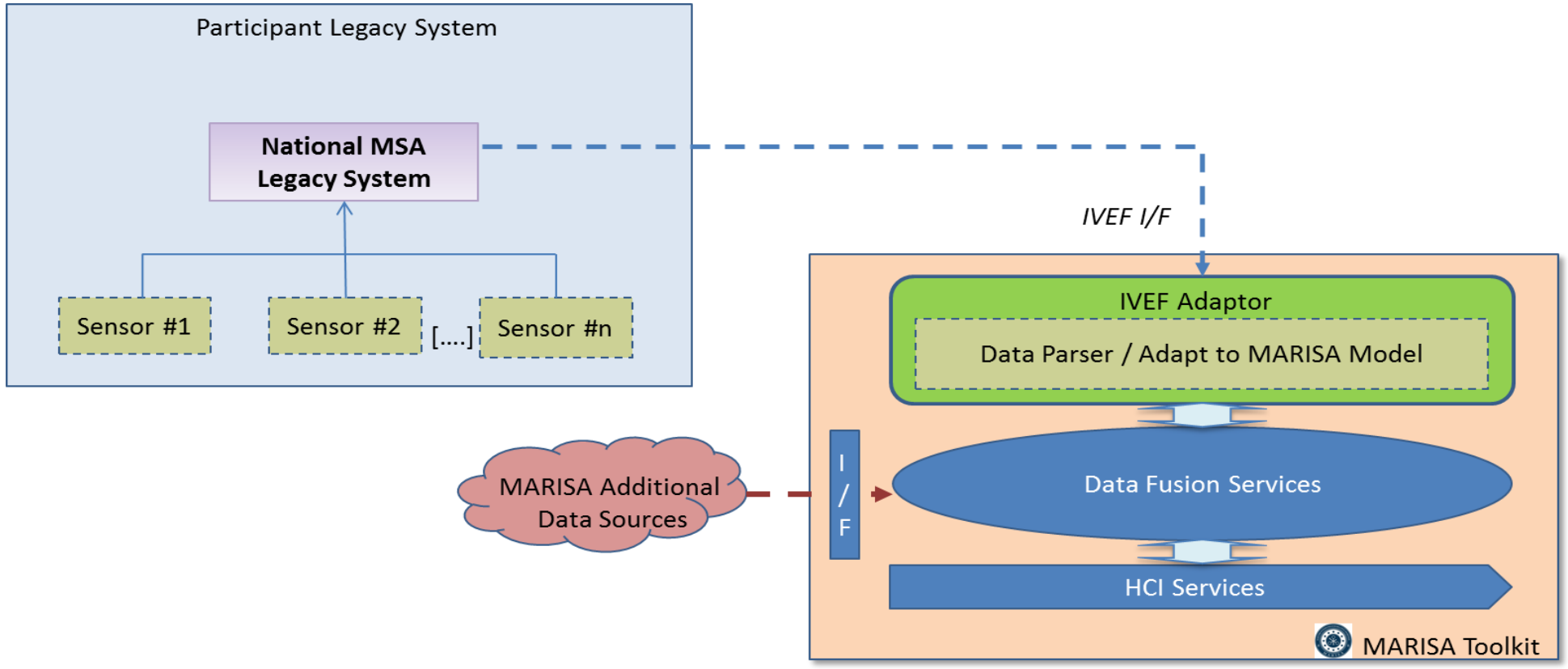
The **MARISA services** are validated through the **Operational Trials**



MARISA Interacts with Legacy Systems through EUCISE 2020



MARISA Interaction with Legacy Systems – IVEF I/F



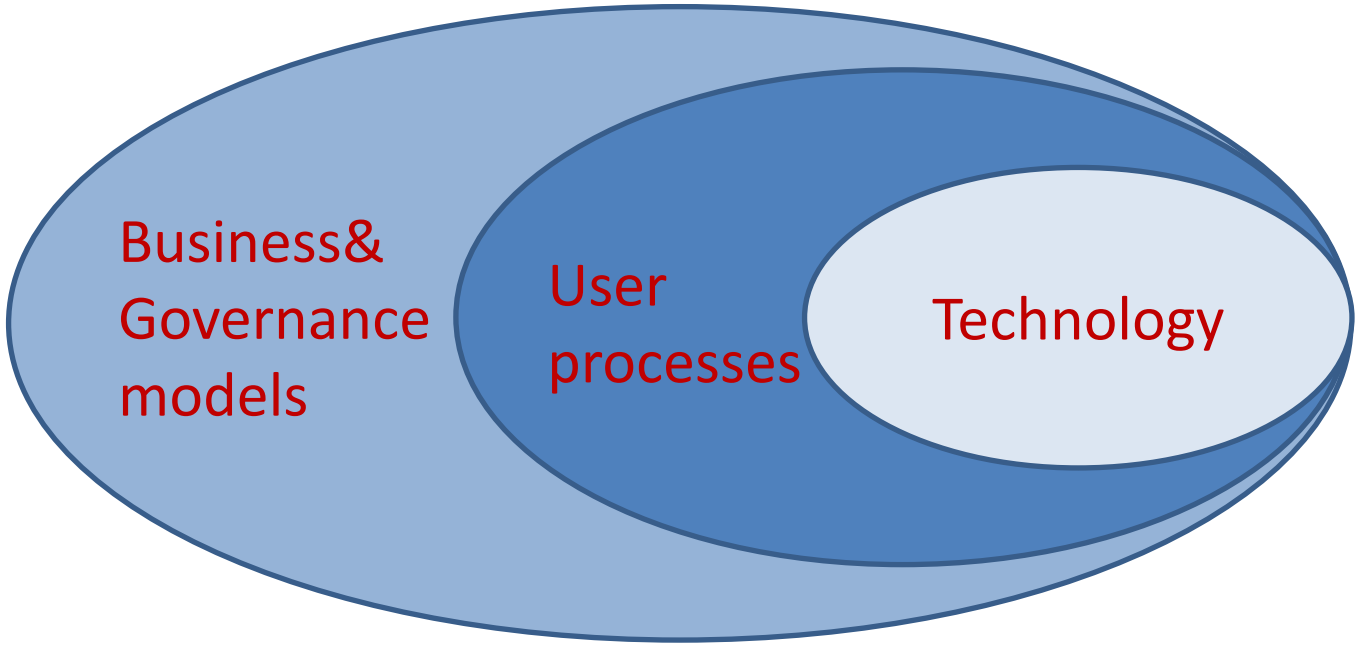
Ethical Dimensions of the MARISA Project

Ethical requirements for the MARISA solution

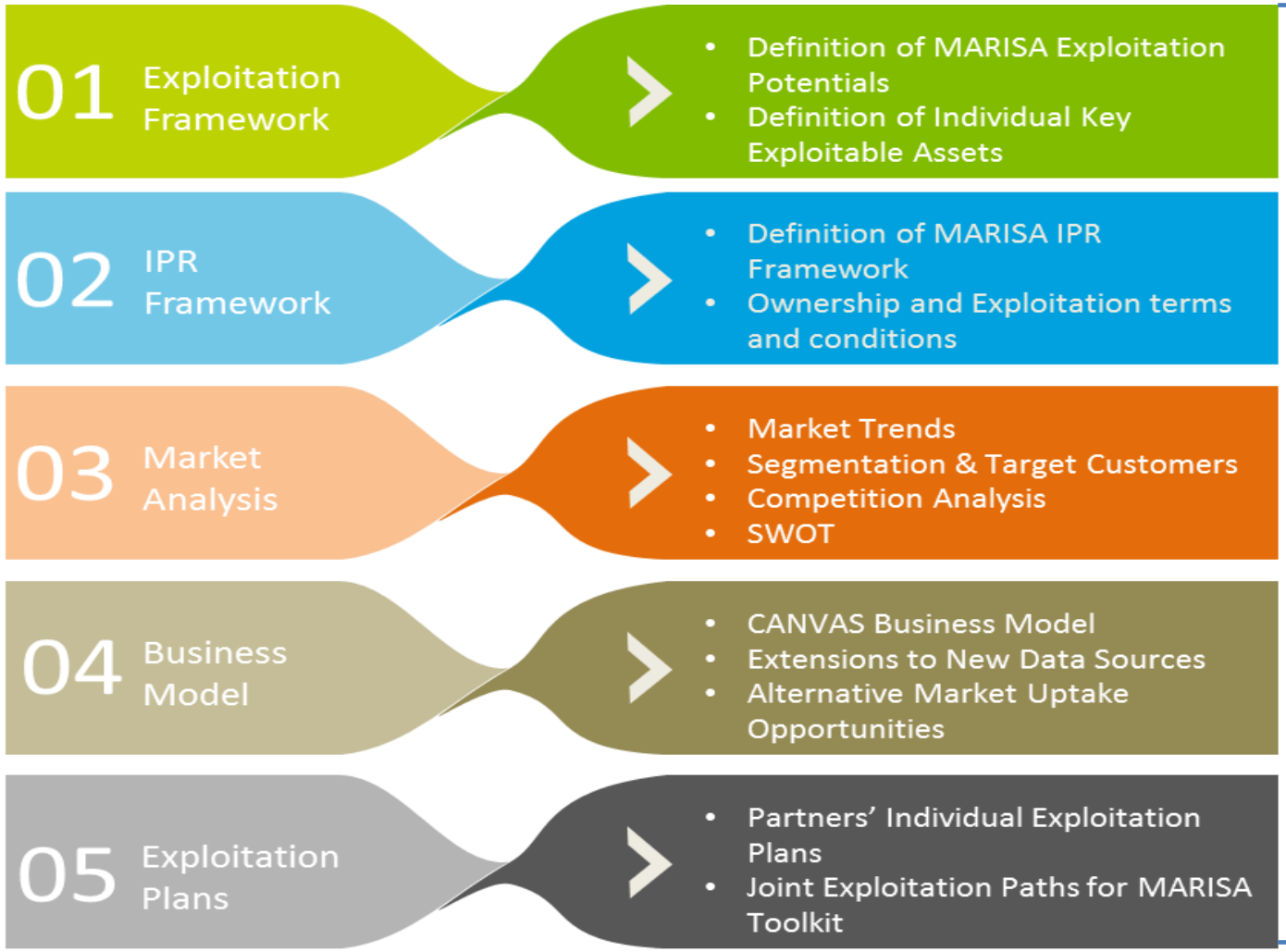
- technology and software
- user processes & training
- governance & business models

Ethics Compliance Check Template
for MARISA deliverables

Trial Information Sheet and Consent Form
for each Operational Trial



Exploitation Plan



A structured process has been conceived to define Individual and Joint Exploitation paths for the MARISA toolkit

THANK **YOU** FOR YOU ATTENTION

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Francesco Cazzato
MARISA Project Coordinator
francesco.cazzato@leonardocompany.com