Appendix A
to Tender Specifications

SSN Ecosystem - Guiding principles for system architecture

EMSA

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Executive summary

As highlighted in the Agency's ICT strategy document, EMSA is seeking to further develop interoperable maritime information services based on the integration of capabilities provided by existing maritime applications. For sustainability reasons, the integration should take into account the evolving maritime services landscape considering state of the art technologies as well as relevant EU initiatives (e.g. Single Windows, BlueBelt service, eMaritime, eNav, CISE initiative, Copernicus services).

This document outlines the EMSA strategy for the further integration and interoperability of the Agency applications related with vessel tracking, monitoring, situation awareness and pollution prevention/ response. The document describes a technical framework (a "system of systems") provisionally defined here-in as the "SSN Ecosystem". This ecosystem includes, in addition to the currently known as "SSN" (comprising the European index server and STIRES applications) and the IMDatE systems, the Earth Observation Data Centre (ex-CSN DC[1]) and LRIT CDC. The ecosystem is supported by a number of horizontal services these are also briefly outlined within the document.

The document is organised in three chapters:

A. Chapter 1 provides a broad outlook of the architectural aspects of the SSN ecosystem Following an explanation of the underlying assumptions and principles in section 1.2 are presented:
   i.   The proposed composition of the Ecosystem (refer to 1.2.1), its core operational data sets (refer to 1.2.2) and its reference databases (refer to 1.3). Here are also presented the mechanisms these data sets could be exposed to external parties.
   ii. The essential services, at EMSA level for supporting the Ecosystem's proper functioning (refer to 1.4).
B. Chapter 2 provides an insight on the essential functionalities.
   i.   Reference is made, in this respect, to the access control functionalities (those associated with the IdM (refer to 2.2.2) and those related to a still-to-be-developed common management console (refer 2.2.3).
   ii. Here is alsoincluded an overview functionalities of each subsystem.
C. Chapter 3 presents a service oriented view of the SSN ecosystem technical framework (IMS – Integrated maritime services framework).

As presented in more details in the chapter 1 of the document, and the Figure 2 and Figure 6, the key elements of the proposed approach can be summarised as follows:

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[1] Details on the integration between CSN and IMDatE are not included in this document, since this is a subject to a separate ongoing analysis.

1. The data inception, processing, storage and service distribution capabilities of the SSN ecosystem systems shall be further integrated to allow a seamless provision of integrated services/data to users of the "SSN ecosystem". The integration mainly relates with the consolidation of the current IMDatE and current STIRES (SSN GI) systems functions into a single subsystem (identified in this document as "STAR").

2. The SSN European Index Server (EIS), the LRIT CDC and the Earth Observation DC (EO DC)[2] shall be maintained as distinct subsystems within the SSN ecosystem, using a data driven approach. These components will be closely linked with the specific data they manage (voyage/ ship call information, LRIT information, Earth Observation data, etc.). Functionalities linked with each of the subsystems will not be replicated in other subsystems of the ecosystem but re-used taking into account interoperability principles.

3. Integration at horizontal level for the use of a single sign on mechanism and sharing reference data should be continued and completed.
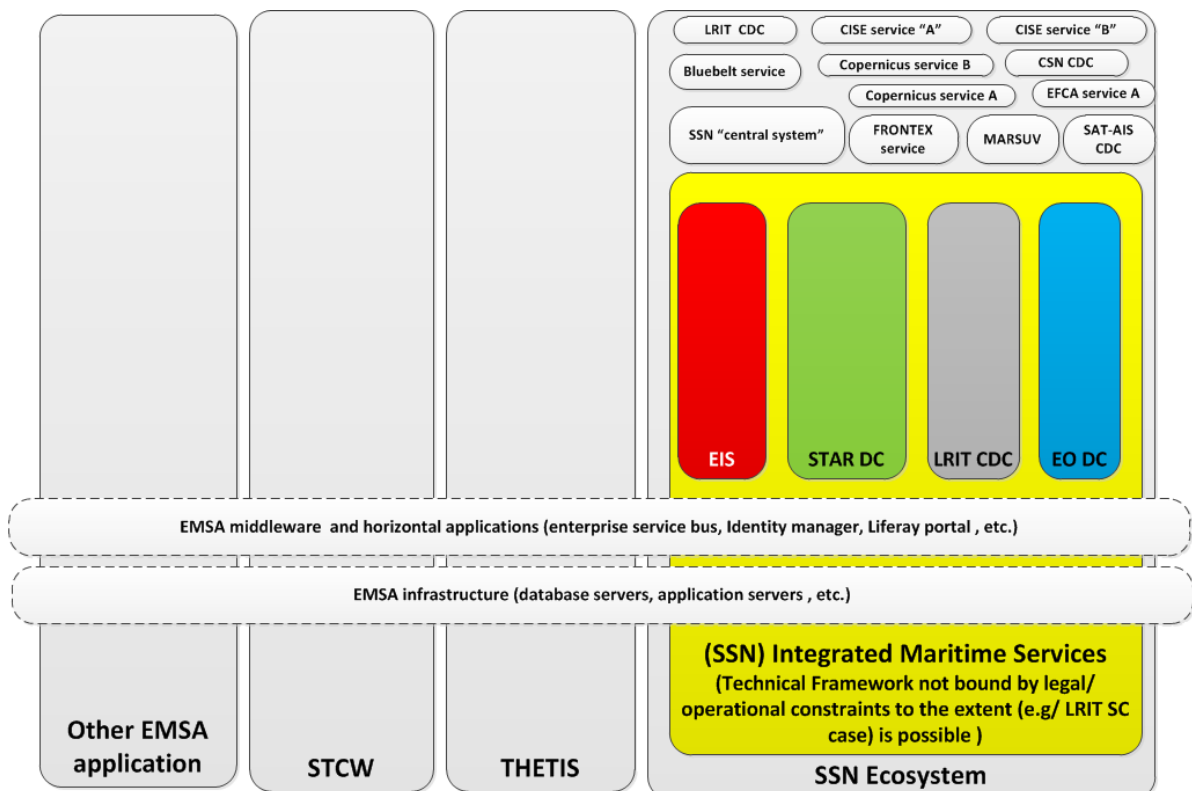
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[2] The EO DC is the evolution of the CSN DC where CSN is just one of the possible a services implemented on top the EO DC)

1   System architecture outlook

1.1   Underlying assumptions and principles

In order to be able to address current and foreseeable user needs, EMSA aims to a more holistic design approach in terms of system architecture. This can be achieved if data processing, distribution and storage capabilities of the applications are integrated into the "ecosystem" and consolidated in a technically convenient manner. The architecture should enable EMSA to:

1. "Decouple" the technical implementation and system capabilities (the "enablers" of service delivery) from the legal and operational constraints that bind the service delivery to end-users.

EIS: European Index Server (
STAR DC: Ship Tracking Awareness & Reporting Data Centre,
LRIT CDC: LRIT Community Data Centre,
EO SC: Earth Observation Data Centre

Figure 1 Decoupling technical capabilities from legal/ operational constraints of services - The concept

As illustrated in the picture the systems included in the ecosystem shall offer all the technical capabilities to meet service requirements stemming from European Directives or existing SLA's, in a user driven manner. The technical decisions on system implementation (i.e. how a specific database is structured) shall be decoupled from the operational level. Obviously the primary aim remains that legal obligations and requirements shall be upheld and enforced by the technical solution selected for the service implementation.

2. Allow human users to access the whole set of services made available to them via a unique system interface;

3. Facilitate the re-use of existing interfaces for the purposes of new or modified service schemes (leveraging the potential of existing interfaces in the delivery future services.

4. Consider, when designing new system interfaces, the potential use in the context of several delivery schemes (e.g. a general purpose web map/feature services (WMS/WFS) for delivery of position data that could be re-used for different user communities e.g. to FRONTEX, EUNAFOR, Copernicus, CISE user groups, etc.)

5. Provide a configurable graphical interface. In this interface shall be made available all the information the users need to build up a tailor made situational picture (that meets their operational requirements). In this sense, the integration of features in the graphical interface should follow a user oriented approach ("SSN central system" services, FRONTEX service, EFCA, etc.) enabling the users to visualize in the graphical interface, considering their data access rights, the information that addresses their specific operational requirements.

6. Establish a more coordinated approach to dissemination/delivery of data via system-to-system interfaces and avoid implementing a new interface when an existing one can serve the requirements of a service with minimum modifications. In the medium term this should lead to the implementation of a Service Catalogue that describes the data sets and interfaces available for delivery of data.

7. Re-use the functionalities of existing EMSA systems to the extent that:

   ▪ There is no duplication (or only limited if it is absolutely imposed by legal constraints[3]) with similar functions in other critical maritime applications in the ecosystem. Examples of functions that should be maintained are:

      o LRIT DC data centre with respect to the interface to IDE and ASPs,;

      o European Index Server (EIS) for the exchange of information between Member States national systems and with Thetis;

      o EO DC functions for EO image reception and processing. .

   ▪ For optimisation of storage resources and infrastructure usage, the duplication of exactly the same information in the operational databases of the ecosystem should be avoided, except if it is imposed by operational and/ or legal constraints (i.e. the case of LRIT DC position database)[4]

8. All the applications in the ecosystem shall share a common management console utilised for:

   ▪ Managing access rights

   ▪ Managing reference data

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[3] This is for example today the case of duplication of processing concerning the T- AIS notifications within STIRES and EIS applications of SSN. Until EMSA, in coordination with the MS, will decide to phase out the request / response mechanism for AIS notifications processing in index server it is necessary to maintain the relevant functions operational (without any actual added value to users). Another example is the maintenance in SSN of a "textual" interface where a number of functions made available via the SSN GI are duplicated. The Textual interface should be maintained because of IFCD requirements.

[4] Limited duplication of LRIT DC information is unavoidable due to the fact that the LRIT positions should be maintained in the LRIT CDC for IMO auditing purposes but also replicated within the application responsible for the data delivery

9. Access control in the various applications shall be harmonised and centralized to allow the provision of integrated data and services to the users in a seamless manner.

10. Ensure that users can access the system via internet or the S-Testa network.

11. Enable the traceability and accountability of information, by allowing the verification of the history, location or application of the information received from the MS by means of a documented recorded identification.

12. Ensure non-repudiation and traceability of actions performed by users accessing the ecosystem.

13. Certify that the information is authentic and complete. The information transmitted via the ecosystem shall only be modified by the data provider itself or by the SSN ecosystem in accordance with the rules/procedures agreed with the data providers.

14. From a "project management perspective" there should be a clearer emphasis on documenting appropriately the system, modules, and components.

In order to clearly distinguish the technical capabilities of the "SSN ecosystem" from those of the underlying EMSA infrastructure and middleware, the suggested approach requires a distinction of:

1. System Integration activities at SSN ecosystem level
   a. Operational data processing & exchange (see Figure 3);
   b. Reference data, data processing & exchange (see Figure 5);
   c. Common management console (refer to 2.2.3).
2. System Integration activities at horizontal services level
   a. Human users Identity management (refer to2.2.2);
   b. Semantics-based Interoperability[5] (Enterprise service bus) (refer to **Error! Reference ource not found.**);
   c. Maritime Application Portal.

1.2 Proposed approach – SSN Ecosystem

1.2.1 SSN ecosystem – composition

The technical framework of the SSN ecosystem (identified in figure 1 as IMS – Integrated maritime services framework) shall be composed of four "component" sub-systems: Three already existing and evolving - SSN European Index server, LRIT CDC, EO DC and a new one, the "SSN Integrated Ship Tracking, Awareness and Reporting Services" subsystem (identified in the drawing below as STAR). The STAR will merge the functions and capabilities of the systems nowadays understood as STIRES and IMDatE. The component sub-systems will be responsible for delivering the following capabilities:

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[5] Ability to automatically interpret the information exchanged meaningfully and accurately in order to produce useful results as defined/ required by the end users of systems participating in an interoperability framework.

1. The SSN European Index Server (EIS) (planned to be upgraded to V3 during 2014/ early 2015) is the component system interacting with the MS for the exchange of information with MS through a message based mechanism or web-browser based mechanism .The EIS will also be the provider of reference data for ship particulars (Central vessel database), location information (LOCODE registry) and Organisations (Authorities, External providers) to all sub-systems of the ecosystem as well as to external organizations. Lastly, it will be the subsystem where the reference operational database for **voyage information**[6] (Dangerous cargos, waste security data, exemptions) shall be maintained and updated[7].

2. The LRIT CDC shall continue acting as the interface with IDE and ASPs and hold the central operational (that can be audited) database of LRIT positions. The LRIT CDC will be also the subsystem where the central database for countries (Countries registry – initiated in 2013) is implemented.

3. The Earth Observation Data Centre (ex-CSN DC) shall be maintained for planning, ordering, journaling and financial control of EO data and derived products. The ingestion backbone for Earth Observation data should also be maintained including acquiring, cataloguing and processing satellite and in situ data.

4. The current STIRES capabilities shall be merged with those of the IMDatE within STAR subsystem. STIRES, in this sense, shall be "phased-out" with the understanding that most of the functionalities supported today in STIRES (e.g. those related to the streaming interface, processing / enrichment of incoming position data, etc.) shall be maintained and re-used in STAR. Furthermore, the present SSN GI business logic shall be considered as a guideline for future developments of STAR graphical user interfaces.

5. The central database for T-AIS, SAT-AIS, VMS, VDS, radar positions, etc. shall be established in STAR as well as the central database for geographical objects. Furthermore STAR shall be in control of the graphical web front-end for all types of users accessing STAR resources.

6. A centralized access policy enforcement solution should be implemented, removing hard coded access control from the individual applications, improving consistency and auditability.

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[6] This data base already exists and shall be updated for compliance with the reporting formalities directive

[7] Regarding the SafeSeaNet central system call information, Hazmat information, Incident information, MRS information, waste and security information, exemptions shall be maintained and updated.
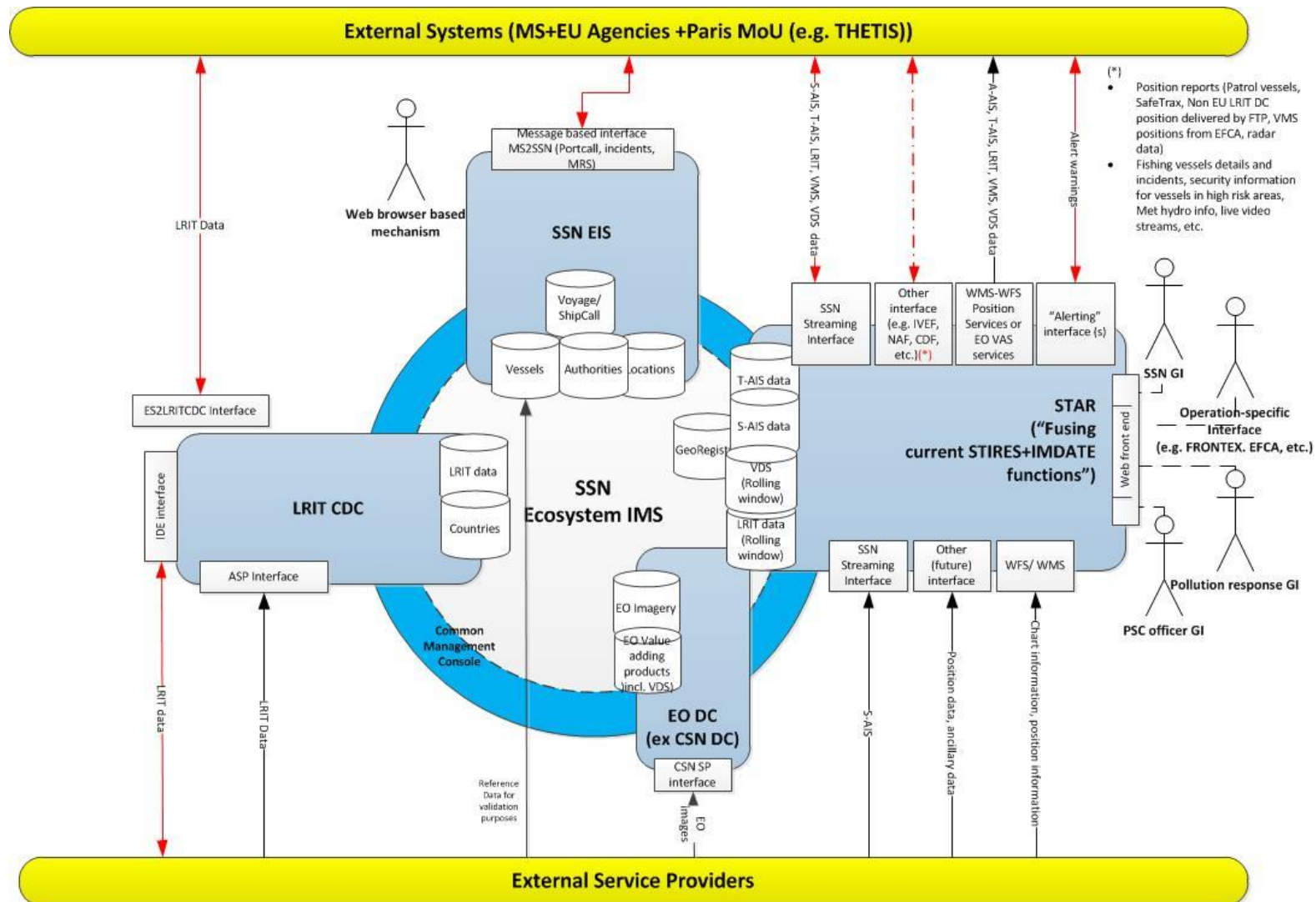
Figure 2 SSN Ecosystem – technical architecture – 2015 and beyond

1.2.2   SSN ecosystem – Operational data sets

Towards fully comprehending the reasons for maintaining for maintaining four distinct subsystems it is useful to provide an insight on the nature of the operational data[8] that the different SSN ecosystem subsystems should store, process and exchange.

As it is illustrated in the Figure 3, the data exchanged and subsequently stored, processed or "relayed[9]" by the ecosystem's components are falling into four major categories:

1. Ship voyage/ passage/ Ship call related information (pre-arrival notifications, arrival / departure notifications, Security, Waste and Hazmat notifications , and potentially in the future cargo notifications,);
2. Ship position information originated from various sensors (terrestrial/ satellite AIS, LRIT, VMS, etc.);
3. Events/ reports (incidents, accidents) related to safety of navigation, safety of people, marine environment;
4. Earth observation data (geo-referenced images and value adding products derived from earth observation data).

These data are collected from data providers or are disseminated to users with a variety of formats. Due to their "operational" definition, the data sets can contain more than one of the data categories mentioned above. For instance:

1. A maritime reporting system report (MRS) report received currently by SSN contains ship voyage and passage information but also ship position information.
2. An EO data set delivered to EMSA by a CSN service provider contains, apart from the oil spill image, vessel detection data that is position information extracted from EO images.
3. An incident report received from a MS would contain, apart from the incident details, also ship position information
4. A BlueBelt report that has to be delivered to Customs would contain, apart from ship call information (e.g. last ten port calls of the ship), the image of the ship track during her voyage which is derived from position data as well as "detected" ship entry information.

Towards ensuring high performance and flexibility in the service delivery the following aspects need to be considered:

a. The design of the ecosystem applications should allow the "as fast as possible" and "reliably as possible" processing of incoming data. This imposes a clear distinction of processes and business logic concerning the four categories of data mentioned above.

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[8] "Operational" data are those that are dynamically changing over time.

[9] Reference is made to data actually stored at MS level and "indexed" in the database for easy retrieval

b. The design of databases and data exchange mechanisms should facilitate the "merging" of information stored in the various data sets "on the fly", with as less as possible overhead.

c. The design of the ecosystem data exchange mechanisms and business logic should facilitate the adaptation of the available interfaces to the requirements of the services requested and the nature of data flows ("non real-time" or "real-time", "event triggered" or "continuous" inflow and/ or outflows). This requires a segregation of functions and capabilities embedded in data exchange interfaces and subsystems.

In this respect, it is anticipatedthe implementation of "four" categories/ families of message exchange mechanisms.

- A mechanism focused in exchange of voyage related data.
    o A good starting point in this respect is the work associated with PortPlus/ Ship-Call request response of SSN. This work should be completed with the establishment of a "voyage notification" mechanism enabling the "push" of voyage information to service subscribers on the basis of a set of criteria. The mechanism should cover the evolving needs of MS related to the reporting formalities but also BlueBelt future requirements.
- A mechanism focused in the exchange of incident reports.
    o The work associated with Incident_Detail messages in SSN is very relevant, in this respect. Future work should build further on what is currently available.
- A mechanism focused in the exchange of ship position reports.
    o In this respect the work associated with the SSN Streaming interface, the EMSA canonical data format (CDF) and the FRONTEX WFS is very relevant. The mechanism should continue evolving taking into consideration the international standards in the domain (e.g. IVEF).
- A mechanism focused in the exchange of EO data and value adding products.
    o In this respect the work related to the EO DC WFS / WMS is very relevant.
- A mechanism to provide the information as sent by the data provider to ensure the segregation between the enhanced functionalities (e.g. correlation, fusion etc.) and the raw data included in the original messages received from data providers.
- The design of all the subsystems should envisage the utilisation of an "enterprise service bus". This is particularly important for delivering services to user Communities using external systems with pre-defined interfaces other than those provided by EMSA systems. In such cases and on the assumption that there is at minimum an agreement at "semantics" level, the ESB could be utilised for transforming the data into the format that the external system can accept.
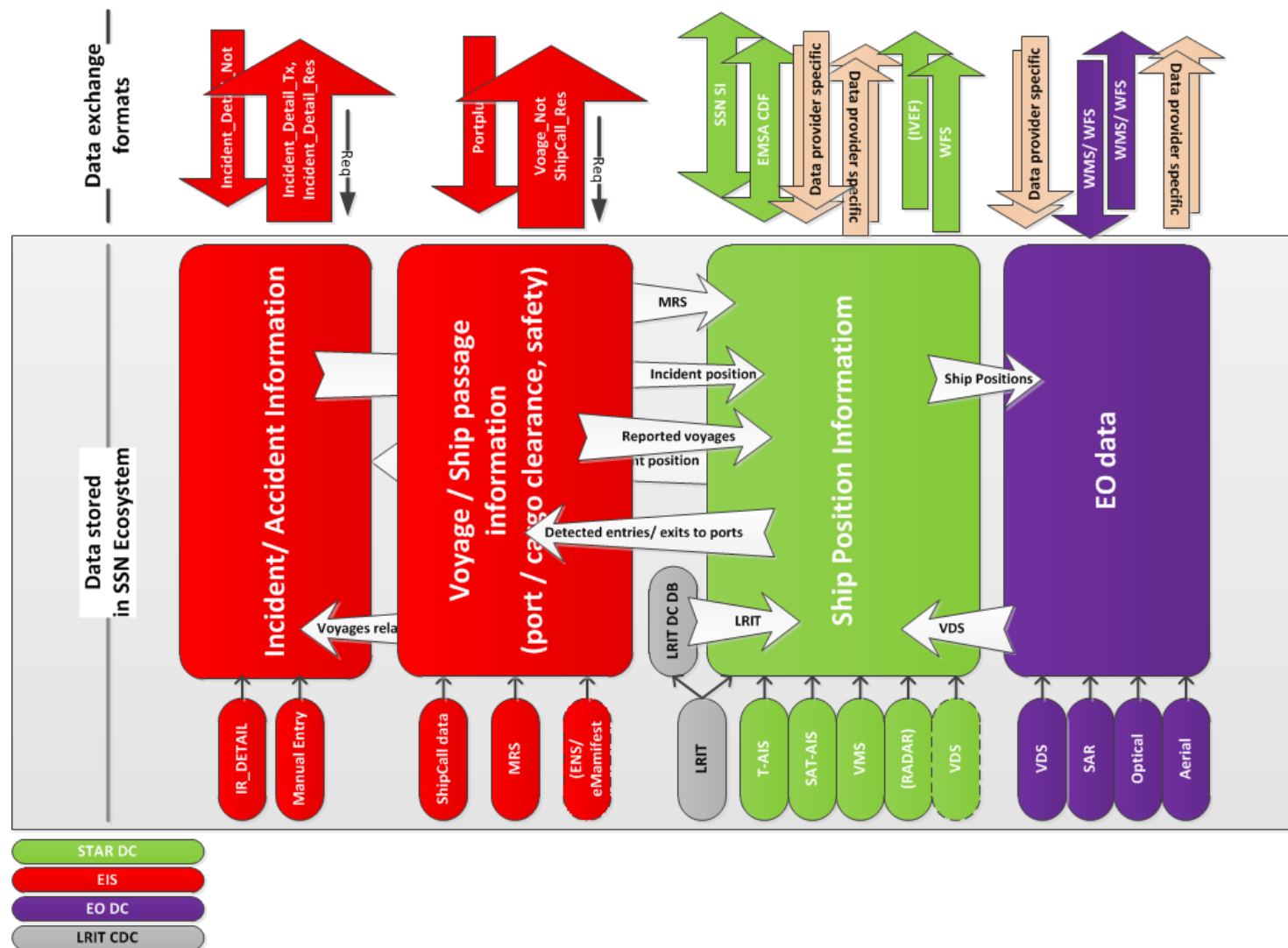
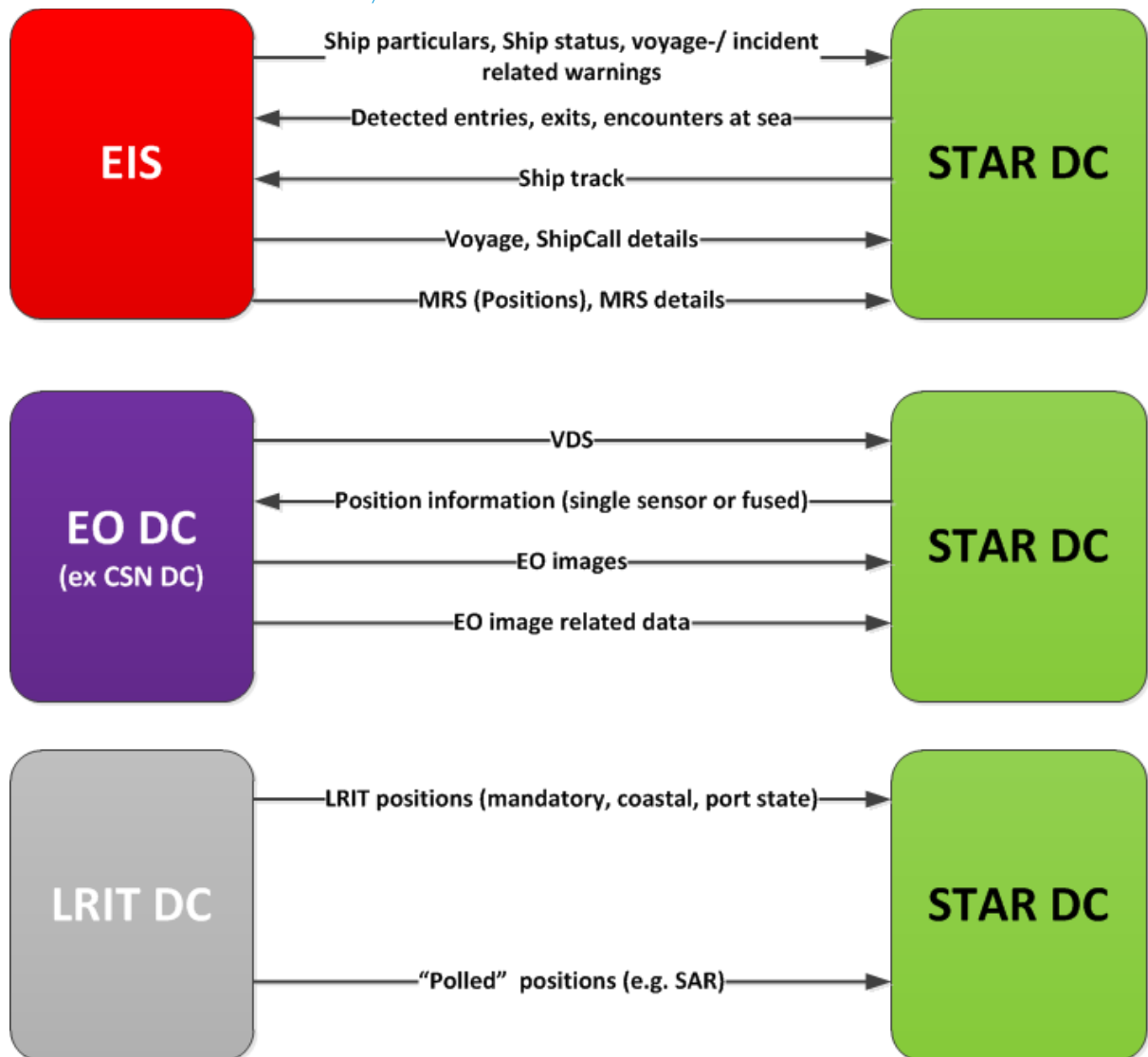**Figure 3 SSN ecosystem - Data stored/ processed and their exchange mechanisms**

Figure 4 Interfaces among Ecosystem applications

1.3 Reference databases

1.3.1 Overview

The figure below presents the databases of the SSN ecosystem that hold the reference datasets.
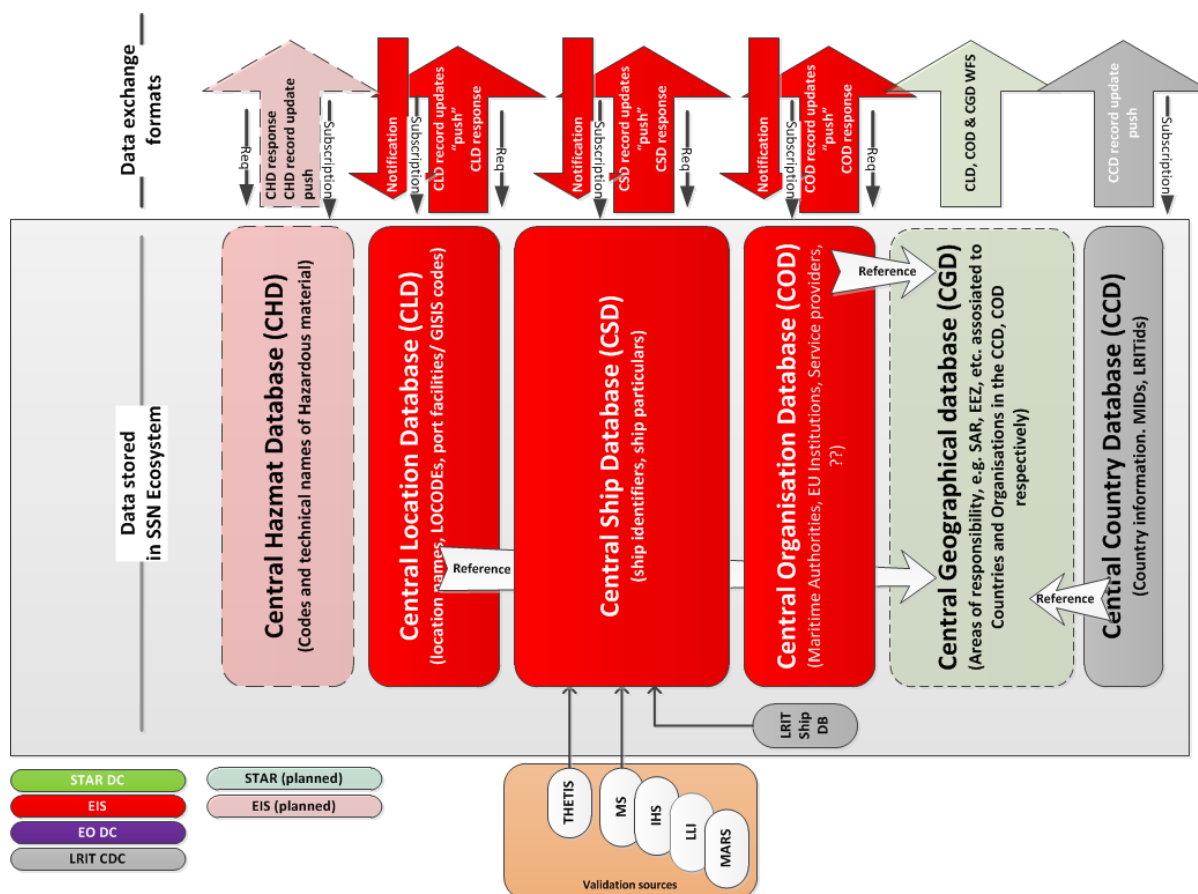

Figure 5 SSN Ecosystem - Reference databases

At the moment of writing this report the reference databases can be divided in:

Existing:

- Central Ship Database (CSD)[10]: The main objective of this database was to facilitate the identification of ships reporting their positions via the AIS transponders installed on board.
- Central Country Database (CCD)[11]: this database used by EMSA to identify in a unique way "countries, dependencies, and other areas of particular geopolitical interest". In addition to the countries and territories as defined by ISO, the CCD includes also the so called Virtual Countries, Regional Agreements and International Organisations.

Under implementation:

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[10] Currently designated as Reference Vessel database and only used by SSN.

[11] Currently ready but not in production.

- **Central Location Database (CLD):** this database shall be the central repository of information related to geographical locations utilised by EMSA applications. It will include a central reference list of LOCODEs used by the Agency to identify ports and other locations that are relevant to all Maritime Applications.
- **Central Organisations Database (COD):** This database shall be the central repository of information related to the administrative entities that have relationships with EMSA. These include: international and national organizations, bodies, associations, ministries, offices, ports, public and private companies etc. The COD has the primary goal to identify in a unique way one of these entities and to share its attributes with all EMSA applications.

Planned or scheduled:

- **Central Geographical Database (CGD):** This database shall be the central repository of areas at EMSA. Geographical areas are being used by several Maritime Applications as a tool to enforce data entitlement rules, set up watch-dogs, trigger alerts, program satellite image acquisition, compute statistics etc. The Base Registry provides a reference database whenever a user needs to use (or re-use) an existing polygon or to create/update polygons.
- **Central Hazmat Database (CHD):** the aim of this database is to improve the data quality of HAZMAT notifications, to minimise the administrative burden for the reporting party and to support the Member States emergency response services to provide effective response to maritime incidents. The CHD will serve as a reference to manufacturers, shippers, reporting parties and member state authorities and as a verification tool for competent authorities and EMSA services to cross-check and validate the correctness of the HAZMAT data.

1.4 Horizontal Services - Future Architecture

The integration effort at the horizontal services level should include all the maritime applications hosted at EMSA, critical and not critical. This is necessary since all applications share middleware resources and this can, in addition to functional integration issues, imply performance variability and reduced agility as regards to change.

It is nonetheless important that a number of basic horizontal services should continue to evolve / be upgraded and implemented. In this respect the most notable service components are:

a. The identity management system of the Agency (based on IdM – OIM/OAM) and a unique database of human users of EMSA maritime applications and services

b. A unique database of Organisations encompassing Authorities/ International and EU Bodies and service providers[12]

c. A unique database of systems (internal / external) exchanging data with EMSA maritime applications. This will be more important for larger initiatives such as for Copernicus and CISE.

d. A Maritime Application Portal application[13] acting as a single entry point to all maritime applications

The following diagram sketches the "would be" architecture for integration at horizontal services level.

As indicated in the Figure 6:

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[12] The procurement for this database was initiated in 2013, and the implementation currently on-going.

[13] Design specifications is available, the procurement for the implementation was launched few days ago
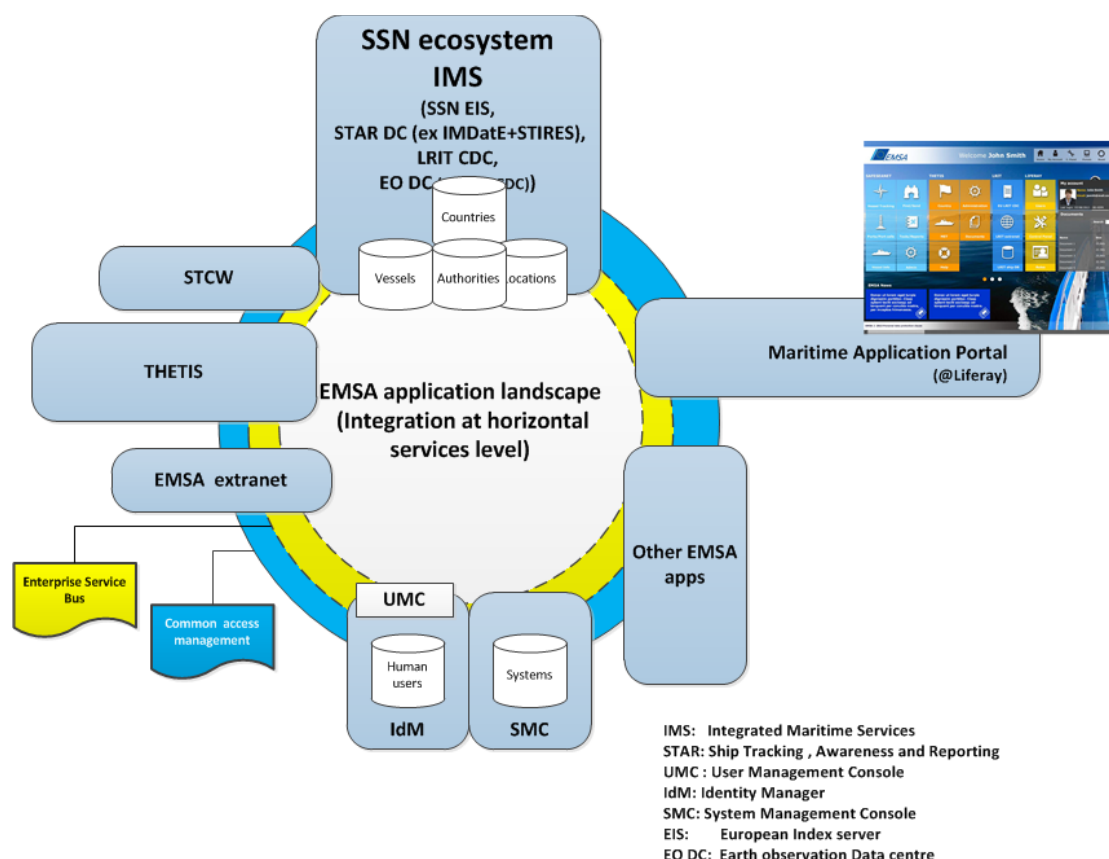
Figure 6 EMSA applications integration (Horizontal services)

1. The Oracle's IdM shall be maintained as the single sign-on platform for EMSA applications. Within IdM a reference database of human users shall be maintained. To facilitate implementation of user friendly workflows for user creation IdM should be upgraded (sooner than later) to interact with the reference databases for Organisations, Locations and Countries. Furthermore the User management console application shall be further improved resuming the role of IdM's front-end.
2. A System Management console should be implemented as a management utility for the reference table for system interfaces. This will be linked to the Authorities reference database and hold all the essential information about the systems interacting with EMSA applications (e.g. will hold information such as web services end-points, purpose of the interface, wsdl and xsd files and links to the documentation of each interface) [14].
3. All the EMSA applications (included the UMC) shall be accessed via the web portal that is to be implemented by the Maritime application portal (MAP) project (activity currently on-going).

2 Functionalities outlook

2.1 Introduction

This chapter provides further insight on:

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[14] This table may evolve at a later stage (after 2015 and after the CISE requirements re further clarified) to a UDDI (that is a platform-independent, XML-based registry, to be used by Authorities wishing to link to EMSA systems in a CISE-based scenario to discover and extract the specifications of system interfaces offered by EMSA applications.. The implementation of a UDDI should be consider as an action for integration after the 2015. There is no urgent requirement calling for its creation at this stage.

1. The access control functionalities (those established at horizontal services level at EMSA and those to be established as part of a Common Management Console of the Ecosystem)
2. The potential solutions for establishing the access control configuration module of the common management console.
3. The core functionalities of each subsystem in the SSN ecosystem;

2.2 Access control

2.2.1 Overview

Access to the EMSA Maritime Applications must be controlled in order to avoid unauthorized use of EMSA services. All EMSA Applications require some level of access right enforcement that allows legitimate users to retrieve Maritime information while blocking other to access confidential and sensitive data.

2.2.2 (Human) User authentication

The Oracle Identity Management (IdM) system controls access to the EMSA Maritime Applications. The IdM provides a mechanism to allow or block access to the Application textual sites based on a Single Sign On (SSO) procedure.

A user wanting to access a Maritime Application needs first to perform a login to be authenticated (username and password). If the login is successful, the IdM checks the user roles and verifies if the user has been given the permission to open a specific application. Based on the user role, the IdM grants or denies access to the corresponding textual site.

Thanks to the SSO feature, after a successful login the user can enter several Maritime Applications without the need of typing every time the username and password. At the same time, the Maritime Applications have access to the same user profile.

2.2.2.1 IDENTITY MANAGEMENT (IDM SYSTEM)

The IdM system provides the centralized management of Maritime Applications users and authenticates them by means of a password protected login. The IdM also provides basic authorization by granting or denying access to specific Maritime Applications.

The IdM shall be maintained as the SSO platform for EMSA Maritime Applications. To facilitate implementation of user friendly workflows for user creation and update, the IdM should be upgraded to increase the usability of the user creation workflow as well as to interact with the reference databases for Organisations, Locations and Countries.

2.2.2.2 USER MANAGEMENT CONSOLE

To address some of the limitations of the currently implemented IdM version , the User Management Console (UMC) was implemented in 2013. The UMC is a tool that provides a direct and complete visualization of the user information stored in the IdM. It is possible to show the full list of users, regardless of the Maritime Application they have access to. The UMC displays all user details and it provides a direct link to the IdM user management forms.

The current version of the UMC is mainly used by the MSS Operators and EMSA Administrators. The future development of the UMC should take into consideration all the limitations of the current IdM system as well as the development of a Common Management Console for the SSN ecosystem applications (refer below).

The Common Management Console (CMC) shall be the access point for enforcing access control policies for all the users accessing the SSN ecosystem applications as well as for the management of all EMSA reference databases.

The CMC will be implemented as a composite service including the following service components:

1. Access rights policies configuration for SSN ecosystem users
2. User Management Console
3. Management utilities of the CSD
4. Management utilities of the COD
5. Management utilities of the CLD
6. Management utilities of the CCD
7. Management utilities of the CGD

The CMC services shall be accessible via the Maritime Application portal implemented as a single entry point for all EMSA maritime application in Liferay[15] .

The following sections provide a preliminary analysis concerning the access rights management for SSN ecosystem users.

2.2.3.1   ACCESS RIGHTS MANAGEMENT – A FUNCTIONAL OVERVIEW

Figure 7 indicates an example of access rights management model (based on the current SSN system). The definition and agreement of a common entitlement model is currently on-going.
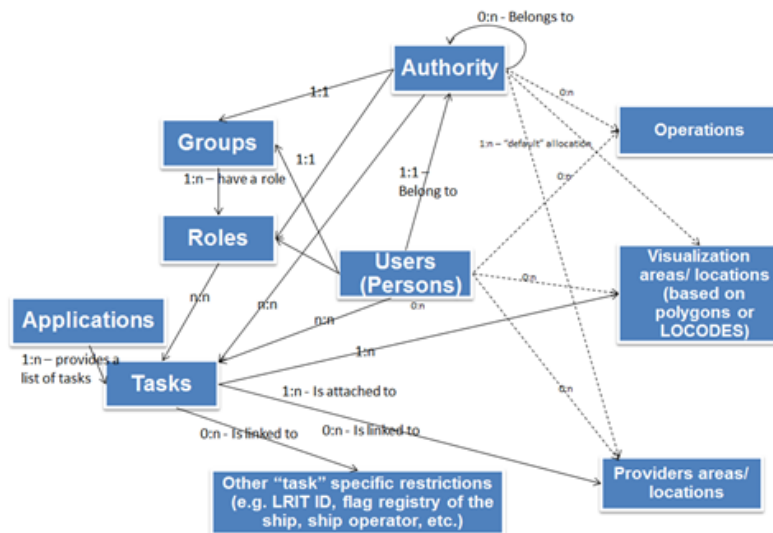
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[15] https://portal.emsa.europa.eu/group/cmc/user-management-console

Figure 7: Example of SSN access rights model

The following shall be noted for the presented model:

1. It allows defining two types of users:
   - Authorities (organisations accessing SSN ecosystem services usually via a system-to-system interface
   - Persons (usually accessing system via the web textual or graphical interface)
2. In an effort to model the organisational models applied by Maritime Authorities, the SSN Authorities are organised hierarchically. An Authority belongs to a Supervisor Authority (while a person must be attached to a unique Authority. The enforcement of these policies will use data stored in COD level for the Authorities.
3. It should not be possible in SSN ecosystem to create a human user without allocating it to an "Authority" user.
4. Both types of users in SSN ecosystem (authorities and persons) might access SSN ecosystem via more than one interface. An NCA, for example, may access SSN ecosystem via the XML/SOAP interface (to notify and request information related to ship calls, incidents etc.) and via the SSN SI (to stream AIS raw data to STAR and potentially, if so configured, to receive AIS information "enriched" with other useful data maintained in SSN ecosystem).
5. An Authority can also be assigned a password to access the system via the web interface. The latter is particularly useful, for back-up purposes, to ensure that Authorities submitting notifications via a system2system interface could update them via the web in case of failure of the system2 system interface.
6. Persons can access SSN ecosystem via any of the textual/graphical interface that shall be made available to them. The behaviour should be the same. If, for example, a user can request and receive Hazmat details via the textual interface of the EIS, he (she) should request/ receive the same information by accessing the system via the STAR web interface.
7. It shall not be mandatory to assign a system to system interface to an authority.

8. Based on the configuration made in the CMC, the users shall access resources provided by all the distinct applications within SSN ecosystem. Access to the resources is controlled by "tasks" that could be allocated to users by a system administrator.

9. The "task" is a fundamental concept for service composition representing elementary resources that could be subsequently grouped by Administrators and assigned to users.

10. Tasks are defined as a set of specific actions that a user perform in an application and essentially represent elementary "services" that could be allocated to a user.

11. The allocation of tasks to a user shall stem from well-defined operational or legal obligations. A new task should be added/ created in the CMC every time new functionality is added in a subsystem.

12. The provisioning of tasks to users is made via the CMC.

13. Tasks can be further restricted by applying a combination of constraints:
    ▪ the position and/ or flag of the vessel that relates to a notification a user creates or visualise/ receives
    ▪ the operational location of the user providing the data
    ▪ the user accessing the data
    ▪ Other criteria to be defined such as an operation a user is assigned to.

14. The geographical restrictions are applied by assigning one or more "visualisation" and "data provision" areas to users. "Areas" could be defined in an "abstract" way (e.g. an "Norwegian SAT-AIS" data area) related to a specific data set, and/ or by polygons covering sea regions and/ or a set of specific locations (identified by their LOCODEs) belonging to one or more countries..

15. The tasks can be grouped into roles. One may note that although tasks are specific application dependent, the roles can be defined independently from applications.

16. Roles are grouped under groups. The group shall be understood as a general profile reflecting the kind of activities a user is able to execute based on the agreements made by the MS. For instance the MS_POR group in EIS is aiming to group all the roles that relate to system activities possible for maritime port Authorities and the MS_PSC for port state control Authorities etc.

2.2.3.2   SYSTEM TO SYSTEM INTERFACES MANAGEMENT (SYSTEM MANAGEMENT CONSOLE)

As presented in the section 1.4, a System Management Console (SMC) should be implemented to manage the information related to system interfaces made available by EMSA to other EMSA applications and external systems.

The principal idea is to collect and manage the information concerning available system interfaces and the way these interfaces are currently set-up in a single database. In the database will be stored information like:

▪ Interface specifications (e.g. xsd/ wsdl files)
▪ Reference of the Authorities using a specific interface and information on the way the interface to a specific system is set-up

It should be also considered, as a medium or longer term action, exposing the information concerning system interfaces using a standard XML mechanism. In this respect UUDI specifications[16] could be utilised as a basis. UDDI is a platform-independent, XML-based registry, and could be utilised in a CISE-context of interoperability with external entities. The implementation of a UDDI should be considered as an action for integration after the 2015. There is no urgent requirement calling for its creation at this stage, based on the information currently made available to the authors.

The complete analysis related to the SMC has been considered by the authors as out of scope of the present document, however, should Management will consider it useful, relevant details could be included in a subsequent release of this report.

2.3 LRIT CDC

2.3.1   Functionalities & interfaces

The LRIT Data Centres (DC) collect, store and provide LRIT information (ship position reports) to users worldwide through an Internet based network.

The EU LRIT CDC (European Union LRIT Cooperative Data Centre) provides the tracking service for the ships flying a flag of the EU Member States and is hosted by EMSA.

Mandatory LRIT position reports

The main function of the EU LRIT CDC is the regular worldwide tracking of EU ships with a periodic rate of one **position report every 6 hours**. The EU LRIT CDC provides a continuous data stream of positions reports that can be received and processed by authorized users.

The periodic transmission rate can be increased for a specific ship up to a position every 15 minutes.

Poll

The EU LRIT CDC allows the user to request the c**urrent position of a ship**. The "Poll" request is sent to the LRIT shipborne equipment and the position report is delivered to the user within few minutes (in average less than 5 minutes).

SAR SURPIC

Search & Rescue services use the LRIT SAR SURPIC function to receive the position of ships that were located within an area in the last 24 hours. The function is free of charge.

The function is very useful in remote areas where there is no T-AIS coverage and LRIT is currently the only source of information.

The LRIT SAR SURPIC is currently being enhanced on the IMDatE platform by adding to the LRIT data also the Satellite-AIS position.

Interfaces

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[16] https://www.oasis-open.org/committees/uddi-spec/doc/tcspecs.htm

The EU LRIT CDC provides two interfaces to the users:

    a. **Web Interface**: a web based GIS application where users can visualize LRIT positions, submit LRIT requests and monitor the LRIT reporting status of their ships.

    b. **XML Interface**: a Web Service interface for a secure System-to-System data exchange. All LRIT functions described above are accessible via the XML Interface. External Systems are authenticated using SSL Certificates.

2.3.2 LRIT CDC service categories

The service provided by the EU LRIT CDC can be divided in four main categories:

1. Management of LRIT ship reporting
2. Archive and distribution of LRIT ship positions
3. Request of LRIT position
4. Visualization of LRIT ship positions

Management of LRIT ship reporting

The management functions of the mandatory LRIT ship reporting are a very important tool for EMSA and the Member States Flag Administrations. They allow the monitoring of the LRIT ship integration process, the troubleshooting in case of malfunction of the LRIT on-board equipment, and statistical analysis of the ship reporting status.

Archive and distribution of LRIT ship positions

The EU LRIT CDC receives the LRIT position reports of the EU fleet from an external provider (EU LRIT ASP). The information is archived and made available to the Member States and to other international Data Centres connected to the worldwide LRIT network.

The EU LRIT CDC also distributes the LRIT position reports to Member States using a system-to-system interface.

The EU LRIT CDC database is also the source of information for the LRIT Consumption Tool that was recently deployed.

Request of LRIT Positions

The EU LRIT CDC allows to request LRIT ship positions through the Web Interface and the system-to-system interface.

The request types are:

- SAR SURPIC
- Poll
- Periodic
- Most Recent Position Report
- Archive Request

Visualization of LRIT Positions

The EU LRIT CDC displays the LRIT ship position in a dedicated web interface.

2.3.3 LRIT CDC way ahead (2015)

The main highlights for the further usage of LRIT CDC in the context of the SSN ecosystem could be summarised as follows:

1. <u>Management of LRIT ship reporting:</u> These functions are very specific to the LRIT application and should remain a service provided by the EU LRIT CDC through the existing web interface.
2. <u>Archive and distribution of LRIT ship positions:</u> Similarly to the previous point the functions and transmission protocols are very specific to the LRIT application. The archive and system-to-system distribution of LRIT position reports should remain a service provided by the EU LRIT CDC.
3. <u>Request of LRIT position:</u> The EU LRIT CDC request capability should be provided as is also in the future, at least during a transition period of one or two years. This is important especially for the SAR requests which are critical in terms of service availability and reliability. After the transition period the EU LRIT CDC Web Interface could be replaced by IMDatE with regard to the request and position visualization functions. The SAR SURPIC request is currently being enhanced by implementing the E-SURPIC tool on IMDatE. The E-SURPIC extends the LRIT SAR SURPIC with Sat-AIS, T-AIS, and VMS data. The other requests should also be gradually implemented on IMDatE starting with the Poll function.
4. <u>Visualization of LRIT ship positions:</u> The LRIT ship positions should be displayed on IMDatE. The same access rights enforcement should be implemented as in the EU LRIT CDC.

As mentioned above, after the transition period the EU LRIT CDC Web Interface could be replaced by STAR with regard to the request and position visualization functions.

2.4 Earth observation dC (ex-CSN DC)

2.4.1 functionalities & interfaces

The CSN service is based on a set of capabilities provided by the Earth Observation Data Centre (formerly known as the CSN DC). The EO DC offers three main sets of capabilities:

5. EO data processing and cataloguing: The EO DC can gather, acquire, process and inventory standard Earth Observation data, for SAR and optical satellites, as well as and in-situ data (wind, wave, etc.). Currently the main data stream are based on satellite images and provided by a network of Service Providers (presently CLS, EDISOFT, E-GEOS, KSAT and EUSI).
6. Earth Observation derived information dissemination (geospatial services): oil spill, vessel detected, wind, wave information is disseminated to web clients (e.g. CSN, IMDatE) or System to System (e.g. Frontex) through geospatial standard services: Web Map Service (WMS) – satellite images; Web Feature Service (WFS) – oil spill and vessel detected; Web Coverage Service (WCS) – satellite images; and Catalogue Service (CSW) – inventoried EOP products.
7. CSN specific tools: CSN's users access the EO information provided by geospatial services through the web CSN-Client and tools, which includes :
   a. Portal components: oil spill monitoring and analysing (GIS-Viewer), financial monitoring (FINSYS), journaling of the data acquisition (JOU), Planning and Ordering (POR), and community based tool (COM),
   b. The Oil Spill Alert Report via e-mail.

Whereas the CSN specific tools are tailored to serve the CSN community, the "geospatial services" can be further extended and integrated within STAR in order to be used by other services (external or internal).

2.4.2 *EO DC way ahead (2015)*

The main highlights in terms of way forward are:

1) The CleanSeaNet WUP will be phased out and implemented in STAR
2) The CSN specific tools (journaling, planning and financial system) will stay in the Earth Observation System)
3) The ingestion, processing and cataloguing of EO data and value adding products will stay in the Earth Observation system
4) The Geospatial services will initial stay in the EO DC but can be eventually moved in the future to STAR.
5) A pollution repository (including not only CSN detections, but also feedback information, uploaded data from mobile devices and other sources) will be moved from the Earth Observation system to STAR.

2.5 SSN European Index Server (EIS)

2.5.1 Functionalities & interfaces

SSN EIS currently one of the applications comprising what is defined in the SSN Interface Control Document (IFCD) as the SSN central system. It supports the exchange of the following "mandatory" information:

1. **Port call information:** Pre-arrival information sent to ports 24 hours in advance and information on ship arrivals and departures (as per Article 4 of Directive 2002/59/EC as amended and Articles 9 and 24 of Directive 2009/16/EC). In addition, 72 hours pre-arrival information if no other national arrangement is in place.
2. **Hazmat information:** Information on the carriage of dangerous and marine polluting goods (as per Articles 4, 13 and 14 of Directive 2002/59/EC as amended).
3. **Incident information:** Information on accidents and incidents which have occurred at sea (as per Articles 16, 17 and 25 of Directive 2002/59/EC as amended) and information on ships which have not delivered their ship-generated waste and cargo residues (as per Articles 11.2.d and 12.3 of Directive 2000/59/EC).
4. **Position information:** AIS[17], MRS information (as per Articles 5, 6.b, 9 and 23 of Directive 2002/59/EC as amended).
5. **Security information**: Prior to ship's entry into a port of a Member State, security information should be sent in accordance with Article 6 of Regulation (EC) 725/2004 taking into account the provisions on exemptions according to Article 7 and the Annex to Directive 2010/65/EC.][18]
6. **Waste and cargo residues information**: Prior to ship's entry into a port of a Member State, ship-generated waste and cargo residues information should be

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[17]AIS positions are provided in EIS every 2 hours in XML format . Based on the currently applicable IFCD the message-based mechanism of EIS as well as the streaming mechanism are alternative ways of providing Ship AIS positions.

[18] To be implemented by 1st June 2015

sent in accordance with Article 6 of Directive 2000/59/EC taking into account the provisions on exemptions according to Article 9][19]

The information collected and exchanged through SSN must comply with the quality and performance standards defined in this IFCD. The administration of user management and locations' codes (LOCODES) are also mandatory system functionalities.

SSN EIS provides a number of additional functionalities which are not mandatory and should they become unavailable, it would not affect the operation of the SSN system.

The additional system functionalities are related but not limited to:

- Statistics;
- Email warnings for giving an indication that there is Incident Report information available in SSN;
- Background information display (e.g. nautical charts);
- System monitoring tools, and;
- Secondary or reference data sources (e.g. SSN users contact details, ship particulars, special lists of ships).

SSN EIS also provides a number of functionalities related to major pilot projects such as the BlueBelt project and the SSN/ VMS synergies pilot.

EIS provides different alternative mechanisms to the national SSN systems in order to enable the mandatory exchange of information. These are:

- **Message-based mechanism:** A mechanism which allows individual messages to be exchanged between the national and central SSN applications. The messages (in XML format) fulfil the needs of both data users and data providers (e.g. proprietary protocol, web-services, etc.). This mechanism supports the notification, request and response functions for all types of SSN information (section 2.5.3 a).
- **Central SSN Web browser-based mechanism:** This mechanism is available for requesting information and providing Incident Reports, and may be used to provide other information as a back-up solution in the case of failure of the national or local SSN systems. It is also available for system administration.

SSN EIS also provides the THETIS system with information received from national SSN systems regarding pre-arrival, arrival or departure of ships calling at EU ports and anchorages, in accordance with Directive 2009/16/EC.

2.5.2   *EIS way ahead (2014/ 2015)*

The main highlights in relation to the way forward for EIS are the following:

a) Continue and finalise the work related with the updating or creation of the reference databases (COD, CSD and CLD). This work does not conflict with any of the proposals made here-in.

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[19] To be implemented by 1st June 2015

b) Continue the upgrading of the application for compliance with the XML Reference Guide SSNv.3. This evolution of SSN EIS does not conflict with any of the proposals made here-in

c) Modify (following a detailed collection of requirements) the database schema of incident within EIS to ensure that it can support:

1. The requirements of MS on incident reporting as per the VTMIS directive, as well as evolving requirements subject to agreement from the HLSG and the SSN Group.

2. Current and future EMSA requirements (to be further clarified) on the collection/storage of additional data for maritime accidents/ major incidents as reflected currently in the data base schema of the SSN Accident module

d) Modify the architecture of the application for compliance with an ESB (following a final decision on the ESB to be utilised by EMSA)

e) *(Should further analysis will demonstrate that the CMC should be implemented on the basis of a bespoke application)* Potential implementation of the CMC as an extension of the existing management console of SSN.

f) Inclusion of the STMID information into the COD. This is subject to the approval by the HLSG.

g) Refactoring and re-using the SSN DW software related with EIS reports and statistics

h) Develop a Hazmat Central Database (as under assessment by the SSN Group) in support to NSW systems and to MS maritime authorities

i) consolidating the interface with THETIS and its extension to cover additional information as made available in SSN V3, depending on policy decision from the appropriate for a (Paris MOU, HLSG).

j) Implementing, subject to agreement with MS, the exchange of crew and passengers information for ships calling EU ports, as considered within the IMP Demonstration Project (NSW prototype).

2.6 STAR

STAR will be composed of functionalities present in IMDatE and STIRES. The starting point for creating the STAR backend will be the IMDatE implementation and then certain STIRES functionalities will be transferred. The main elements are addressed in the following sections.

2.6.1 Functionalities & interfaces

2.6.1.1 IMDATE FUNCTIONS TO BE TRANSFERRED TO STAR

IMDatE is the technical platform for supporting ship tracking capabilities and processing of other data sets to support the needs of integrated maritime services. It is designed to be extensible to accommodate new requirements without having to request changes by an external contractor.

The core processing supports the processing of terrestrial AIS reports, SAT-AIS, LRIT (flag, coastal and SAR), VMS, and other tracking sources. The functionality to be transferred to STAR is:

- **Database and Data Processing architecture and functionalities**: the processing chain of standard (CDF) messages for position, voyage, ship particulars and incident data.

- **Integrated Position and Track Services and EO correlation**: the fusion service to combine of distinct reporting and detected sources.
- **Satellite AIS processing and storage**:
- **Community specific registry service**: provides the management of Operations and the ability to assign user community specific information to the tracking data.
- **Automated behaviour framework**: the component (called SA-VAS engine) that supports pluggable algorithms to detect events of interest and notify the users through different means (WUP alerts, emails, XML messages).
- **Reporting node** - Provides alerting and reports (email, PDF, XML) in support of the behaviour monitoring events.
- **Distribution engine** - Allows the distribution of maritime information (positions, voyages, incidents, ship particulars,) via system to system interfaces in a variety of formats (CDF, IEC, IVEF) and protocols.
- **Router planner** – the component that calculate the expected voyage/trajectory of a vessel based on origin and destination criteria
- **Central Geographical Database** – as described in the individual chapter on the central databases.
- **Enhanced SAR SURPIC handling** – request and processing mechanisms supporting the Enhanced SAR SURPIC functions.
- **Video and sensor coverage** – component to allow external entities/system to provide data from patrol asset campaigns (UAVs and patrol vessels).
- **3D model engine** - ability to load and process 3D vessel and infrastructure models.
- **Access rights engine** – currently based on the OES and to be decided as reflected in discussion in chapter XX.

2.6.1.2 STIRES FUNCTIONS TO BE TRANSFERRED TO STAR

STIRES is currently the other major application of the SSN central system supporting the near-real time ship tracking capabilities of SSN. It supports the exchange of the terrestrial AIS position information but it is also used currently to capture SAT-AIS data and capture and display LRIT Data.

STIRES provides different alternative mechanisms to the national SSN systems in order to enable the mandatory exchange of information. These are:

- **The SSN Graphical interface (SSN GI):** This uses geographical information system technology to provide access to ship positions enriched with the data in the central SSN system (information on pre-arrival, arrival, Hazmat cargo, incidents, etc.), thus creating a vessel traffic image showing movements in near-real time.
- **A streaming interface** (the SSN SI): A mechanism which enables the constant flow of AIS data (based on predefined criteria) from the national systems to the central SSN system (either directly or via an AIS regional server). This mechanism is currently only available for the provision of AIS information and is an alternative to the message-based mechanism (section 2.5.3 b).

STIRES also provides a number of essential functionalities utilised for major pilot projects like the BlueBelt and VMS pilot. Worth noting in this respect is the functionality related to the detection of ship / entries and exits from EU ports.

The streaming interface is also used in the context of the IMDATE integration for the injection of SAT-AIS data which after processing and enrichment are provided to IMDATE for visualisation.

The SSN GI was recently fully refurbished for better ergonomics, performance & scalability.

2.6.2 Graphic interface implementation approach

Nowadays the existence of several graphical interfaces could be eventually justified from constraints imposed by the current integration approach. Given, however, that the back-end functionality of STIRES and IMDatE will be merged, there is no technical reason to continue developing two interfaces offering more or less similar functionality and configuration capabilities. The goal should be a single front-end platform supporting all the configurations required to cover existing legal and operational requirements.

In this respect a phased- approach has beebn adopted:

A. Phase A (2014/ 2015) Two graphical interfaces shall be maintained in operations - One best configured for "Traffic monitoring" scenarios and another for "Situation awareness and maritime Surveillance" scenarios. The Phase – out the one of the two shall only take place following the completion of the back- end integration and taking into consideration the evolving user needs by the end of 2015

During Phase A:

   1. The "refurbished" SSN GI should continue evolving merely to cover the needs for SSN v3 launch
   2. The IMDatE WUP should evolve merely to the extent that the currently undertaken obligations are served
B. Phase B (2016 onwards) Implementation and maintenance of a single highly configurable and performing graphical interface

2.6.3 STAR way ahead

The main highlights on the way forward for STAR are the following:

   a) Merging of STIRES with IMDATE current capabilities (the back-end shall be integrated within 2015)
   b) Fully re-using the software components of the SSN SI (SSN "proxy") implementation in STAR. Further upgrading of the "outflow" capabilities of the SSN SI software in order to allow an easy configuration of the outgoing steam to include, based on the SLA with the data recipient, the inclusion of position reports having origin to SAT-AIS and/ or LRIT and/ or VMS.
   c) Optimise the data processing and management components of IMDatE for improved scalability and performance
   d) Implement the receipt and processing of the pushed voyage data from SSN EIS.
   e) Implement periodic synchronisation mechanism with the Central Ship Database.
   f) Continue and finalise, under the existing IMDatE contract, the work related with the Central Geographical Database (CGD).
   g) Refactoring and re-using the STIRES reports and statistics module and SSN DW geospatial reports.
   h) (Should a decision is taken to base the CMC on a COTS product) Implement the CMC in STAR module.

3 SSN Ecosystem – a service oriented view of the architecture

3.1 Services overview

The EMSA current vision on a SOA-based IMS is illustrated in the Figure 8 on the following page and detailed further within this chapter.
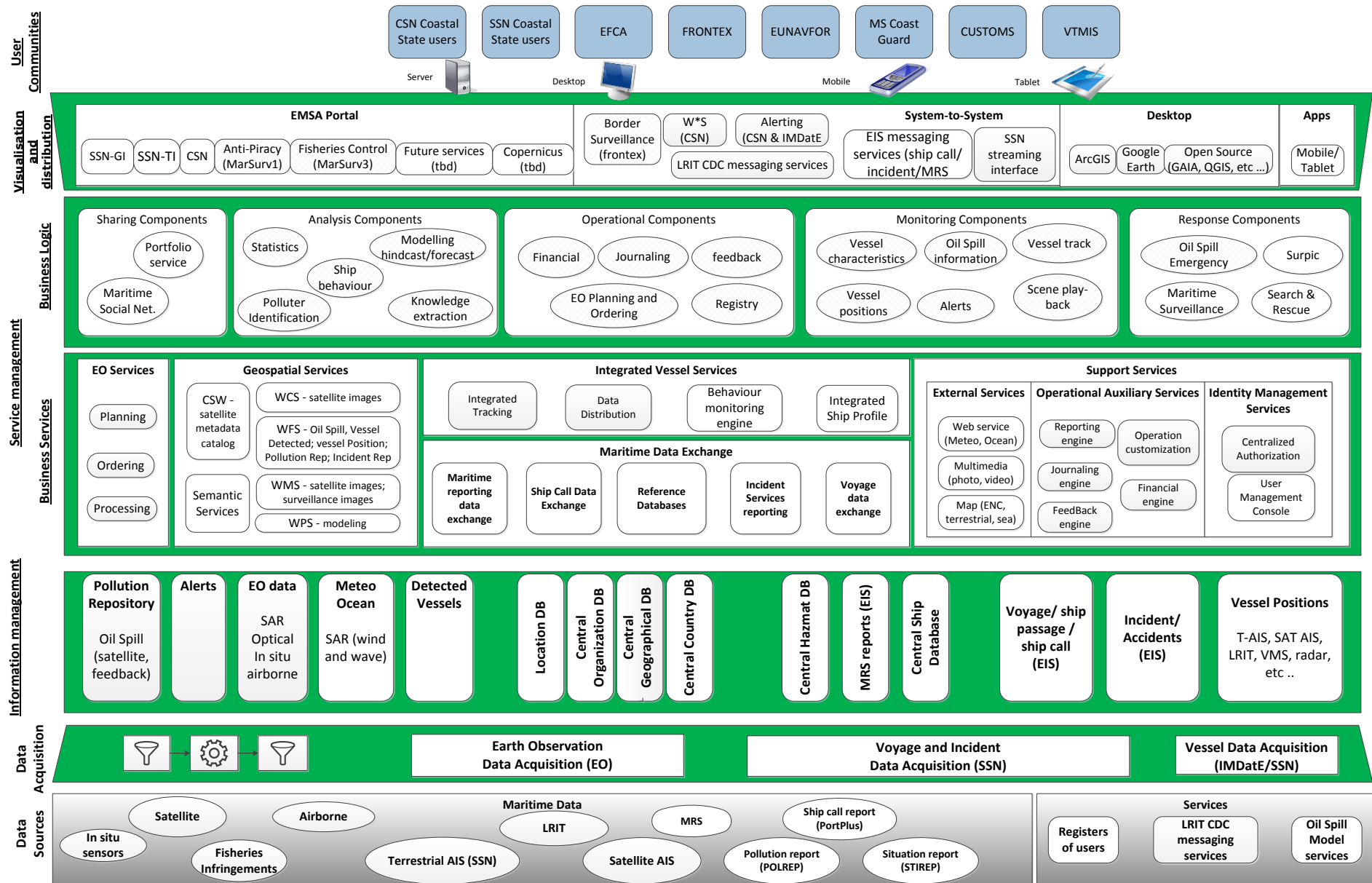
Figure 8 IMS - "Services" view of the architecture
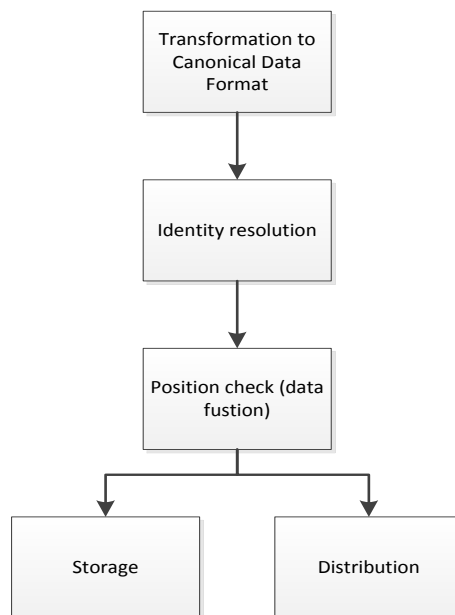
3.2   Services description

3.2.1   Data Acquisition

3.2.1.1 Vessel Data Acquisition: - Data acquisition of vessel information follows the principles of Canonical Data Format architectural patterns, which means that data is received in the native format and transformed to the appropriate canonical data format for that data type.

3.2.1.2 Vessel data can be classified in one of the following data types:

(i.)   Vessel Positions

(ii.)   Vessel Voyages

(iii.)   Vessel Incidents

(iv.)   Vessel Particulars

3.2.1.3 New information is pushed into the acquisition system in its native format and follows a generic flow depicted in the following diagram

3.2.1.4 Voyage and Incident Data Acquisition: - the source of voyage and incident data is mainly the SSN European Index Server. The acquisition uses protocols agreed between the MS and documented in the SSN XML Reference Guide. The data acquired can be classified in one of the following data types:

(i.)   Several kind of Pre-arrival notification

(ii.)   Arrival notification,

(iii.)   Departure notification,

      (iv.)   Notification of dangerous and polluting goods carried (HAZMAT)

      (v.)   Incident accident information

      .

3.2.1.5 Earth Observation Data Acquisition: - is responsible for the ingestion, processing, inventory, catalogue, storage and archiving of Earth Observation Data.

3.2.1.6 Earth Observation data include the following data types:

      (i.)   EO imagery (SAR and Optical with different bands) in low and high resolution

      (ii.)   Oil Spill detection

      (iii.)   Vessel Detection

      (iv.)   Data streams from aircraft

      (v.)   Other derived products

3.2.2 Information management

3.2.2.1 This section aims to provide a high-level overview of the type of information that the IMS manages and upon which the IMS services should be built.

3.2.2.2 The Pollution Repository module manages all information related to the detection of oil spills, including detections based on Earth Observation data and in situ feedback.

3.2.2.3 The Alert module refers to the system generated events and notifications based upon external events (e.g. Oil Spill detection, Vessel Positions) and system processing such as matching of conditions upon which a notification shall be triggered. For example, an alert shall be generated for a specific user when an oil spill is detected in its area of interest.

3.2.2.4 The Earth Observation Data module manages the data acquired via Earth Observation Data Acquisition, including satellite imagery (optical and radar), in situ and air borne sources.

3.2.2.5 The Met/Ocean Data module manages all meteorological and oceanographic information in the IMS, namely:

      (i.)   Wind and Wave information data derived from EO products

      (ii.)   MyOcean service data

      (iii.)   Meteorological information from other sources

3.2.2.6 The Common Registries module contains databases (DB) of reference information needed by different services, such as: Location DB (LOCODEs information), Central Organization DB (list of authorities), Central Geographical DB (geographical areas), Central Country DB (country codes).

3.2.2.7 The Central Hazmat DB manages information on Hazardous Material notifications as exchanged via the European Index Server.

3.2.2.8 The MRS reports module manages mandatory reporting information as exchanged via de the European Index Server.

3.2.2.9 The Central Ship Database manages the reference information for vessels. This information is received and consolidated from various sources. It includes:

  (i.)   Vessel identity information: MMSI, IMO number, Vessel name, Call Sign, Flag, IR number for fishing vessels.

  (ii.)   Build and technical information: length, beam, vessel type

  (iii.)   Community specific information: e.g. fishing gear, security measures, and contact information.

3.2.2.10 The Voyage module manages the Ship Call notifications as exchanged via the European Index Server.

3.2.2.11 The Incident and Accidents repository manages information from incidents and accidents as exchanged via the SSN European Index Server.

3.2.2.12 The Vessel Positions module manages the aggregated vessel positions received from the different vessel position reporting systems.

3.2.3   Services management

3.2.3.1 Earth Observation Service

3.2.3.1.1 This service includes: web-services, Application Program Interface (API) or server-side components (for example Enterprise JavaBean) over standard internet protocols, such as: HTTP/HTTPS, UDP, TCP, POP3, FTP/sFTP, IMAP, POST/GET, SOAP, RMI, REST, etc. The Earth Observation services shall be integrated with the authentication and authorization tools and policies implemented by EMSA.

3.2.3.1.2 The Earth Observation services shall be implemented and deployed on the EMSA infrastructure as requested by the "Non-functional requirements" section of this tender specification.

3.2.3.1.3 This service complies with international standards.

3.2.3.2 Interoperable and Geospatial Services

3.2.3.2.1 Within this procurement "interoperability" has to be understood as the ability of systems and machines to exchange, process and correctly interpret information in an agreed and understood way. "Standards" have to be considered as an approach to achieve interoperability, such as: web-services, Application Program Interface (API) or server-side components (for example Enterprise JavaBean) over standards internet protocols, as: HTTP/HTTPS, UDP, TCP, POP3, FTP/sFTP, IMAP, POST/GET, SOAP, RMI, REST, etc ….

3.2.3.2.2 The Geospatial Services are a set of services that provide "business logic" layer and "application" layer services based on interoperable interfaces following agreed standards. The services are compliant with the geospatial standard specification as described within this document by both sections "Standard" and "Interoperable Maritime Services capabilities".

3.2.3.2.3 The Geospatial services shall be integrated with the authentication and authorization tools and policies implemented by EMSA and made available to all users.

3.2.3.2.4 The Geospatial services shall be implemented and deployed on the EMSA infrastructure as requested by the "Non-functional requirements" section of this tender specification.

3.2.3.3 Integrated Vessel Services

    (i.)   The Integrated Vessel Services (IVS) will be compliant with the EMSA architecture.

    (ii.)   The main types of services to be developed in this layer can be grouped as: Maritime Behaviour Monitoring, Data Distribution, Integrated Vessel Tracking and Integrated Ship Profile.

    (iii.)   These services process Maritime Information (Position, Voyage, Vessel Particulars, and Incidents) to provide higher level integrated services.

    (iv.)   In the area of surveillance/maritime behaviour monitoring, new algorithms shall be implemented to enable vessel behaviours to be detected, modelled and reported. These algorithms shall be integrated into the IVS maritime surveillance engine which allows for management and orchestration of the various specific algorithms.

3.2.3.3.1 Integrated data are distributed to other systems and in particular to national systems hosted by Member States. In the area of data distribution, new data distribution means shall be implemented for maritime information as information exchange standards emerge or evolve over time.

3.2.3.4 Maritime Data Exchange

3.2.3.4.1 The Maritime Data Exchange area refers mainly to the functions performed by the SSN European Index Server (EIS).

3.2.3.4.2 The EIS's main function is to enable the exchange of maritime information at a European level. It supports the exchange of a wide range of data including ship calls, MRS and incident information.

3.2.3.4.3 Changes shall be implemented as required by the evolution of the Maritime Data Exchange requirements.

3.2.3.5 Support services: the following types of services shall be implemented and deployed based on the technology specification provided within the EMSA's technical landscape:

a. External Services – to provide access to services outside of the EMSA infrastructure based on system-to-system interfaces.

b. Operational Auxiliary Services – to support monitoring, incident management, ticketing, help-desk and emergency activities.

c. Identity Management Services – to integrate specific modules/software use by the Agency to manage the identity of all users.

d. Financial Services – supporting financial activities associated to the IMS, such as: cost of satellite imagery, cost of LRIT information, etc.

3.2.3.6 The business logic components are grouped in: operational, monitoring, sharing, analysis and response. These components can be either implemented to enrich the Business Services (Earth Observation services, Interoperable Maritime Service, Support services and the Integrated Vessels services) or to create new services.

3.2.3.7 The business logic components will be based upon and use web-services, Application Program Interface (API) or server-side components (for example Enterprise JavaBean) over standards internet protocols, as: HTTP/HTTPS, UDP, TCP, POP3, FTP/sFTP, IMAP, POST/GET, SOAP, RMI, REST, etc ….

3.2.3.8 Operational Components: Operational business logic components deal with the following aspects: planning and ordering of Earth Observation products (including the implementation of a complex workflow), financial aspects in order to acquire data (the contracts with data owners or providers, the EMSA budget, the EMSA financial reporting criteria, the EMSA invoicing requirements, the calculation of contract penalties), and Journaling (tracking and monitoring data acquisitions workflows);

3.2.3.9 Monitoring Components: The business logic components deal with:

(i.) the processing and visualization of spatio-temporal information such as: vessels (positions, track, and details) and maritime pollution (oil spills).

(ii.)   the processing and visualization of real-time or near-real-time alerts or warnings

3.2.3.10 Sharing Components: The business logic components enable EMSA to manage its portfolio in terms of the following resources: services, datasets, data series. The adequate services shall be implemented in order to expose these resources to EMSA's stakeholders.

3.2.3.11 Analysis Components: The business logic components provide analysis capabilities for maritime issues. Therefore the business logic components shall be implemented to deal with: statistical tools, modelling algorithms (oil spill drift), etc ...

3.2.3.12 Response Components: The business logic components encompass situational awareness tools (for example "Common Operating Picture" for oil spill responses, search and rescue tools, etc …).

3.2.4   Data visualisation and distribution

3.2.4.1   The presentation layers shall be sufficiently decoupled from the underlying business services taking into account performance considerations.

3.2.4.2   System 2 System: the services shall be designed, implemented and maintained in a way that they can be exposed to EMSA stakeholders taking into account performance requirements..

3.2.4.3   EMSA Portal: the web portal components shall be designed, implemented and maintained as described in EMSA's ICT technical landscape.

3.2.4.4   Desktop: Different Geographical Information Systems (GIS) such as "ESRI ArcGIS", "Goole Earth" and "open source" GIS (for example GAIA, QGIS, etc …) can be used to support and access the EMSA services.

3.2.4.5   Mobile Platform Applications: in the framework of this contract, it may be necessary to implement mobile and/or tablet applications. The apps will be implemented for the following platforms: iOS and Android.