Enhancing the technical architecture of the Unified State Ocean Information System (ESIMO) through the use of a cloud platform and digital technologies

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The Unified State Ocean Information System (ESIMO) is a state interagency information system aimed at solving following problems: the integration of information about the World ocean state, received from the information systems of the federal bodies; provision of comprehensive information about the situation in the oceans to the state authorities of the Russian Federation, as well as to legal entities and individuals engaged in maritime activities; information exchange with international systems.

As of 2020, ESIMO is integrating more than 250 databases on more than 450 environment parameters in the World Ocean (more than 3,500 so-called “information resources”) provided by over 20 departmental information systems. The total amount of data from the ESIMO information resources is about 15 terabytes. The system is composed of a global node (Moscow, Roshydromet), two regional nodes (Far East regional node in Vladivostok and northwestern node in Saint Petersburg responsible for the Arctic region), several specialized nodes in ministries, and departmental nodes around the country in data provider organizations.

ESIMO is a distributed system that provides metadata and data exchange between the nodes of a unified system. ESIMO applies following interoperability standards - ISO 19115 for metadata, NetCDF 2/3 for data, SOAP, REST, OGC, and SPARQL for the web services. Later developments include the wider user of Semantic Web standards such as OWL and RDF.

The hardware and software of ESIMO was formed in 2011–2013 under the federal target program “World Ocean”. At present, about 30 percent of the equipment has failed completely; periodic failures in existing facilities are registered. Many efforts are required to maintain human resources in the field, capable of providing technical support. The most relevant requirements for the modernization of ESIMO in technical terms are:

- use of modern digital technologies (cloud computing, big data, etc.) and last generation software and hardware at the data centers operating in the Russian Federation to ensure the sustainable operation of the system;
- wider adoption and use of interoperability standards;
- use of open / free and shareware software products, dominantly developed and maintained in Russia;
- updating of middleware and specialized software;
- deployment of information security tools in accordance with the requirements of the Federal Service for Technical and Export Control of Russia;

The composition and quality of modernized hardware and software should be sufficient to ensure the operation of a unified system, including: a) information interaction with more than 350 departmental databases and ensure their availability; b) data integration and maintenance of the consolidated information base of at least 4,500–5,000 data sets; c) information services for at least 100 users/per

moment, more than 5000 calls daily, data delivery to end-users in the amount of 350 GB or more per month.

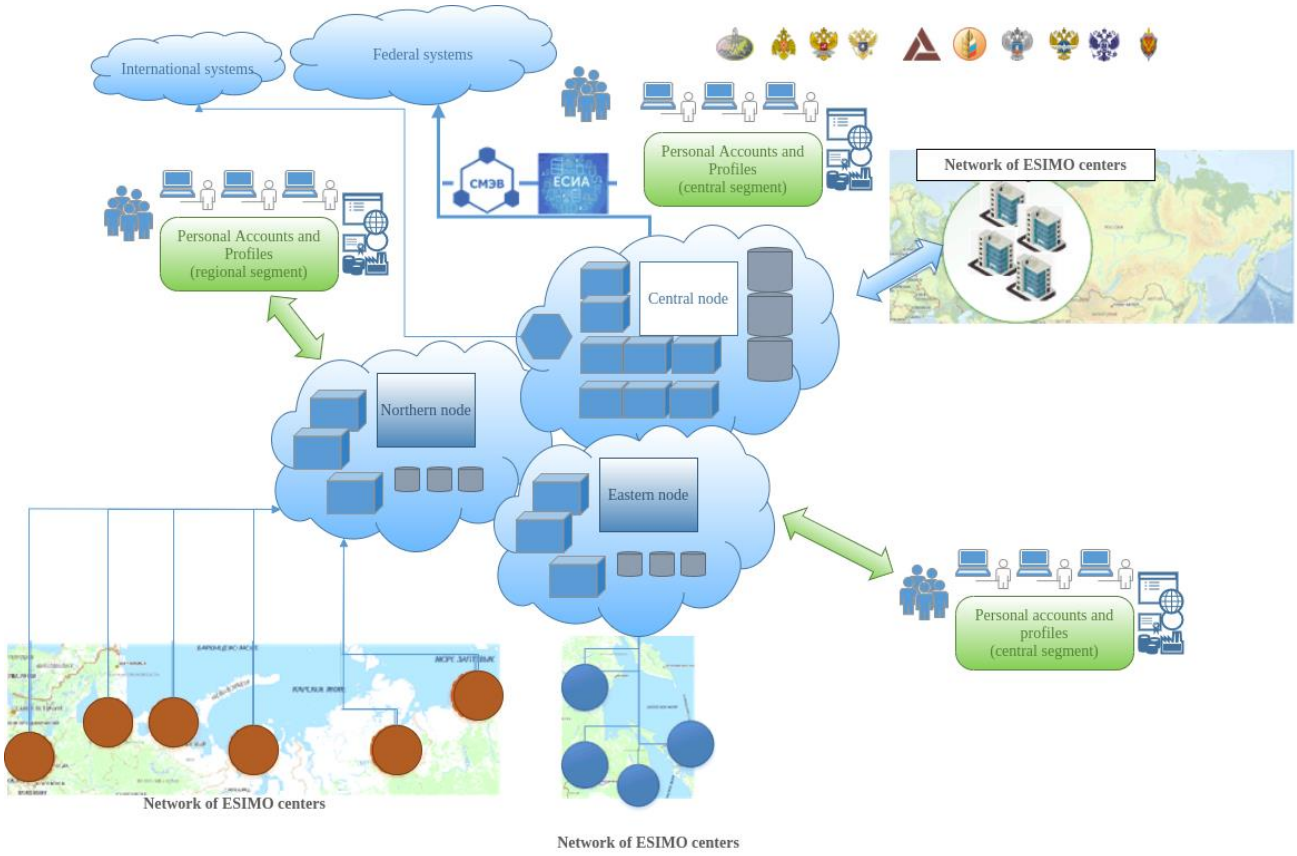

Figure 1: Generalized architecture of the modernized ESIMO

The concept of modernization of ESIMO is based on the transformation of a unified system as an interdepartmental state system of information on the situation in the oceans into an interdisciplinary digital platform focused on integrated information support of the main types of maritime activities in the Russian Federation. From an information point of view, a digital platform is an integrated distributed repository of observations, information products and services in the field of the situation in the World Ocean, to which effective access of information consumers is provided.

The digital platform of ESIMO will support a variety of communication interfaces between information providers and consumers. It will also enhance interoperability arrangements (new services and protocols), including semantic interoperability through the wider use of Semantic Web and Linked Open Data techniques. Services will be provided to consumers in a “one-stop-shop” manner. Personalization of ESIMO data and services is foreseen as: from end-user profiles (user groups) of “workplace” type on stationary / mobile devices to a digital platform (in fact, a profile of an ESIMO digital platform) for an enterprise or industry.