International Standard

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Ships and marine technology — Publish-subscribe architecture on ship-shore data communication — General requirements

Navires et technologie maritime — Architecture Publish-subscribe (publier/s'abonner) pour la communication de données entre les navires et les autorités à terre — Exigences générales

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Foreword

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This document was prepared by Technical Committee ISO/TC 8 *Ships and marine technology*, Subcommittee SC 26, *Smart shipping*.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Information and Communication Technology (ICT) plays an increasingly important role in assuring effective and secure data communication in the marine industry. In this context, there is a growing need for an architecture that not only enables interoperability between applications and systems onboard vessels, but also supports real-time streaming services within ships. Moreover, data communication between ship and shore is provided in real time to support decision-making as integrated information by collecting and analysing data.

In order to expand the usage range between relative entities and to improve the ship's performance, it is important to standardize the message format transmitted from the ship side server to the shore side server.

Existing International Standards on managing data that are derived from ship or shore have been used in the industry such as:

— the IEC 61162 series for the digital interfaces of navigational equipment within a ship;

— ISO 19847 for shipboard data servers;

— ISO 19848 for standard data for shipboard machinery and equipment;

— ISO 23807 for asynchronous time-insensitive ship-shore data transmission.

However, it is recommended to establish a message communication system that shall respond flexibly to the various message formats derived from relevant sectors such as smart shipping, smart ports, smart logistics, etc. Furthermore, utilizing a communication protocol optimized for satellite communication can be considered, even in a situation where communication is intermittently disconnected. Furthermore, it should be highlighted that the data model is designed with scalability to accommodate future expansions related to eco-friendly technologies and environmental regulations.

This document defines a publish-subscribe architecture to facilitate widespread data utilization. It enables many-to-many communication by allowing data to be transferred through registered topics. It provides a dynamic, batch-based messaging structure.

This document provides general requirements for publish-subscribe communication, including security requirements, topic naming definitions, message format, and functional requirements for data management.

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Ships and marine technology — Publish-subscribe architecture on ship-shore data communication — General requirements

1 Scope

This document specifies requirements on publish-subscribe architecture on ship-shore data communication. It is intended for use by system providers and users, including software vendors, platform developers, fleet managers, application users in the field of the shipbuilding industry, shipping companies, equipment manufacturers, and port and on-shore service providers, to communicate in the publish-subscribe architecture between ship and shore.

This document focuses on enabling interoperability of shipboard and shore-based systems for the exchange of operational data using publish-subscribe methods.

This document describes:

— the role of a broker, publisher and subscriber;

— the multitenancy-based data management system in the cloud environment;

— general requirements for publish-subscribe architecture;

— security requirements for ensuring data confidentiality, integrity and availability;

— the message format for client id and topic name, and data model;

— functional requirements for data management.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 24060, *Ships and marine technology — Ship software logging system for operational technology*

IEC 61162-460, *Maritime navigation and radiocommunication equipment and systems — Digital interfaces — Part 460: Multiple talkers and multiple listeners — Ethernet interconnection — Safety and security*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

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3.1
publish-subscribe architecture
system in which *publishers* (3.5) post messages to an intermediary *message broker* (3.4) and *subscribers* (3.6) register subscriptions with that broker, allowing the broker to filter, classify the client and designate the priority of messages

Note 1 to entry: The message broker performs a store-and-forward function to route messages from publishers to subscribers, with optional prioritization of messages in a queue before routing.

3.2
quality of service
QoS
level that is a deal between two parties, the *publisher* (3.5) and *subscriber* (3.6), of a message with respect to the assurance of distribution of data

3.3
topic naming definition
hierarchical structure in which clients publish messages on designated topics and receive messages that match those topics

Note 1 to entry: This structure comprises multiple topic levels separated by slash ("/") characters and allows the use of wildcards such as "+" and "#".

3.4
message broker
intermediary system responsible for controlling the distribution of data, and storing, forwarding, filtering and prioritizing public requests from the *publisher* (3.5) to the *subscriber* (3.6)

Note 1 to entry: Clients switch between publisher role and subscriber role depending on the functionalities desired.

3.5
publisher
client of ship side or shore side who sends messages with a topic to a *message broker* (3.4) and the topic matches with a subscription created by the client

3.6
subscriber
client on the ship side or shore side who receives published messages on a specific topic

Note 1 to entry: The subscriber obtains data by registering a subscription with the *message broker* (3.4) according to a defined topic structure.

3.7
multitenancy
architecture in which many tenants (users) simultaneously share the same software instance

Note 1 to entry: It allows a single *message broker* (3.4) to serve multiple tenants or customers, while keeping their data and communication separated from each other. It stores metadata about each tenant and uses this data to alter the software instance at runtime to fit each tenant's needs. The tenants are isolated from each other via permissions. Even though the tenants share the same software instance, each one uses and experiences the software differently. It consists of handling multiple IDs on a single server in cloud environments.

3.8
ship-shore data communication
exchange of information between a shipboard system and a shore-based system through a communication network

Note 1 to entry: It enables real-time sharing of operational, navigational, safety, environmental, and maintenance data, supporting enhanced monitoring, management, decision-making, and regulatory compliance for vessel operations. This communication typically utilizes a publish-subscribe architecture depending on the specific operational and technical requirements.

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