

A XML documentation for Marine Casualty Data considering S-100

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Abstract. International Hydrographic Organization has been developing a new paradigm of handling and displaying hydrographical related data based on ISO 19100 series. The data developed depending on this standards can be provided by web service. Marine casualty data can be one of target for this new paradigm. This paper suggests a XML schema using UML for marine casualty.

Keywords: IMO, e-navigation, S-100, UML, XML

1 Introduction

IMO (International Maritime Organization) e-navigation is a new paradigm of safety navigation on the sea and related service. Recently, as the electronic chart has replaced the paper chart, the contents on the electronic chart onboard are increasing dramatically. This makes a requirement of new standard related marine chart. S-100 is the new standard for this purpose which is a framework for representing geographic and maritime information including ENC (electronic navigational charts) and their related information such as tides, bathymetry, nautical publication in figure 1 [1].



Fig. 1. Adopting S-100 in ECDIS

The feature of S-100 is derived by ISO 19100 series and described using UML, which is one of modeling for object-oriented analysis and construction. UML is a common method for information modeling, it is imported to various part of industry.

It is also translated to XML (eXtensible Markup Language) for web-service which is a part of S-100 service. This paper proposes S-100 applicable XML schema for maritime casualty information.

2 Related works

2.1 IHO S-100

To develop S-100, the IHO (International Hydrographical Organization) Universal Hydrographic Data Model was included in the IHO Work Programme in 2001. S-100 has been developed by the IHO Transfer Standards Maintenance and Applications Development (TSMAD) Working Group with active participation from hydrographic offices, industry and academia. The S-100 development and maintenance process is specifically aimed at allowing direct input from non-IHO stakeholders, thereby increasing the likelihood that these potential users will maximize their use of hydrographic data for their particular purposes. Figure 2 shows the abstract structure of S-100 concept [2].

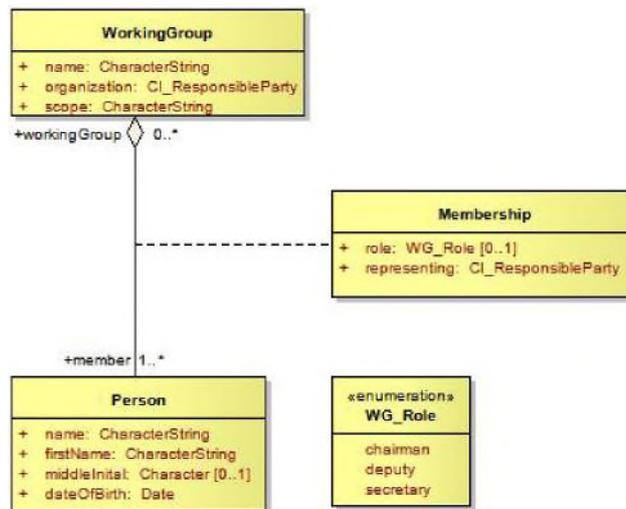


Fig. 2. Composition of S-100 Standard

2.2 XML schema

The Extensible Markup Language (XML) is a simple text-based format for representing structured information: documents, data, configuration, books, transactions, invoices, and much more. It was derived from an older standard format

called SGML (ISO 8879), in order to be more suitable for web use [3]. XML Schema is to define the legal building blocks of an XML document in

3 XML documentation with Marine Casualty

KMST (Korea Maritime Safety Tribunal) has published casebooks called "Casebook of KMST" every year. The books offer from casualty information to vessel specification. This information is able to help surveying the cause of formal accident and predicting the future one. In this paper, it is created that the table of casualty data from the casebooks [4, 5]. These marine casualty data is organized in Table 1.

Table. 1 Part of analyzed marine casualties

| No. | ID | Type | Description | Speed of ship A | Speed of ship B | Name | Ship Type | Volume |
|-----|----------|----------|-------------|-----------------|-----------------|---------|-----------|--------|
| 1 | 부해심 제200 | 6. 달항 폭포 | 제1번 일발도 | 6.7 | 3 | 달항도 해포 | 제1번 일발도 | 9.8 |
| 2 | 부해심 제200 | 2. 부해심원 | 제1호 일발도 | 10.5 | 11 | 제1호 일발도 | 제1호 일발도 | 770 |
| 3 | 부해심 제200 | 1. 일발도 | 제1호 일발도 | 12.5 | 7 | 제1호 일발도 | 제1호 일발도 | 4737 |
| 4 | 부해심 제200 | 제1호 일발도 | 제1호 일발도 | 0.5 | 8.8 | 제1호 일발도 | 제1호 일발도 | 2623 |
| 5 | 부해심 제200 | 제1호 일발도 | 제1호 일발도 | 7 | 8 | 제1호 일발도 | 제1호 일발도 | 48 |

By analyzing these casualties, UML based classes are derived as Accident_data class including the base information of accident and Ship_data class including the information of ship's status. An attribute in "Accident_data" class, Accident_location, has latitude and longitude. This construction is easier to abstract the data because the data is categorized. A tool to design UML class, EA (Enterprise Architecture) by Sparx Systems, is used in this paper [6]. Figure 3 shows the abstract UML class for marine casualty data.

The XML document is created by combining defined schemas and analyzed data. The name of element in XML schema would be used tag name in XML document. It is an important to mapping with data. Figure 4 shows XML Schema based on abstract UML class of figure 3.

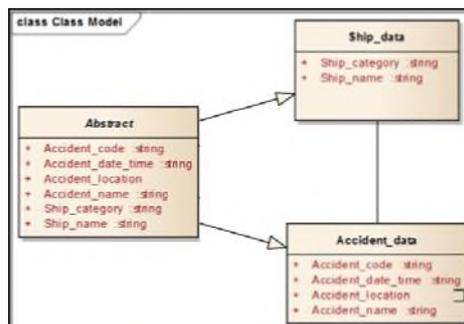


Fig. 3. Part of abstract UML class

```
<?xml version="1.0" encoding="UNICODE"?>
- <xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
  - <xs:element name="Accident">
    - <xs:complexType>
      - <xs:sequence>
        - <xs:element name="Abstract">
          - <xs:complexType abstract="true">
            - <xs:sequence>
              <xs:element type="xs:string" name="accident_code" maxOccurs="1" minOccurs="1"/>
              <xs:element type="xs:string" name="accident_date_time" maxOccurs="1" minOccurs="1"/>
              <xs:element type="xs:string" name="accident_location" maxOccurs="1" minOccurs="1"/>
              <xs:element type="xs:string" name="accident_name" maxOccurs="1" minOccurs="1"/>
              <xs:element type="xs:string" name="ship_category" maxOccurs="1" minOccurs="1"/>
              <xs:element type="xs:string" name="ship_name" maxOccurs="1" minOccurs="1"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>
```

Fig. 8. XML Schema based on abstract class design

4 Conclusion

This paper proposed XML documentation of marine casualties considering S-100 standard which is suggested by IHO. UML abstract classes designed with analyzing marine casualty data can be changed to XML schema. With this, XML document is created to provide on the web environment.

This result is going to be extended to adopt the concept of S-100 feature completely, to modify UML abstract class with treating more casualty cases.

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