

S-121 MRN



**Comment on the Maritime Resource Name (MRN) Implementation
in the IHO S-121 standard
for Maritime Limits and Boundaries (MLBs)**

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Introduction

The Canadian Hydrographic Service (CHS) recognizes the importance of a persistent and globally unique identifier for S-100 objects and that the Maritime Resource Name (MRN), introduced in the S-100 Standard Edition 4.0, answers the need for such an identifier. The S-121 Standard for Maritime Limits and Boundaries (MLBs) also stands to greatly benefit from this adoption of the MRN. Although MRNs are not currently included as part of the latest S-121 product specifications, work is being done to propose a new MRN-based S-121 identifier scheme. In CHS's view, the MRN combines flexibility, compatibility with existing identifier schemes and authoritativeness. It also facilitates interoperability with other existing standards as outlined by Jeppesen (2013). CHS also sees the potential for maintaining the differentiation between objects that may be present in other standards among the S-100 family of hydrographic standards. Having the Coastal State as authority over the identifier scheme of its own Maritime Limits and Boundaries offers another great advantage in allowing persistence of existing identifier schemes already in use in national databases. This can be done by embedding them in the MRN structure. In this comment, different scenarios of implementations of the MRNs in the S-121 standard are presented.

1. Background

A MRN is a Uniform Resource Name (URN) which, like URLs (Uniform Resource Locator), are a form of standardized Uniform Resource Identifier (URI). The URNs tell you "What" but not necessarily "Where". Because of its direct standard application and model based on the URL, the MRN is fully interoperable with established web standards.

The MRN is designed as a system of persistent identifiers (IDs) that uniquely identify resources in the maritime domain. Each level of the hierarchy within the MRN yields more specific details about an endless variety of maritime resources. It can be used to identify any type of resource and this includes both physical and virtual resources.

The top level MRN namespace (urn:mrn) is registered and administered by the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA). IALA, however, does not have authority over all namespaces within the MRN or identified maritime resources. It hosts and facilitates the implementation of MRNs.

The MRNs were added to the S-100 standard in its version 4. Through its partnership with IALA, the International Hydrographic Organisation (IHO) registered MRN namespaces for the S-100 standard. The namespace for a S-100 product would have the following structure:

urn:mrn:iho:S-1XX

In the case of the S-121, it becomes:

urn:mrn:iho:S-121

Inside the S-100 family of standards, the MRNs are becoming more and more accepted as part of product specifications because these MRN namespaces are hierarchical and fit the S-100 structure (Jeppesen, 2013, Mong & Malyankar, 2018, Nielsen et al, 2019). Under this hierarchy, it is possible to encode elements from a S-100 product standard such as the S-121 for Maritime Limits and Boundaries (MLBs)

while allowing each Coastal State to define and manage all MLBs that fall under its national jurisdiction.

If we analyse the following hypothetical MRN, it can be decomposed into its basic elements. Following this hierarchical structure, the following example hierarchical elements are acknowledged: the maritime domain, the IHO, the S-121 standard, the identifier of the State and the type of MLB.

urn:mrn:iho:S-121:CA:112-99

The meaning of the first four hierarchical levels is explained below:

- urn:mrn = Any resource in the maritime domain.
- urn:mrn:iho = Any resource following an IHO specification in the maritime domain.
- urn:mrn:iho:S-121 = Any resource following IHO S-121 product specifications in the maritime domain (i.e. an MLB resource).

2. Coastal State code for resource owner:

The structure, urn:mrn:iho:S-121 , follows the one suggested by Mong and Malyankar (2018). It should, however, differ from their proposal at the producer hierarchical level. Since national MLBs are owned and managed by the Coastal State, the country's code should be used instead of a producer code. We recommend that the hierarchy within the S-121 namespace reflects the individual Coastal State's responsibility for implementation of the resource name of the MLBs under its jurisdiction.

This country code could be leveraged through existing standards specifically for country codes such as ISO 3166 *Codes for the*

representation of names of countries and their sub-divisions and ISO 3166-1 *Codes for the representation of names of countries and their subdivisions – Part 1: Country codes*. This is illustrated by the following example which would designate any Canadian MLB resource:

urn:mrn:iho:S-121:CA

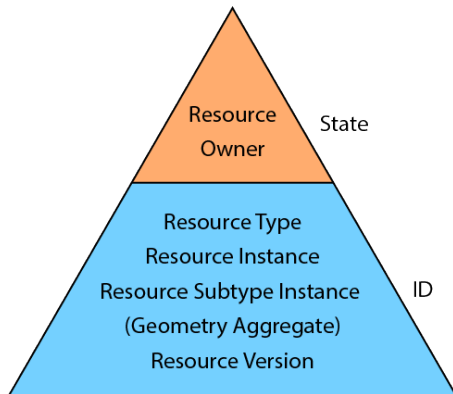
Still following the ISO 3166, in the next example, Canada's Territory of Nunavut is included both as a resource name owner and as a sub-division of Canada.

urn:mrn:iho:S-121:CA-NU

Once the Coastal State owner is included in the namespace, the object can be designated, numbered and versioned following the State's preferred scheme.

The S-121 Product specifications will need to define default rules for the remainder of the MRN-based IDs for those States that do not have a pre-existing ID scheme that they want to perpetuate. An example illustrating the possible hierarchy under the Resource owner's namespace is given in the section below.

3. Proposed hierarchy of the S-121 MRN



This MRN's hierarchy allows for both mandatory and optional components to be identified in order of descriptive importance.

The resource sub-components can use "-" separator to create further hierarchy. The version number which is specified at the end of the string uses a unique separator "." that can be inserted at any level after the first resource instance for improved flexibility. (See Appendix A for more information on the MRN namespace format)

Assembling all the elements with separators above produces an example MRN for a Canadian MLB of the Territorial Sea Outer Limit (codelist 112, see Appendix B), specifically resource number 99 in its first version as explained in Appendix A.

urn:mrn:iho:S-121:CA:112-99.1

4. Benefits of the MRN

The advantages of the MRN are numerous. They are standardized and foster interoperability. Their structure renders them globally unique while still allowing flexibility and extensibility. Through them, a pre-

existing ID system can be made persistent. The MRN namespaces support the authoritative character of the data and identifier. This may be used to facilitate data discovery and human readability.

5. Hypothetical Examples

The flexibility of MRNs opens the door to a large array of unique Identifiers. Using the format guidelines in Appendix A, the following examples are presented.

1.) Generic S-121 Object with ID string and version number

urn:mrn:iho:S-121:CA:101-99.2

2.) Generic S-121 Object with a universally unique identifier (UUID)

urn:mrn:iho:S-121:CA:F23229A5-638B-40EC-BE44-4D6A793BBB1E

3.) Generic S-121 Object with alpha code ID, version number and date and time in UTC.

urn:mrn:iho:S-121:CA:BASELN-999-36.1:20181031T125510Z

4.) Point object with ID string, version number, date and human-readable feature type string.

urn:mrn:iho:S-121:CA:001-99-9.2:20181031:continentalShelfPoint

5.) Source object with human-readable feature type string and linked persistent legal identifier

urn:mrn:iho:S-121:CA:431-
1.1:20181031:sourceDocumentDigital:"C.R.C., c. 1550"

6.) Source object with human-readable feature type string and linked identifier, as a URN

urn:mrn:iho:S-121:CA:433-2.1::sourceMapHardcopy:"urn:isbn:978-1-100-54116-7:7237517"

As proposed by Jeppesen (2013), implementation of MRNs in a national database environment should optimize space by storing the repeated non-unique part of the identifier string in metadata that is only reattached to the identifier during export outside of this environment. In this scenario, the ID string urn:mrn:iho:S-121:CA:112-99.2 will be stored in the database as the unique part 112-99.2 while urn:mrn:iho:S-121:CA is stored in the metadata.

6. Considerations for hypothetical test data

Since URNs are persistent, we should encourage the use of a temporary version of the namespace string for development work. A special character can be added to S-121 namespace to indicate a transient test object (still unique worldwide) which is not intended for inclusion in the production database. The use of the suffix X could be leveraged to this effect as shown below.

urn:mrn:iho:S-121X:112-99.1

7. Proposed Use Cases

Two main use cases for MRNs are being proposed. In Use case 1, the State does not have a national ID scheme for its Maritime Limits and Boundaries (MLBs). In Use case 2, the State already has a national ID Scheme for its MLBs.

Use case 1: No previous national ID scheme exists

This State has not yet developed an ID system for its MLBs. Canada is in this situation. Any scheme could be used, but the standard should provide a default structure already built on an understanding of components needed for persistent and versioned legal identifiers. In this scenario, the S-121 Product Specifications determines a default ID scheme that can readily be used by States who need it.

Use case 2: A previous national ID scheme exists that can be persisted

This State is already using an existing ID system for its MLBs. Australia is in this situation (Mark Alcock, Geoscience Australia, personal communication). The State may choose to embed its existing IDs into MRNs and thereby make them globally unique and persistent as well as backwards compatible with their previous systems.

8. Conclusion

The MRNs are built on existing URI standards which makes them interoperable with technologies that support URIs. As demonstrated in this paper, they have the flexibility needed to satisfy a wide array of State requirements and they are extendible which allows them to include more information that can be extracted and used as part of automatic ID generation. They are needed in the Standard.

Canada encourages that MRN development in S-121 be coordinated with other efforts on MRN development within the S-100 standard. MRN developments in the main standard should allow flexibility in the implementation of MRN in S-100 product specifications.

References:

Jeppesen. -TSMAD26/DIPWG5_11.7E Uniform Resource Identifiers for S-100. 10-14 June, 2013

https://www.iho.int/mtg_docs/com_wg/TSMAD/TSMAD26/TSMAD26_DIPWG5Docs.htm

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Nielsen, Kasper, Jensen, J. K., Park, J. H., Lee, K. – Maritime Resource Names - IALA, IHO GI Registry Workshop, REGWS1-3.2C, 4th S-100 Working Group (S-100WG) Meeting, Aalborg, Denmark, 25-26 February 2019. (also presented as IALA ENAV17-9.14 Marine Resource Name)

https://www.iho.int/mtg_docs/com_wg/S-100WG/S-100WG4/regWS/S-100WG_RegWorkshop-3.2C_Maritime%20Resource%20Name_IALA.docx

Appendix A: MRN Namespace Format and ID

Namespace Format

The specific details on the format of Namespace Specific Strings (NSS) are defined by IALA and represented in S-100 using the following structure:

- `<URN> ::= "urn:mrn:" <OID> ":" <OSS>`
- `<OID> ::= 1*(ALPHA / DIGIT) ; Organizational ID`
- `<OSS> ::= <OSNID> ":" <OSNS> ; Organizational specific string`
- `<OSNID> ::= 1*(ALPHA / DIGIT / "-") ; Organizational specific namespace ID`
- `<OSNS> ::= 1*<URN chars> ; Organizational specific namespace string`
- `DIGIT ::= %x30-39 ; 0-9`
- `ALPHA ::= %x61-7A ; a-z`

To illustrate this

`urn:mrn:iho:S-121`

Resource ID

The resource ID and the version number can be included in the S-121 name string :

`<OSNS> ::= <Resource Owner> ":" <Resource ID> "." <Version>`

The resource ID can be defined as a resource type followed by resource instance potentially followed by sub-type instance

`<Resource ID> ::= <FeatureType> "-" <Instance> "-" <SubType>`

- Important that the Resource ID support enough characters for a State specific implementation without using reserved characters such as ":"

<Resource ID> ::= 1*(ALPHA/DIGIT / "-"); But can be expanded.

<Version> ::= 1*(DIGIT); version number.

112-999.1

urn:mrn:iho:S-121:CA:112-999-55.1

Acronym Alpha Codes

The ID could include hypothetical acronyms inspired from the S-57 standard as given below. This could improve the human readability of the MRN.

TESLIM	Outer Limit of the Territorial Sea
CZOLIM	Outer Limit of the Contiguous Zone
EEZLIM	Outer Limit of the Exclusive Economic Zone
CSOLIM	Outer Limit of the Continental Shelf
RDSLIM	Outer Limit of the Roadstead

Example: urn:mrn:iho:S-121:CA:TESLIM-999-55.1

Future Extensions

The extendibility of the MRN promotes the use of even further information in the ID. Good candidates for extra information for the resource name (ID) forming are the date of release (Date), a human-readable feature name (FeatureName) or even a linked resource (LinkedResource). Encoding format examples are given below.

<Date> ::= 1*(ALPHA/DIGIT); ISO 8601 date

<FeatureName> ::= 1*(ALPHA); Human readable feature type

<LinkedResource> ::= "" + 1*(ALPHA/DIGIT/URN chars) + ""; resource identifier surrounded by quotes

Appendix B: Example Feature Type Codes

000	Point	113	Outer Limit of the Contiguous Zone
001	Limit Point	114	Outer Limit of the Exclusive Economic Zone
002	Baseline Point	115	Outer Limit of the Continental Shelf
003	Boundary Point	116	Outer Limit of the Exclusive Economic Zone
004	Contributing Point	117	Outer Limit of the Roadstead
		118	Construction Line
100	Limit	-	
101	Baseline	200	Zone
102	Normal Baseline	201	Archipelagic Waters
103	Straight Baseline	202	Contiguous Zone
104	Archipelagic Baseline	203	Continental Shelf
105	Low Tide Elevation B.	204	Exclusive Economic Zone
106	Mouth of Rivers Baseline	205	High Sea
107	Bay Baseline	206	Internal Water
108	Port Baseline	207	Roadstead
109	Reef Baseline	208	Territorial Sea
110	Boundary		
111	International Boundary		
112	Outer Limit of the Territorial Sea		

Example Feature Type Codes (continued)

209 The Area

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300 Space

400 Information

401 Right

402 Restriction

403 Responsibility

420 Party

421 Party Member

422 Group Party

430 Source

431 Source Document Digital

433 Source Map Hardcopy

500 Administration