Paper for Consideration by S-100 TSM5

Maritime Resource Names (MRN) concept

Submitted by:	NOAA; Eivind Mong; Raphael Malyankar
Executive Summary:	Using the Maritime Resource Names (MRN) concept for the recommended S-100 unique identifier structure.
Related Documents:	S-100
Related Projects:	S-100

Introduction / Background

The Maritime Resource Names (MRN) concept was proposed to IALA in October 2015 as a method to create persistent unique identifiers. Initially planned as a unique identifier for Aids to Navigation, it was realized its usage could be much more versatile and it subsequently became a means of creating unique identifiers for any maritime resource.

MRN is a naming scheme that can uniquely identify any maritime resource on a global scale. By maritime resource we basically mean anything that has an identity of some kind. This could be organizations, employees, a person, a physical or a virtual object, for instance an electronic document, a buoy, a ship, a mariner, a nautical chart or an electronic service. Not all resources are "retrievable" in an electronic sense; For example, human beings, corporations, and buoys. However, they can still be considered a resource.

The MRN specification is submitted to The Internet Engineering Task Force (IETF.org) and this submission is attached in Annex A.

At S-100WG1, the following action was taken "Pending IALA approval of the MRN concept, JP to add clarifying language to S-100 that when UIs are used within the S-100 Framework the IALA MRN concept should be used". This paper seeks to complete this action.

References
S-100WG01-10.11A   Summary of activities related to the request of UI availability in S-100

How the MRN concept works
The MRN namespace is administered by International Association of Lighthouse Authorities (IALA) through the website http://mrnregistry.org. The topmost namespace urn:mrn remains fixed, with subsequent name spaces separated by colons, and available through the application process explains on the website. Any organization wishing to issue MRN conformant identifiers should apply for a name space from IALA, or from an organization that already has a namespace registered. For example, IHO applies for a name space, and subsequently gives all producing agencies a sub name space under the urn:mrn:iho name space; for NOAA this could be urn:mrn:iho:us and for CHS this could be urn:mrn:iho:ca. NOAA and CHS would then administer their respective name spaces as needed and within the MRN rules. MRN does not currently define a resolution of the identifier, which means that there is no requirement that an MRN map to an Internet resource such as a Web page. Nor does there appear to be a length limitation, which means that under the top most name spaces there is, in theory, the possibility of an endless identifier string. IHO may therefore wish to set a limit of how many sub name spaces are permitted after the iho namespace.

Rules that apply to MRN name spaces
The Namespace Specific String (NSS) of all URNs that use the "mrn" NID shall have the following structure:
    <URN>   ::= "urn:mrn:" <OID> ":" <OSS>
    <OID>   ::= 1*(ALPHA / DIGIT) ; Organizational ID; iho
    <OSS>   ::= <OSNID> ":" <OSNS> ; Organizational specific string
    <OSNID> ::= 1*(ALPHA / DIGIT / "-") ; Organizational specific namespace ID
    <OSNS> ::= 1*<URN chars> ; Organizational specific namespace string
Character set used

```
   DIGIT   ::= %x30-39 ; 0-9
   ALPHA   ::= %x61-7A ; a-z
```
The entire URN is case-insensitive.

Example 1, an identifier for IHO special publications; urn:mrn:iho:pub:s100

Example 2; an identifier for a feature urn:mrn:iho:us:5502201778050

Example 3, is from IALA, which is developing mrn as identifier for ship reports. The current draft is given below.

urn:mrn:iala:sr:igr:cc:st:prt:bth:12345:vsn where

- "mrn" denotes that this is a Maritime Resource Name
- "iala" denotes the international organization that owns the register of ship report templates (i.e. IALA)
- "sr" denotes that this is a Ship Report Template
- "igr" denotes that this is a ship report template that is required to be submitted when entering a Inter Governmental Region (IGR, i.e. "Schengen", "Strait of Malacca", etc.). A standard list of abbreviations of IGR's should be maintained and kept up to date by IALA. If the report is not required by an IGR the the "igr" should be "999".
- "cc" denotes the code of the country that requires submittal of the report. The UN LoCode should be used for a country's code. If the report is required to be submitted for an IGR then "cc" should be "99"
- "st" denotes the State/Province that requires submittal of the report. The UN LoCode of the State/Province should be used to identify States and Provinces within a country. If the report is required to be submitted for an IGR or for all States/Provinces within country then "st" should be "99"
- "prt" denotes the UN LoCode of the port that requires the report. If the report is required by an IGR or all ports within a country or state/province then "prt" should be "999".
- "bth" denotes the berth/anchorage for which the report is required. The port's authority should be responsible to maintain and update its berth/anchorage codes. If the report is required to be submitted for all berths within a port then "bth" should be "999".
- "12345" should uniquely identify the report template within an Inter Governmental Region, Country, Port and/or Berth/Anchorage.
- "vsn" should identify the version of the required report template. The shore-based authority who requires submittal of the report should be responsible for the version number.

Use MRN in S-100 for persistent unique identifiers
MRN is an organized and structured identifier concept that is currently utilized in various e-Navigation projects, including Efficiensea2, STM Validation and SMART Navigation. IALA is also working out the utilization within their organization. The MRN method gives great flexibility and permits the reuse of existing unique identifier concepts, both nationally and internationally, that may simplify transitions. The MRN identifiers could be retained throughout a feature's lifecycle to give lineage and source origin, which can useful as the S-100 ecosystem expands. It therefore would be a good fit for S-100 as the recommended method of unique identifiers utilized within S-100 based product specifications and resulting products.

Information types can also use MRNs for persistent unique identifiers especially those which refer to identifiable sections of shipping regulations, legal codes, etc.

Other uses for MRNs
Other uses of MRNs in the S-100 ecosystem include:
- Catalogue items in feature catalogues - feature types, information types, associations, and roles in feature catalogues; e.g., urn:iho:def:s101:1.1::LandArea to mean the LandArea feature in the feature catalogue for revision 1.1 of S:101 (in any clarification of version 1.1).
- S-100 based product specifications (e.g., urn:mrn:iho:prd:s101:N:N:N or urn:mrn:iho:prd:s101:N.N.N to identify a specific version of S-101). We recommend that the structure be such that it is possible to use wildcards for clarifications at least (meaning, the clarification number at least should be a separate component which can be 'wild-carded' using the '::' construct).

Implementation considerations
XML syntax rules do not allow the ':' character in certain items such as attributes of the built-in XML type ID, and that when used in XML tags the ':' character is a namespace separator. This means that MRNs **cannot** be used as the value of any attribute of type ID (in particular, they cannot be used as the values of *gml:id* attributes, which are mandatory in the GML specification), nor can they be used in XML tags.

Data formats may benefit from devising compact representations that do not require encoding of the same prefix string e.g., "urn:mrn:iho:cc:" in every single feature or information type with a unique identifier.

Conclusions
The MRN concept has now matured significantly, and is set up with a basic management process. It offers a single system that allows stakeholders to specify identifiers in a uniform and unambiguous way, and should therefore be considered ready to be included in S-100.

Recommendations

- Add Maritime Resource Name as the recommended method of creating unique identifiers within the S-100 ecosystem as per change proposal in Annex B.

- IHO should apply for the urn:mrn:iho name space at **info@mrnregistry.org**

- IHO should develop a management process for the urn:mrn:iho name space.

Action Requested of TSM5
The TSM5 group is invited to:
   a.   Discuss the paper
   b.   Endorse addition of the MRN concept to S-100 as per change proposal in Annex B
   c.   Recommend to HSSC that IHO register for the urn:mrn:iho name space.
   d.   Recommend to HSSC that IHO establish a management process for the urn:mrn:iho name space.

Annex A

Maritime Resource Names (MRN)
draft-knielsen-mrn-urn-01

Abstract

   This document describes a Uniform Resource Name (URN) namespace
   intended for persistently and uniquely naming maritime resources.
   published by the International Association of Lighthouse Authorities
   (IALA AISM).

Status of This Memo

   This Internet-Draft is submitted in full conformance with the
   provisions of BCP 78 and BCP 79.

   Internet-Drafts are working documents of the Internet Engineering
   Task Force (IETF). Note that other groups may also distribute
   working documents as Internet-Drafts. The list of current Internet-
   Drafts is at http://datatracker.ietf.org/drafts/current/.

   Internet-Drafts are draft documents valid for a maximum of six months
   and may be updated, replaced, or obsoleted by other documents at any
   time. It is inappropriate to use Internet-Drafts as reference
   material or to cite them other than as "work in progress."

   This Internet-Draft will expire on December 15, 2017.

Table of Contents

1. Introduction

   IALA is a non-profit, international technical association founded in
   1957. It gathers together marine aids to navigation authorities,
   manufacturers, consultants, and, scientific and training institutes
   from all parts of the world and offers them the opportunity to
   exchange and compare their experiences and achievements.

   Although a lot of standardized identifier schemes for vessels, buoys,
   mariners and other maritime resources already exist in the maritime
   world. There is no single system that allows people to specify such
   an identifier in a uniform and unambiguous way.   We believe that it
   makes sense to introduce a naming scheme that can uniquely identify
   any maritime resource on a global scale. By maritime resource we
   more or less
   mean anything that has an identity of some kind. This could be
   organizations, employees, a person, a physical or a virtual object,
   for instance an electronic document, a buoy, a ship, a mariner, a
   nautical chart or an electronic service (e.g., "today's weather
   report for the Oresund Strait"). Not all resources are "retrievable"
   in an electronic sense; For example, human beings, corporations, and
   buoys. However, they can still be considered a resource.

   It is our opinion that having such a naming scheme will facilitate

innovation, integration, trade, safety, and security in the maritime
sector, by paving the way for new kind of maritime digital
information services.

This document defines such a standard naming system, based on Uniform
Resource Names (URNs).

2. Specification Template

Namespace ID

   "mrn"

Registration Information

   Registration version number: 1

   Registration date: 2017-xx-xx

Declared Registrant of the Namespace

  Registering organization:

   International Association of Lighthouse Authorities (IALA)

   10 rue des Gaudines

   78100

   St Germain en Laye

   France

   Email: contact@iala-aism.org

  Designated Contact:

   International Association of Lighthouse Authorities (IALA)

   Email: info@mrnregistry.org

<http://www.mrnregistry.org/>

Declaration of structure:

The Namespace Specific String (NSS) of all URNs that use the
"mrn" NID shall have 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

Basics of the ABNF notation used :

 " " literals (terminal character strings); terms not in quotes are
    non-terminals

 /   alternatives

 () indicates a sequence group, used as a single alternative or as a
    single repeating group

 <a>*<b> indicates that the following term or group can repeat at
      least <a> and at most <b> times; default values are 0 and
     infinity, respectively

 ;   comment

 <URN chars> As defined in [@!RFC2141]

Relevant ancillary documentation:

The process for assigning unique organizational IDs is managed by
IALA. Details and application process can be found at
<http://www.mrnregistry.org>.

Identifier uniqueness considerations:

Guaranteeing uniqueness is a two-way process. First, IALA will
guarantee that each organization will be assigned a unique
organizational id that will never be reused. Second, each

organization must guarantee that they do not assign identical
organizational specific strings (OSS).

Identifier persistence considerations:

Each individual organization must guarantee that assigned URNs
will not be reused and will remain valid beyond the lifecycle of
the referenced resources. However, it should be noted that
although the URNs remain valid, the status of the referenced
resource may change.

Process of identifier assignment:

While the assignment of OIDs for each organization is managed by
IALA. The assignment of organization specific namespace ids and
strings are fully managed by each individual organization.

Process of identifier resolution:

There are no plans to provide a general available resolution
mechanism. However, organizations are free to setup resolution
servers for all or part of the URNs assigned under their
organizational id.

Rules for Lexical Equivalence:

The entire URN is case insensitive.

Conformity with URN syntax:

   There are no additional characters reserved except as noted in the
   ABNF above.

Validation mechanism:

   In the case of each sub-namespace, there will be namespace-
   specific rules for determining validity. There are no plans to
   provide a central repository for these rules.

Scope:

   Global.

3. Examples

   All the examples provided in the following section are hypothetical
   examples. Real world naming schemes will most likely look different.

   Using the MRN identifier scheme a vessel with an IMO number of
   9743368 could be identified as follows:

     urn:mrn:imo:imo-number:9743368

   The governing organization of how to assign IMO numbers is the
   International Maritime Organization (IMO). IMO may have delegated
   the actual assignment of numbers to another organization. But IMO is
   still the organization who has determined that an IMO number is an
   unique seven-digit number. Within the context of maritime resource
   names the organizational id (OID) refers to the organization who
   governs the syntax and rules of a particular resource type. In the
   above case the organizational ID is "imo".

   Each organization further divides the organizational specific string
   (OSS), which is the part following "imo", into two parts. An
   organizational specific namespace ID (OSNID) which is a unique
   identifier within the governing organization for a particular type of
   resource. In this example, we have used "imo-number" but it could

9

just as well have been "imonumber" or just "number".

The second part is the organizational specific namespace string (OSNS). Which is the only part that differs for resources of the same type, in this case it is "9743368". The organizational specific namespace string is (as the name implies) specific for a combination of a OID and OSNID. In this case the organizational specific namespace string is always a 7 digit IMO number.

Another way to identify the same vessel might be to use its MMSI number. Here the identifier could look like this:

  urn:mrn:itu:mmsi:538070999

In this case ITU is the governing body because MMSI numbers are based on recommendation M.585 from ITU. It might be that national bodies does the actual assignment of MMSI numbers, but ITU is the governing body for the standardization of MMSI numbers.

As can be seen from these two examples. The same vessel can be identified by multiple different identifiers. This is no different to a person who might be identified either by his driver license number or his social security id. Multiple identities can identify the same entity. Some parameters frequently used for identification, such as 'names of people', do most of the time qualify as identifiers, as they are not guaranteed to be unique. A single identifier must refer to one and only one identity.

The concept of URNs can be taken from a very coarse grained level to a very fine grained level. For example, a container ship might be identified by one of the two previous URL's. The containers aboard the ship might be identified with an URN adapting the ISO 6346 identifier scheme for container ids.

  urn:mrn:bic:container-id:csqu3054383

Finally, individual items in a single container might be identified by another URN scheme. It might even be possible to integrate with

URNs defined outside of the urn:mrn namespace. For example, all
items in a container might be identified by an electronic product
code ([RFC5134]). In other words, the usage of URNs as identifiers
are not limited to those defined within this document. In the future
other non-maritime sectors might even adopt similar naming schemes
based on URNs to facilitate easier integration across sector
boundaries.

An identifier does not need to be a physical object, but can be a
virtual item such as an electronic document. For example, IMO might
decide that all of their documents would use a "publications" prefix.
So

    urn:mrn:imo:publications:if110s

would refer to the publication "IMO SOLAS Consolidated Spanish
Edition, 2014 IF110S"

On the other hand an organization such as IALA might decide that all
of their publications would follow another format where the category
of the publication is included in the identifier. For example, a
recommendation could be

    urn:mrn:iala:publications:recommendation:e-nav-140

while the identifier of a guideline might be written as

    urn:mrn:iala:publications:guideline:synchronisation-of-lights-1069

As can be seen from the previous example the Organizational specific
namespace string can be split into multiple hierarchies. It is all
up to the governing organization how they want to structure their
identifiers.

Another example of identifiers with multiple hierarchies could be an
identifier scheme for lights and buoys. Here IALA could choose to
let the OSNS consist of <CountryCode>:<National Identifier>. For
example

    urn:mrn:iala:aton:us:1234x5

There are no requirements that organizations are permanent entities. For example, the European STM Validation project could choose to use "stm" as their organizational id. So, for example, a voyage id in this project might look like

urn:mrn:stm:voyage:id:xcus231230

Internally in the project they can use xcus231230 to refer to a voyage plan. But when working with external systems or other projects the full URN can be used in case other projects uses another type of identifier for a particular voyage.

As can be seen from all these examples. The scheme is highly adaptable. Each organization can choose their own layout for a specific type of identifiers. It is easy to fit existing identifiers into the naming scheme. And it provides good context information about the type of the identifier in comparison to something simple like a random UUID.

4. Namespace Considerations

IALA traditionally addresses the maritime community, but its resources are made available to all interested parties. While URN namespaces may exist for which any generic naming system can be encoded. Is is the goal of IALA to foster a community around maritime resource names within the global maritime community. Therefore, the possibility of binding to various other namespace repositories have been deemed impractical.

5. Community Considerations

Members of the IALA community will benefit from persistent and globally unique identifiers for use in software and in conformance with protocols developed and used by IALA and third-party collaborators.

While in general organizations will be free to structure their organization specific namespace in any way they see fit (as long as they guarantee uniqueness and persistence). It is our intention to provide general guidelines and best practices in the future. For example, encouraging that every organization use "publications" as the organization specific namespace id for referring to official publications from them. Or that every identifier that refers to a country uses standards available in ISO 3166 for the representation of names of countries and their subdivisions.

6. Security Considerations

There are no additional security considerations other than those
normally associated with the use and resolution of URNs in general,
which are described in [RFC1737], [RFC2141], and [RFC3406].

7. IANA Considerations

This document defines a URN NID registration that is to be entered
into the IANA registry of URN NIDs. It specifically requests the MRN
NID.

8. Normative References

[RFC1737] Sollins, K. and L. Masinter, "Functional Requirements for
           Uniform Resource Names", RFC 1737, DOI 10.17487/RFC1737,
           December 1994, <http://www.rfc-editor.org/info/rfc1737>.

[RFC2141] Moats, R., "URN Syntax", RFC 2141, DOI 10.17487/RFC2141,
           May 1997, <http://www.rfc-editor.org/info/rfc2141>.

[RFC3406] Daigle, L., van Gulik, D., Iannella, R., and P. Faltstrom,
           "Uniform Resource Names (URN) Namespace Definition
           Mechanisms", RFC 3406, DOI 10.17487/RFC3406, October 2002,
           <http://www.rfc-editor.org/info/rfc3406>.

[RFC5134] Mealling, M., "A Uniform Resource Name Namespace for the
           EPCglobal Electronic Product Code (EPC) and Related
           Standards", RFC 5134, DOI 10.17487/RFC5134, January 2008,
           <http://www.rfc-editor.org/info/rfc5134>.

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13

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Annex B

Title: Maritime Resource Name (MRN) concept

S-100 Maintenance - Change Proposal Form

Organisation	NOAA	Date	8/03/2017
Contact	Julia Powell	Email	Julia.Powell@noaa.gov

Change Proposal Type *Select only one option*

1.Clarification	2.Correction	3.Extension
		X

Location *Identify all change proposal locations*

S-100 Version No.	Part No.	Section No.	Proposal Summary
3.0.0	3	3-10 Instance Identifiers	Add new section to explain MRN concept.
3.0.0	11	11-7.4 Object identifiers	Amend section to recommend MRN concept as preferred method of creating unique identifiers.
3.0.0	11	Part 11, Annex	Add new annex with guidance on unique identifiers.

Change Proposal

Please provide a detailed change proposal.

Add new section (3-10 Instance Identifiers) to establish recommend the inclusion of identifiers in data models and that these should follow the MRN concept. See attachment for full text.
.
Amend section 11-7.4 to recommend the use of the MRN concept when creating unique identifiers, as well as adding recommendations to how identifier management should be implemented in a product specification. See attachment for full text.

Add new Annex E to Part 11 to give guidance on establishing and managing unique identifiers concept. See attachment for full text.

Change Proposal Justification

Please provide a suitable explanation for the change and where applicable supporting documentation.

In line with action noted in minutes of S100WG1 regarding unique identifiers, the MRN concept is now sufficiently mature to be added to S-100 along with guidance for how to manage unique identifiers products created from S-100 based product specifications.

Please send completed forms and supporting documentation to the secretary S-100WG.

Add to S-100 Part 3.

3-10 Instance Identifiers

Identifiers of instances should utilize the Maritime Resource Name (MRN) concept and namespace. The MRN namespace is administered by International Association of Lighthouse Authorities (IALA) through the website http://mrnregistry.org, which also contain references to the full set of rules that apply to the MRN concept. The topmost namespace urn:mrn remains fixed, with subsequent name spaces separated by colons, and available through the application process explains on the website. Any organization wishing to issue MRN conformant identifiers should apply for a name space from IALA, or from an organization that already has a namespace registered. For example, IHO applies for a name space, and subsequently gives all member states a sub name space under the urn:mrn:iho name space; for NOAA this could be urn:mrn:iho:us and for CHS this could be urn:mrn:iho:ca. NOAA and CHS would then administer their respective name spaces as needed and within the MRN rules.

The following rules apply to the mrn namespace.

The Namespace Specific String (NSS) of all URNs that use the "mrn" NID shall have 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

Basics of the ABNF notation used:

" "	literals (terminal character strings); terms not in quotes are non-terminals
/	alternatives
()	indicates a sequence group, used as a single alternative or as a single repeating group
<a>*<b>	indicates that the following term or group can repeat at least <a> and at most <b> times; default values are 0 and infinity, respectively
;	comment

The entire URN is case-insensitive.

<URN chars> As defined in RFC2141

The process for assigning unique organizational IDs is managed by IALA. Details and application process can be found at <http://www.mrnregistry.org>.

Replace S-100 11-7.4 with the following text (new or revised portions are highlighted; deleted text is stricken);

The specification of persistent global identifiers for feature and information objects is strongly recommended. Identifiers need not be defined where the physical realities dictate otherwise or it is known that a reference to the object will not be needed, even from an as-yet-unknown external dataset conforming to another product specification. For example, identifiers need not be defined for cartographic objects.

Identifiers of instances should utilize the Maritime Resource Name (MRN) concept and namespace. The MRN namespace is administered by International Association of Lighthouse Authorities (IALA) through the website http://mrnregistry.org, which also contain references to the full set of rules that apply to the MRN concept. The topmost namespace urn:mrn remains fixed, with subsequent name spaces separated by colons, and available through the application process explained on the website. Any organization wishing to issue MRN conformant identifiers should apply for a name space from IALA, or from an organization that already has a namespace registered.

It is not required to encode all feature instances with the whole MRN string, provided the whole string can be recreated, for example by utilizing metadata. Data volume savings can be obtained by utilizing such mechanisms. Furthermore, technical issues such as GML restricting the use of ":", may be surmounted by this approach.

If there are technical reasons why the MRN concept cannot be utilized, other means for persistent global identifiers should be established. One way to implement persistent global identifiers is by defining a namespace and a persistent unique local identifier for individual feature or information types. The persistent global identifier can be constructed by combining the namespace with the local identifier. Local identifiers must be unique within the namespace for the lifetime of the feature or information object.

The local identifier must be an attribute of feature and information data objects whenever it is defined. The persistent global identifier need not be a data object attribute if the namespace portion can be computed from metadata. Namespaces may be specified by construction, for example a rule describing how to construct a namespace from available metadata. Product Specifications must specify how persistent global identifiers are to be constructed from namespace and local identifiers. ~~It is recommended that the resulting persisting global identifier be a "HTTP URI" (i.e., a URL) or a URN. IETF documents RFC 3986 and RFC 2141 describe the appropriate semantics and structure.~~

Product Specifications should note that location-based identifiers may not be sufficient to disambiguate data objects, because (for example) two agencies might issue AtoNs in the same area, for example physical buoys marking a channel and a virtual AtoN marking section of the channel with low air draft. Updating and normalizing the data in this case must take into consideration that the two items have similar characteristics (location, aids to navigation, etc), but are different items. Therefore, a location based identifier is likely not enough to enable a link between data.

Add to S-100 Part 11 as new Annex E; Guidance on Unique Identifiers

A major benefit of the S-100 framework is that products can be produced which can be displayed together on one screen such as in a ECDIS or VTS monitoring system. That necessarily requires a regime which enables an S-100 based system to operate with different products simultaneously. The challenging aspect of operating with different products simultaneously, is to find a solution that allows exactly one instance of a data within the system and which might be used by various products. In an S-100 environment, the data originators provide the data and these data could be used for various products without direct influence by a hydrographic office. As long as the data are based on the same framework and if they use the same identifier, the data exchange and data processing in this supply chain is relatively simple.

It is important to preserve identifiers in data products to assist in identifying data objects which describe the same real-world entity between different datasets, especially datasets from different specifications. E.g. Identify instances of the same restricted area between ENC (S-101) and Marine Protected Area (S-122) datasets in an ECDIS. Another principle for preserving instance identifiers is to assist in identifying associated instances between datasets, especially datasets from different specifications. E.g. S-124 marking a light as out of order. This navigational warning could be used to mark the issue in S-201, S-125 and S-101. Note that this requires the identifiers to be preserved so that the system can link the related feature instances.

Persistent unique Identifiers would reduce the workload and likely issues with translation tables which have to be developed and to be maintained if various stakeholders use different Identifiers for the same feature; e.g. a light has an IALA Identifier (created by a coastal authority) and a HO Identifier. The use of unique Identifiers will become more important the more the interoperability between various products within an S-100 based environment evolves. Thinking interoperability to the last consequence, the clear and standardised definition of the Unique Identifier's structure becomes essential within that structure, and it is recommended that the Maritime Resource Name (MRN) concept, see 3-10, be utilized as far as possible.

There are implications to establishing a regime of preserving persistent unique identifiers. These include;

- Implications for data maintenance; processes have to be established to preserve the persistent unique identifiers for features where the identifier is needed, and to do so through maintenance cycles. This means that the identifier remains as long as the feature remains, even when there are changes to the attributes of the feature. E.g. Status of a conspicuous building may change over time.

- Production system processes must be established to preserve the persistent unique identifiers of sources into product instances. If a source object is used to create an amalgamated feature (e.g. built up area is made up of all the buildings in the area, but need not show them individually), then the new feature should get a new identifier, and it may not be necessary to preserve the source object identifiers into the product.

- It may be prudent to establish product specific rules for when and how persistent unique identifiers change with object change. E.g. A platform is removed, does the remaining obstruction retain the identifier, or is it given a new identifier.

- Persistent unique identifiers may not give any indication of version/date of a feature instance. Guidelines should be established by stakeholders of products and object types for how to determine the most up to date instance if there are discrepancies between data objects which describe the same real-world entity between different datasets.

Persistent unique identifiers are likely to only be unique from the source originator. It is theoretically possible that two source originators generate different feature instances from the same real-world item. It is therefore important that stakeholders communicate, especially where among stakeholders that intend to provide data to the same end user systems. Communication should be aimed at understanding domains and working out interoperability issues.