INTERNATIONAL HYDROGRAPHIC ORGANIZATION

ORGANISATION HYDROGRAPHIQUE INTERNATIONALE

NAUTICAL INFORMATION PROVISION WORKING GROUP (NIPWG)

[A Working Group of the Hydrographic Services and Standards Committee (HSSC)]

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To NIPWG Members Date 8 August 2016

Subject: Provision of fuzzy area information)

References: NIPWG 2 minutes Annex 2 Action item 2/02, Minutes of DQWG 11 (item 8.2)

Dear Colleagues,

We all know that we have an information entity between charted information and information which is provided in textual format by NPUBs. Both sources have to be assessed to be able to navigate a ship safely.

The majority of charted information has a defined spatial extent. We know some examples where the information is unspecified (broken depth lines, undefined ice edges and a few others). That occurs mostly in remote areas. It doesn't happen in areas where well established shipping routes exist.

Contrary to charted information, NPUBs relatively often provide information which has no or unconfirmed spatial extent. This phenomenon is based on several facts, such as uncertain sources and environmental conditions.

The correct provision of these uncertainties in spatial determination of NPUB information has been intensively discussed during several NIPWG meetings. A request was addressed to the DQWG to provide a quality based solution for an uncertain spatial extent. The DQWG considered the examples provided by NIPWG, and responded that NIPWG should rather try to use the current S-100 based data model instead of introducing new data quality based solutions.

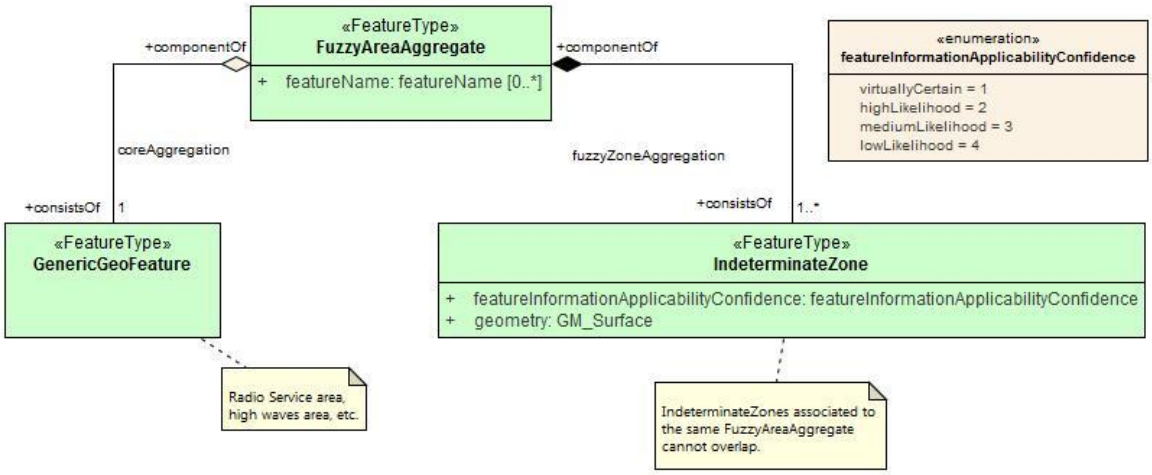
A small NIPWG project team discussed the various available options. Starting with a proposal to adapt the DRVAL1 and DRVAL2 system to provide percentage based confidence level information and assuming the continued use of the current approach to time and date ranges for time related information, the current status is to introduce various levels of likelihood to encode differences in information applicability over geographic space, and to use S-101 based quality information elements for encoding uncertainty in coordinate values.

This solution considers in the first instance the ECDIS users, who will not be forced to be study and remember an additional quality system, but can use the easily-understood high/medium/low scale. Furthermore, it considers the encoders who will have a realistic method to provide the information on best-guess basis.

The proposed solution consists of adding a generic feature type (**IndeterminateZone**) that allows datasets to encode areas where the encoder does not have complete confidence in the existence of the concept described by an associated geographic feature (**GenericGeoFeature**). The concept can be the availability of a service or the existence of a natural phenomenon (e.g., hazardous natural conditions), etc.

An aggregation feature (**FuzzyAreaAggregate)** is introduced in order to allow application schemas to model properties of the collection of core and fuzzy features (e.g., a collective name).

The general data model for the provision of the likelihood information will be as follows:



Understanding that it may not be possible for encoders to find or calculate numerical probability distributions for many fuzzy areas, the feature information applicability confidence attribute values are defined primarily in verbal form. The definitions will be:

1. Virtually certain: Virtually certain to be experienced by (or available to) an individual vessel; will be experienced by nearly all vessels. In statistical terms, this definition will correspond to 95% and higher probability of availability of service, or the phenomenon is encountered 95% of the time, or by 95% of vessels in the area.
2. High likelihood: Frequently experienced by (or available to) an individual vessel; experienced by a majority of vessels. This definition will correspond to 66% to 95% probability.
3. Medium likelihood: Occasionally experienced by (or available to) an individual vessel; experienced by (or available to) about half of all vessels. This definition will correspond to 33% to 66% probability.
4. Low likelihood: Unlikely, or rarely experienced by (or available to) an individual vessel; experienced by (or available to) a minority of vessels). This definition will correspond to 5% to 33% probability..

With the proposal on hand encoders have:

1. the ability to describe uncertainty of position by using S-101 elements (quality of horizontal measurement, horizontal position uncertainty, Quality of Non-Bathymetric Data, Spatial Quality).
2. with the assumption that the spatial extent is determined, the accuracy (i.e., reliability) of an information item can be indicated by enumerates, such as “reported”, “statistic”, full text”, “summary”, “actual” etc.

3. with the assumption that the spatial extent is fuzzy, the accuracy (or better, likelihood, reliability, or fuzziness) of the spatial information can be specified by using the fuzzy area application schema.
4. with the assumption that a mix of 2. and 3. exists, both solutions can be combined.

The project team is the opinion that the developed solution is a one-fits-all solution for NPUB information and that it could be used for all NPUB product specifications.

Knowing that we have only very few instances in NPUBs where the following information will be provided, and considering that the feature information applicability confidence attribute values could be applied anyway, the proposed solution does not fully cover all aspects of fuzziness (e.g., certain time-dependence or definitions of fuzzy terms) nor does it provide a full solution for exact representations of probability distributions over areas.

However, the proposal provides a relatively simple solution to the majority of the fuzzy spatial encoding problems encoders will realistically encounter in the foreseeable future.

Action on NIPWG

I would like to invite you to consider the proposed approach and to discuss that with your office colleagues who might be affected from this in the future.

A comprehensive paper which will discuss that proposal in more detail will be provided at NIPWG3.

Requests

The NIPWG is invited to take note on this paper and to provide feedback if appropriate. Due to the fact that the proposal will be discussed at NIPWG3, this NIPWG letter doesn't provide a feedback time.

Yours sincerely,

Jens Schröder-Fürstenberg, Chairman