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Binding Specific Concepts to Generic Concepts

<i>Submitted by:</i>	United States, NOAA National Weather Service Ocean Prediction Center and University of New Hampshire
<i>Executive Summary:</i>	A proposal to allow for specific concepts to be binded to generic concepts is presented below. The proposal suggests that attributes with a specific definition and usage could use a more generalized attribute or attribute set.
<i>Related Documents:</i>	All other S-100 product specifications and related Working Group documentation
<i>Related Projects:</i>	All other S-100 product specifications and related Working Group documentation.

Introduction / Background

In an effort to simplify concepts and reduce the complexity of product specifications, the Ocean Prediction Center and the University of New Hampshire (UNH) are proposing a modelling methodology that would allow generic concepts to be associated with specific concepts. This paper will give a brief summary of previous discussions on this topic in hopes to continue the discussion and find some resolutions as to how to move forward with data model development with methodologies that can be reused across all domains.

The IMO's e-Navigation concept seeks to integrate various disciplines using S-100 as a baseline. Because of this, a modeling methodology that supports the concepts traditionally defined by other disciplines while encouraging generic concepts usage should be considered. Additionally, a central point of IHO's S-100 is that it can accommodate change. We envision that a solution integrates specific traditional concepts and generic concepts, promotes harmonization and enables interoperability, while reducing overhead of harmonization efforts.

To demonstrate how effective the concept of reuse would be in this context, we will use an email exchange in December 2017 between the University of New Hampshire (on behalf of NIPWG) and the IHO Registry manager. A specific example arose regarding the various definitions that in essence were a term for "distance". Although each definition of distance is unique to it's domain at the product specification level, in essence, they all basically describe "A numerical description of how far apart two objects are". At the time of the email exchange, there were 22 separate distance concepts registered in

the IHO Registry. UNH's proposal introduced a supporting attribute `distanceType` which was an enumeration of possible definition uses for distance to allow for each domain to define its particular meaning.

It was noted in the email exchange that a possible disadvantage for this type of modeling (with a generic distance attribute with a distance type) is that it would be "more complex, and something that needs more consideration and discussion. For one, it adds another attribute (another two, if you define a complex attribute as a 'container' for distance and distanceType)." Although it was agreed the principle is a better way of modelling the real world, there is the reality that changing it now could hold up current product specification development. It was confirmed that it would be added to the IHO registry manager's holistic review of the contents of the registry.

In the interest of advancing S-100 based Product Specifications and acknowledging that there are issues with the FCD Register, the Registry Manager has been approving all submitted proposals unless it is an absolute duplicate (including bindings) of an already existing item in the Register. The intention is to rationalize this content into the new "Concept Register" in accordance with the final agreed Conventions and Guidelines (compilation of issues encountered). In the meantime, the Registry Manager is documenting any issues so far identified with the FCD Register.

Because best practices or the methodology for how best to utilize generalized concepts has not finalized and questions have again been encountered by the weather overlay (S-412) development team, it is hoped this paper will demonstrate the need to move forward with a solution on this matter so that S-412 product specification development will not be delayed. It is also recommended that the methodology presented below will be an official submission to the Registry sub-working group and accepted to allow generic complex attributes to be bound to more specific attributes.

Analysis / Discussion

While building the S-412 data model and grouping like items in the UML diagram, a pattern emerged exposing similar concepts used throughout the data model. It was evident that many features contained an attribute related to direction. Five complex attributes depicted in Figure 1 could all share a common definition of direction that contained three simple attributes. These three simple attributes would cover the needs of meteorology, including the distinction of whether the directional component is measured either from or toward. In addition to fulfilling the requirements of S-412, this attribution can support other concepts, including surface currents (S-111), course over ground, ice flows, drifting buoys, etc.

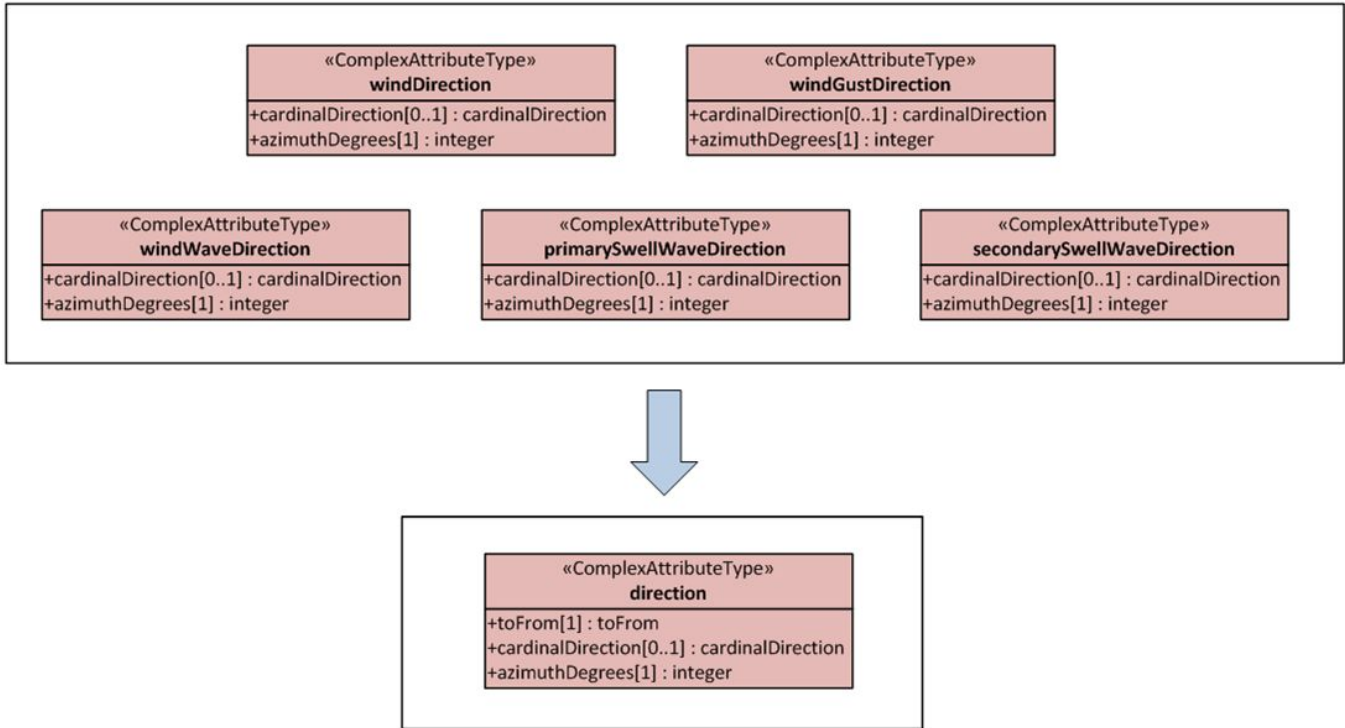


Figure 1 Multiple complex attributes simplified to a single complex attribute

In total, this methodology would allow 23 separate attributes to use 8 generic complex attributes in the S-412 product specification.

The S-412 model also had another example where reduction of attribute types would be possible with a velocity attribute. Figure 2 shows how this reduction and the new velocity complex attribute would be implemented following the proposed methodology.

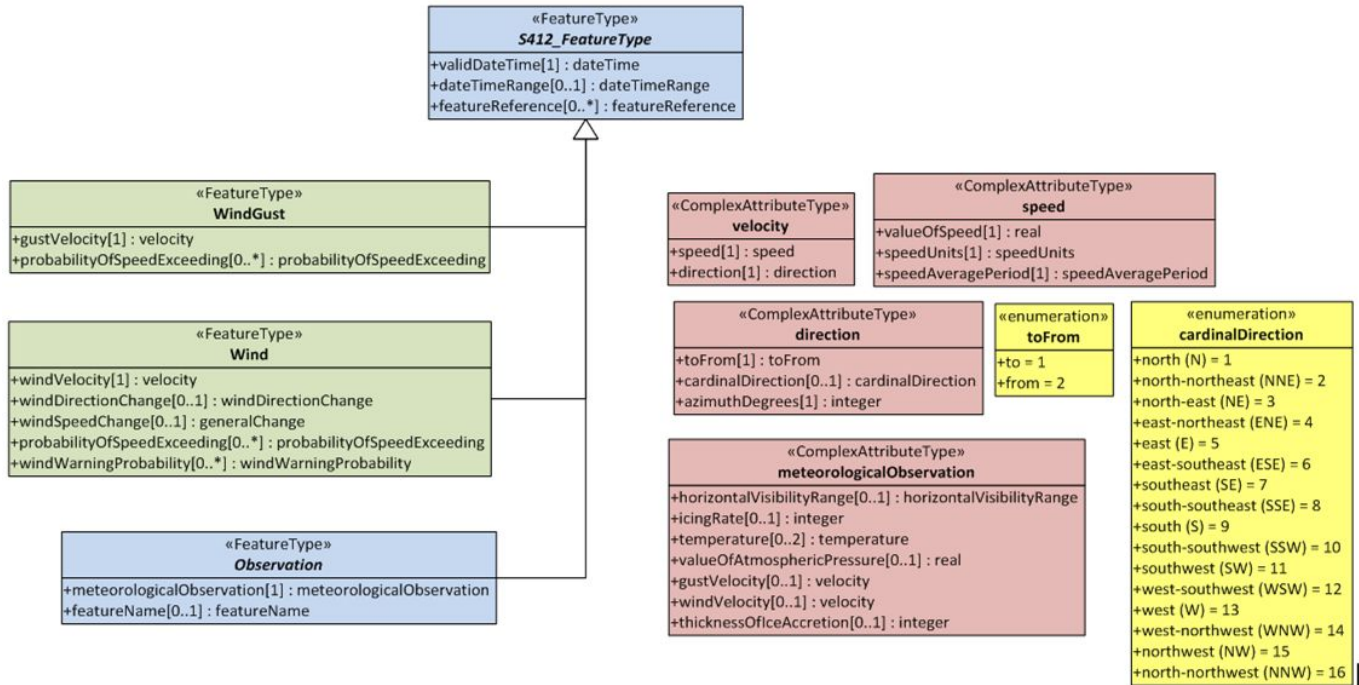


Figure 2. Multiple features utilize a velocity and direction complex attribute type for their specific attribute sets.

Justification and Impacts

This methodology simplifies the modelling of S-412, could simplify the modelling of other product specifications, and allow for generic concepts to be more widely used. It is envisioned that binding of this nature would require changes to the IHO Registry and Feature Catalogue Builder.

Distance and velocity, discussed in the previous section, are common among many S-100 products and the impact of the proposed methodology will certainly have an effect concerning those dataTypes. In order to understand the far reaching impacts of this proposal further, also depending on the outcome of the discussion on this subject, identifying other potential harmonized dataTypes should be a priority among S-100 based product specifications.

Conclusions

A methodology has been proposed that allows specific concepts to be associated to generic terms. Essentially, we are proposing a methodology that enables S-100-based complex dataTypes for concepts that are largely reusable across S-100 product specifications. A complex attribute can then use that dataType, giving a product specification the freedom to bind the complex attribute to its requirements.

Action required of S-100 Working Group

S-100 Working Group is invited to:

- a. Discuss options that encourage product specifications to use more general concepts
- b. Consider this proposal and provide feedback on S-412's usage of this data modeling methodology.
- c. If accepted, discuss best-practices measures for other products to adopt this methodology.