

Mastering Maritime Efficiency

The S-131 data model and potential for encoding of relevant Port information

- Background
- MHI Product Specification
- MHI Data model
- MHI Testbed

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The DYNAPORT project – webinar:
Digitalizing Nautical Communication
Between Ship and Shore with S-100.

May 14 2024

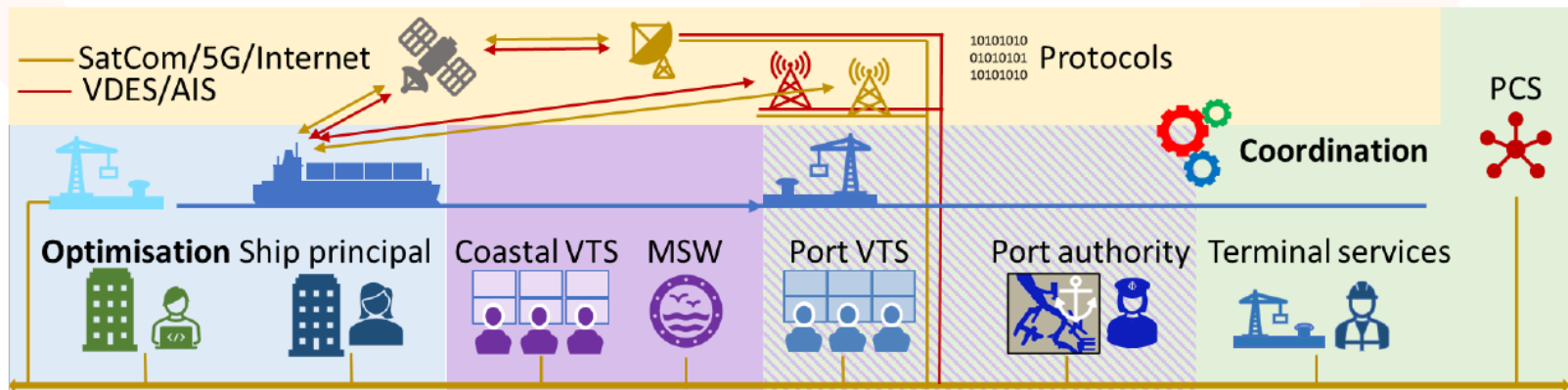
- ❑ Mikus Ranka
- ❑ Senior Geodata Consultant
- ❑ Electronic Chart Centre (ECC)/PRIMAR

- ❑ Mikus has been in the Nautical chart production since 2007, and from 2008 has been leading the Nautical Charting division in the Maritime Administration of Latvia Hydrographic Service overseeing all navigational Nautical publication production. Have been working also in Hydrographic offices of New Zealand and Denmark covering various positions and projects. From 2022 employed by Electronic Chart Centre (ECC) working as Senior Geodata Consultant with the tasks covering data validation, standardization and various projects. Mikus has been involved in various IHO standardization Working Groups since 2008 on behalf of the employing institution. Mikus is a Chartered Marine Technologist and a member of IMarEST since 2018.



Why S-131

DYNAMIC NAVIGATION AND PORT CALL OPTIMISATION IN REAL TIME



The challenge

- Coordination ship-port in voyage- & port call planning
- Hurry-up & wait
- Port congestion
- Inefficient port operations
- GHG emissions
- Supply chain deficiency

Project goal

- Timely, reliable, efficient information sharing
- Voyage optimization
- Port call optimization
- Integrated planning ship-port
- Improved nautical safety
- Communication standards

Expected impacts

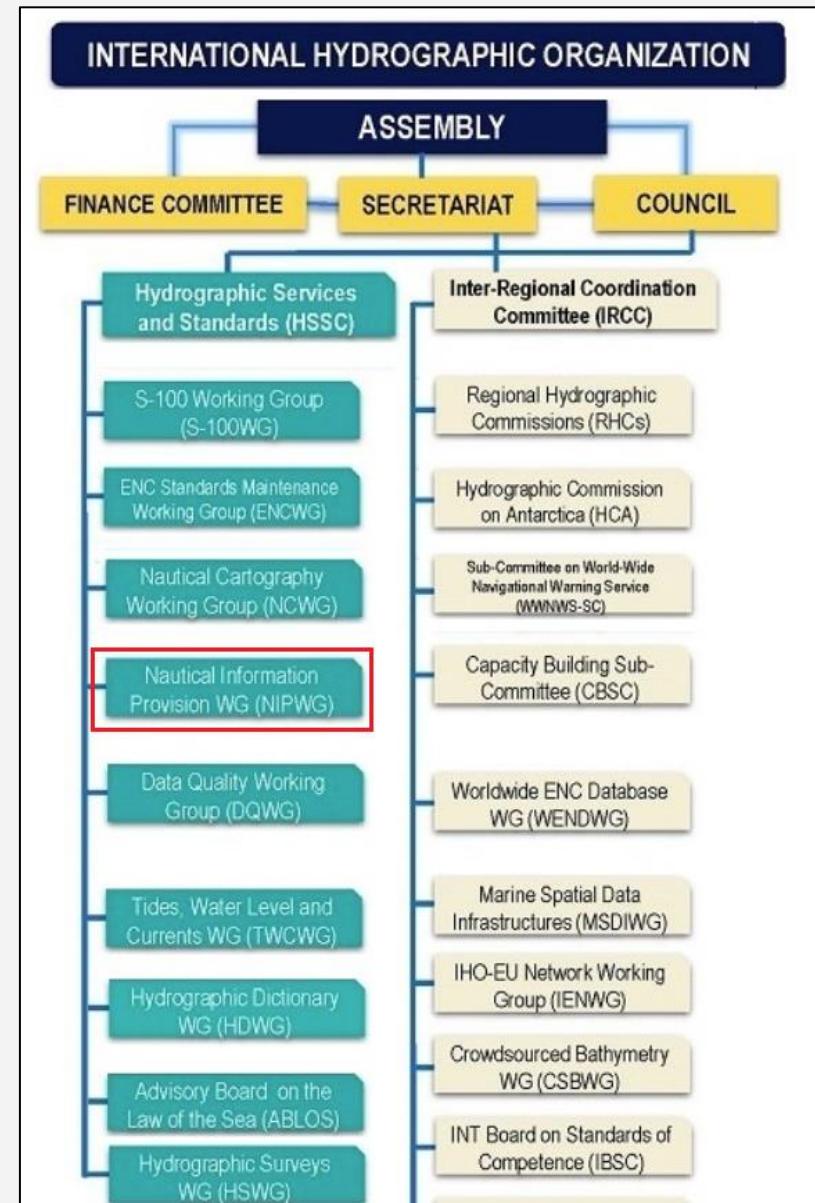
- Reduced GHG & harmful emission at sea and port
- Improved supply chain efficiency
- Reduced resources and energy waste
- Economic sustainability



“... Only official Nautical Publications fulfill SOLAS carriage requirements; unofficial Nautical Publications don't. ...” Port Information Manual for nautical data, v.1.1, 2022

Background

- Ongoing discussions since 2005 (IHO SNPWG/NIPWG).
 - International PORTCDM Council.
 - Port Manual information (2019) IHMA.
- NIPWG work on S-131 started 2020 (Commissioned by HSSC).
- WG participants:
 - IHO Member States
 - Industry (Port of Rotterdam)
 - Academia (UNH)
- Published edition: 1.0, March 2023 (*for testing and implementation purposes*)



S-131 Marine Harbour Infrastructure (MHI)

- S-131 is an S-100 standard based Product Specification (PS):
 - allows the content, the content definition (Feature Catalogues) and the presentation (Portrayal Catalogues) to be updateable without the implemented base system changes.
 - is a data product that can be used as a Nautical Publication Information Overlay (NPIO) within an Electronic Chart Display and Information Systems (ECDIS) or any other S-100 based marine navigation or shore-based systems.
 - is a vector (GML) product specification intended for encoding information relating to port and harbour facilities for facilitating berth-to-berth navigation.

S-131 Marine Harbour Infrastructure (MHI) (cont.)

- allows to encode the layout of ports and the availability of port services - facility locations, service areas, services offered, contact details.
 - is intended to be as a supplement to ENC (in ECDIS).
 - is built taking into account the Port Information Manual for Nautical Data of BIMCO, IAPH, IHMA, IHO, ITPCO
 - as independent dataset is also useful for shipping companies, brokers and other in the industry to optimize their planning.
- The Marine Harbour Infrastructure describes relevant data on **harbour infrastructure, facilities, services** and **regulations** in a standardized form.

S-131 Data or DB Scope

- Traditional harbour component of Sailing Directions/Coast, as well with IMO Resolutions A.893(21) berth to berth navigation and A.862(20) recommended contents in port information books
- From local fishing harbours to mega ports
- Improve the information exchange between harbours, hydrographic offices and end users by acting as a neutral repository of harbour information

Nautical data

- a) Port depths and water levels
- b) Port infrastructure
- c) Port information

Operational data

- a) Arrival / Departure times at berth and pilot boarding place
- b) Starting / Completion times of vessel and cargo services

Administrative data

- a) IMO FAL forms data
- b) IMO Port facility number

S-131 Data modeling

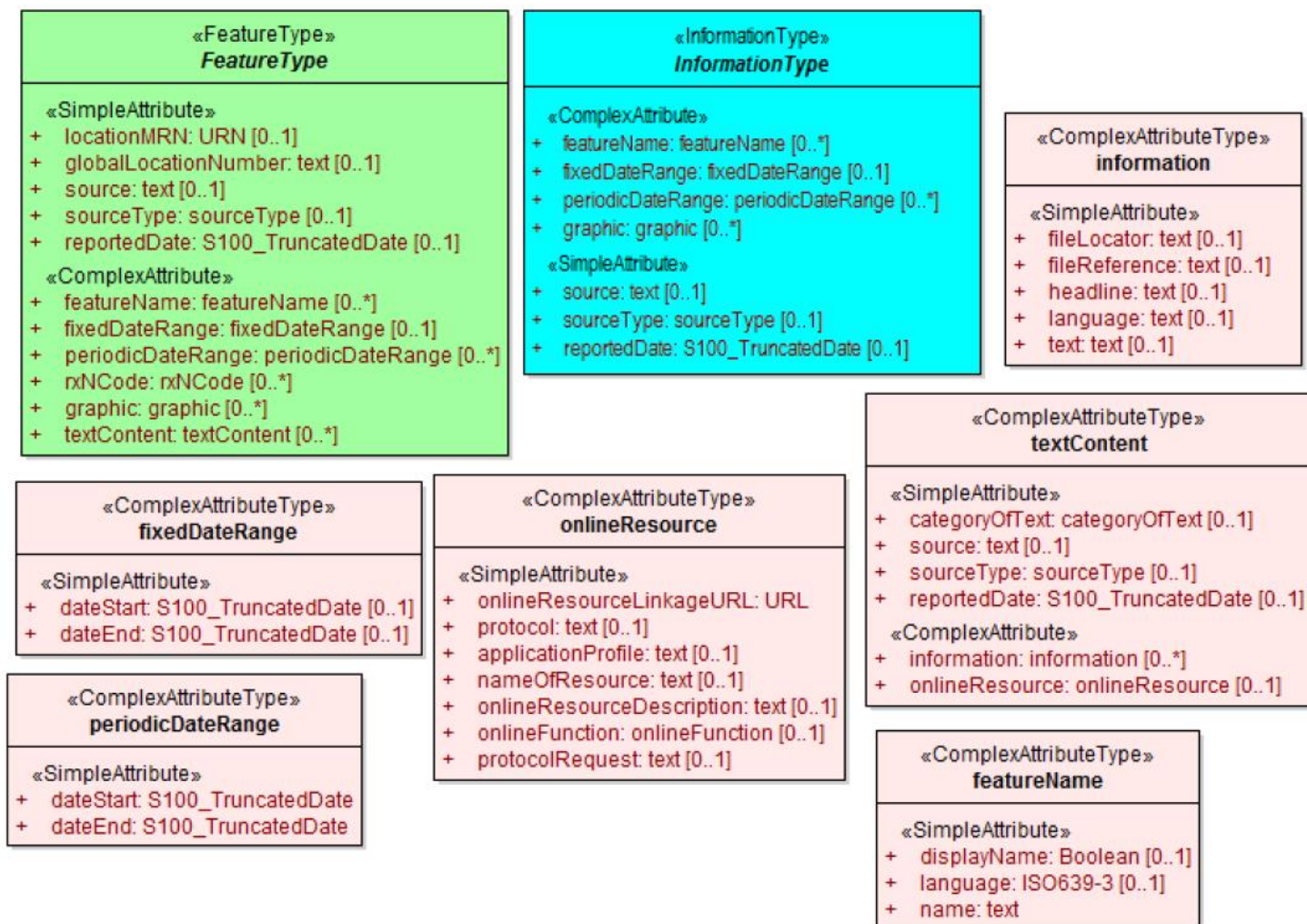
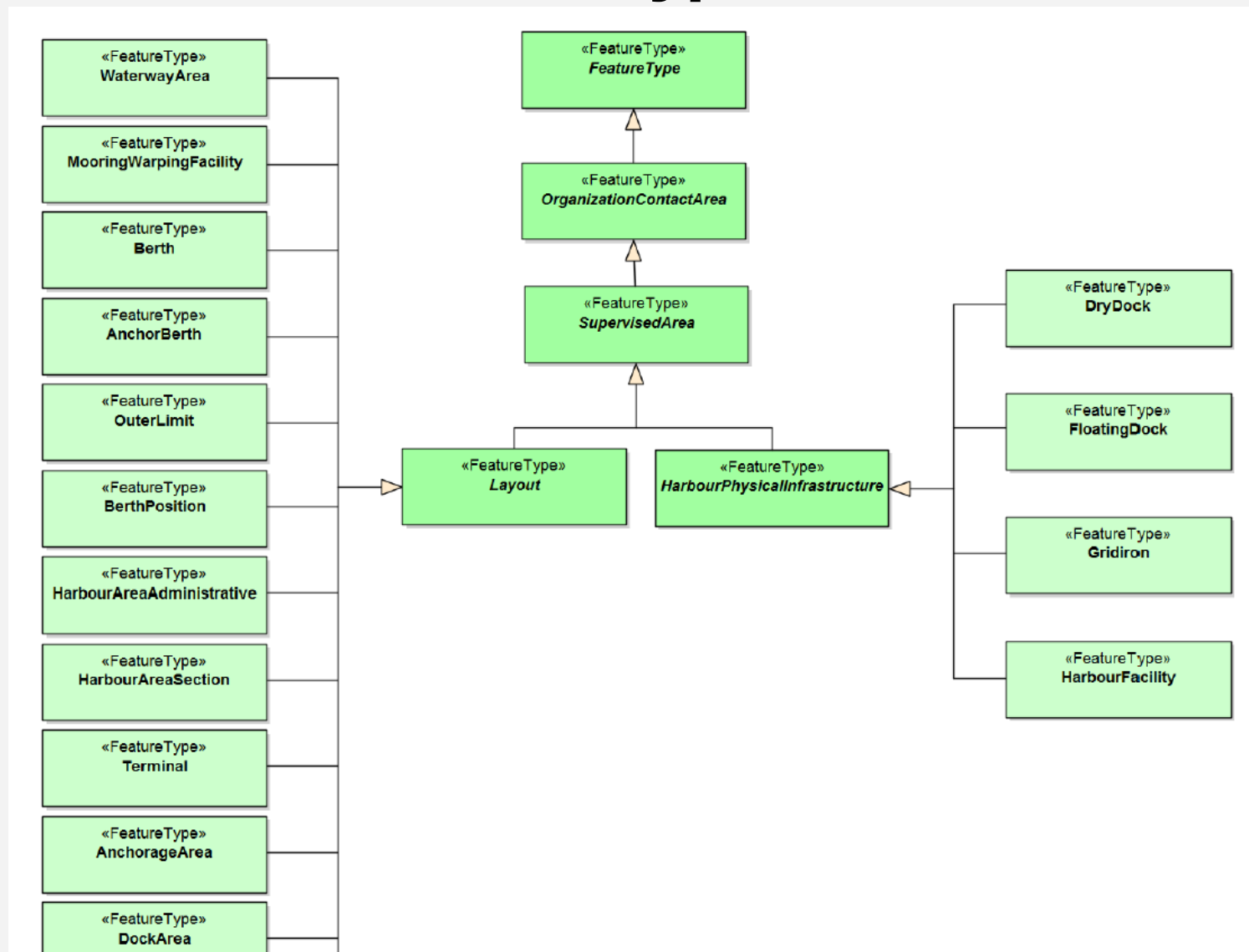
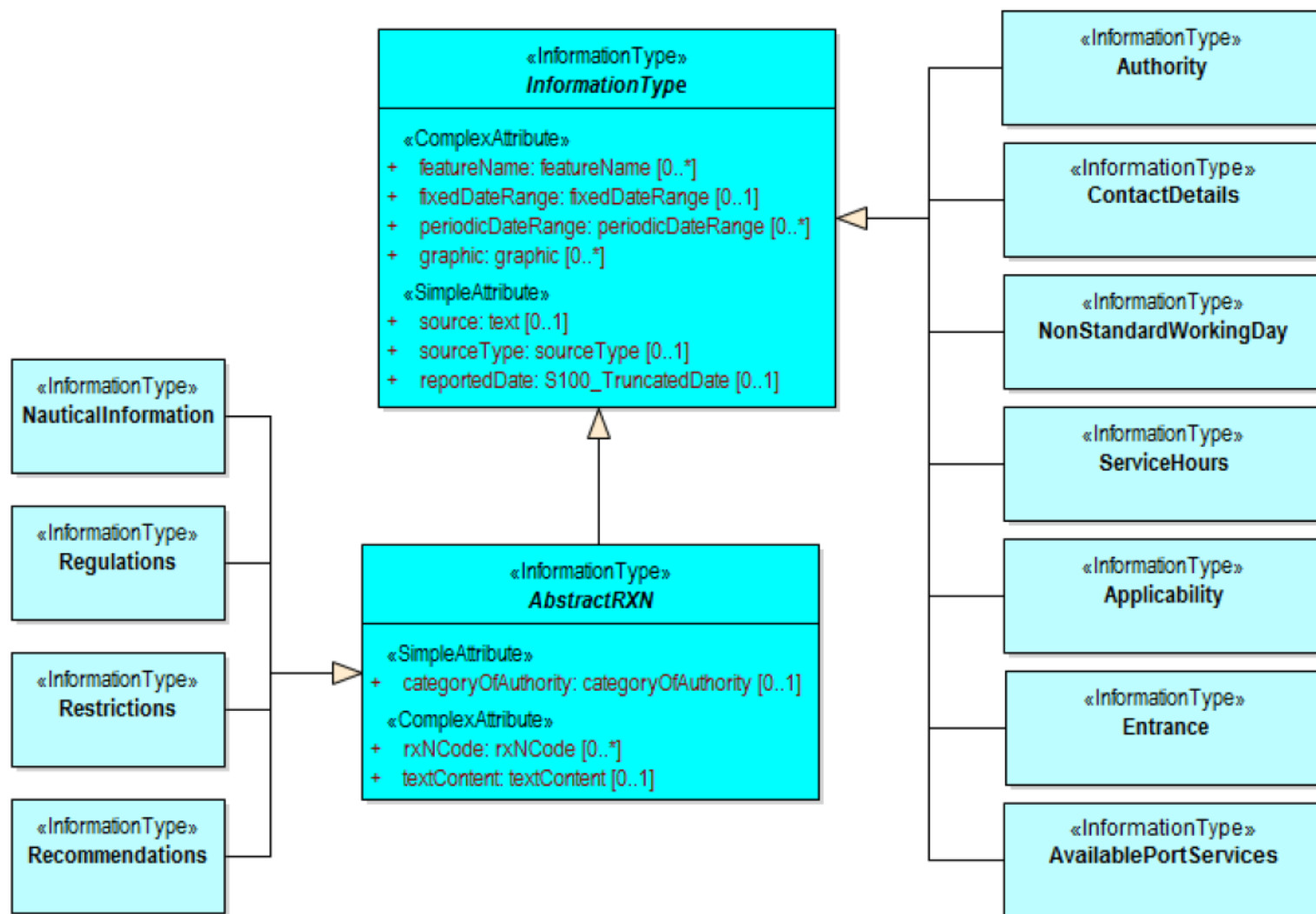


Figure 4.2 - Base classes in S-131

Attribute inheritance type model



Attribute inheritance type model



Data modeling examples - Associations

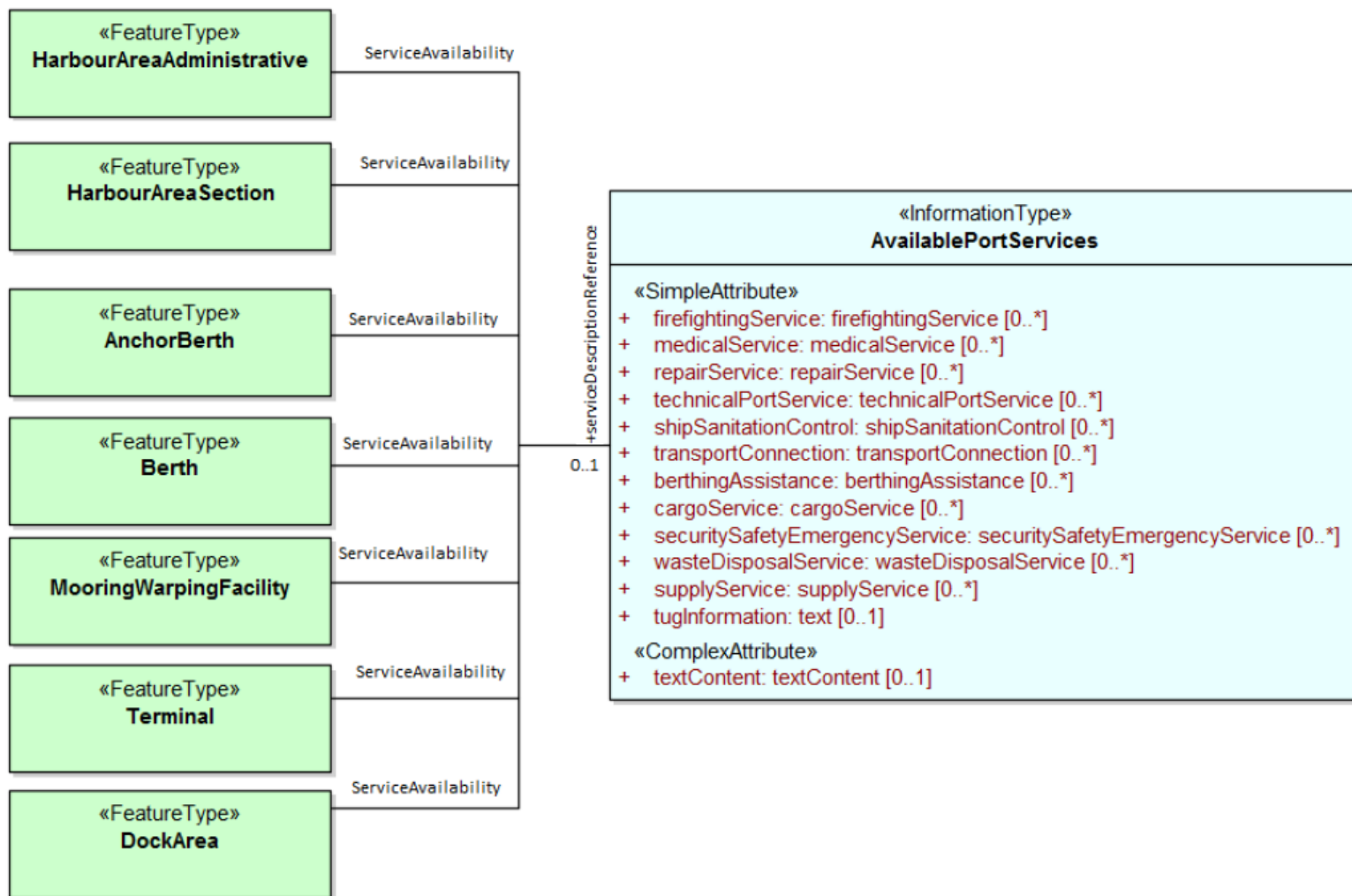


Figure 4.9 - Port services

Data modeling examples - Associations

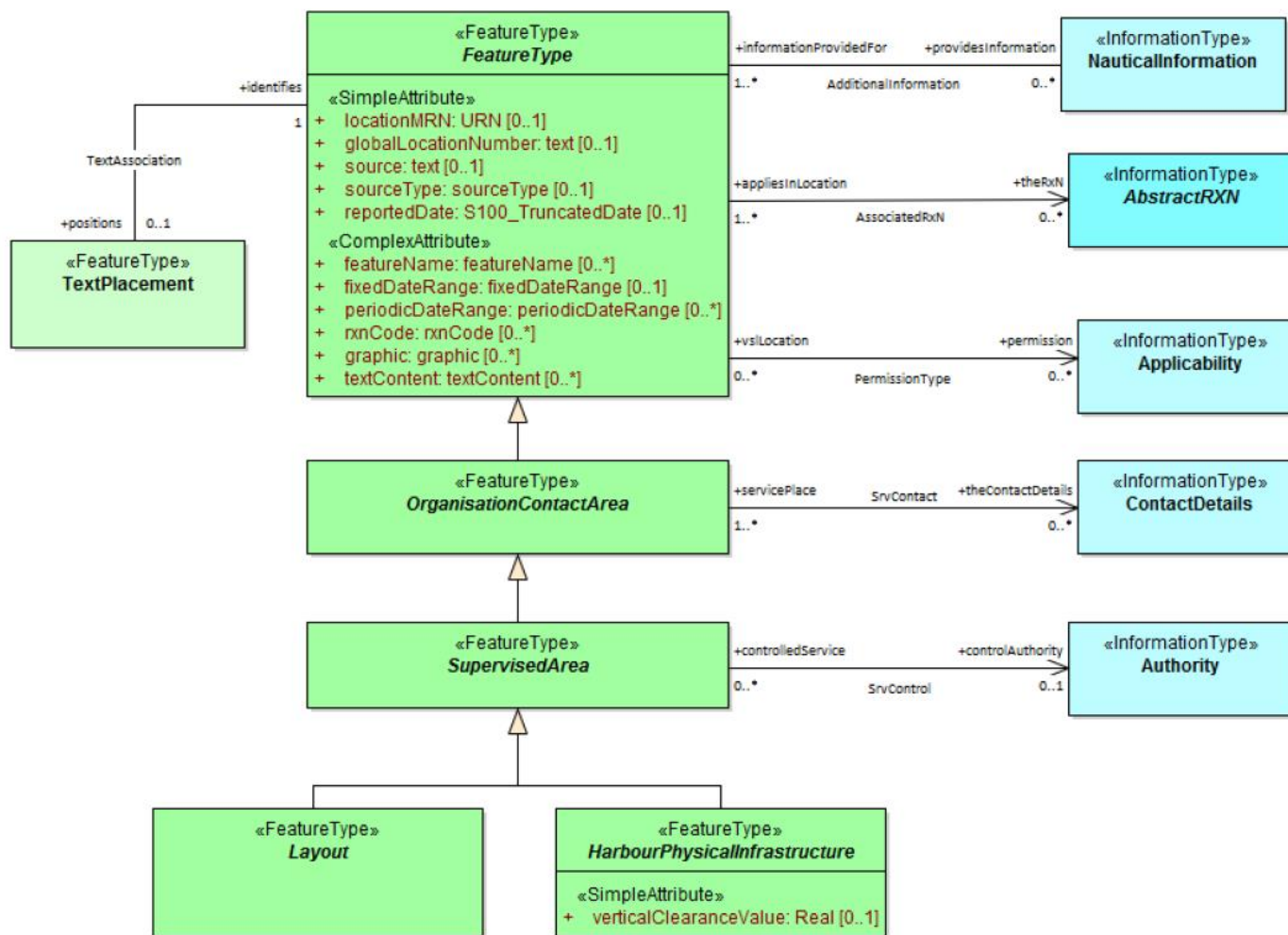
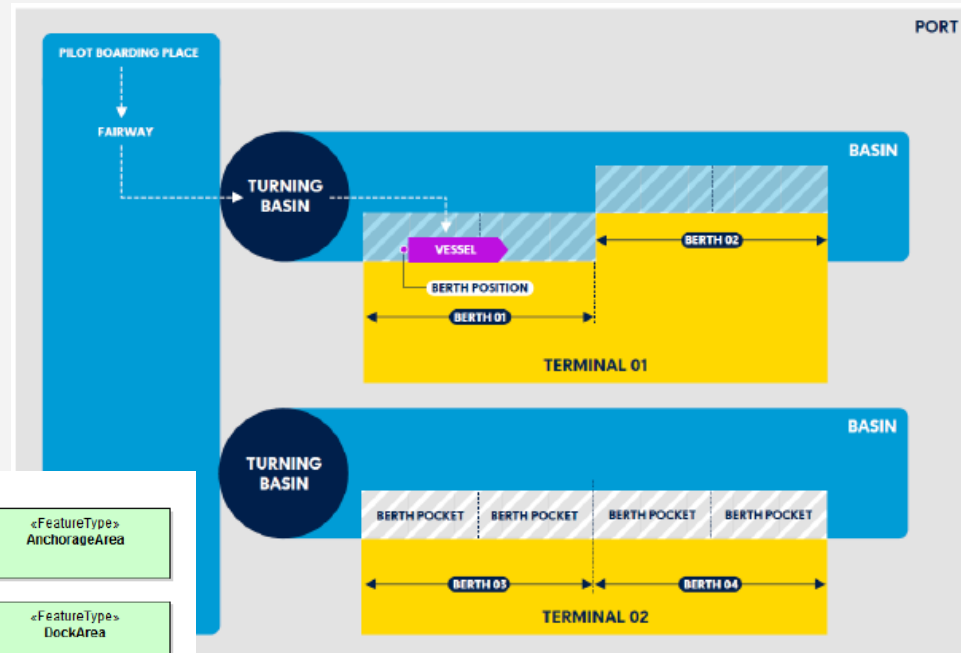
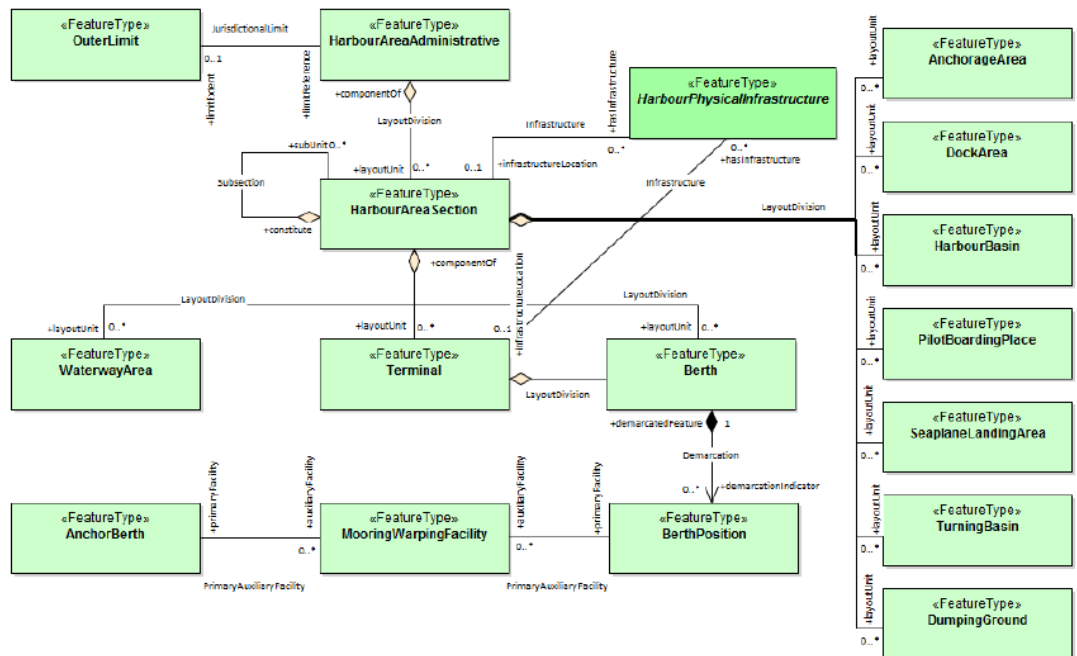


Figure 5.1 - Abstract feature types and their relationships

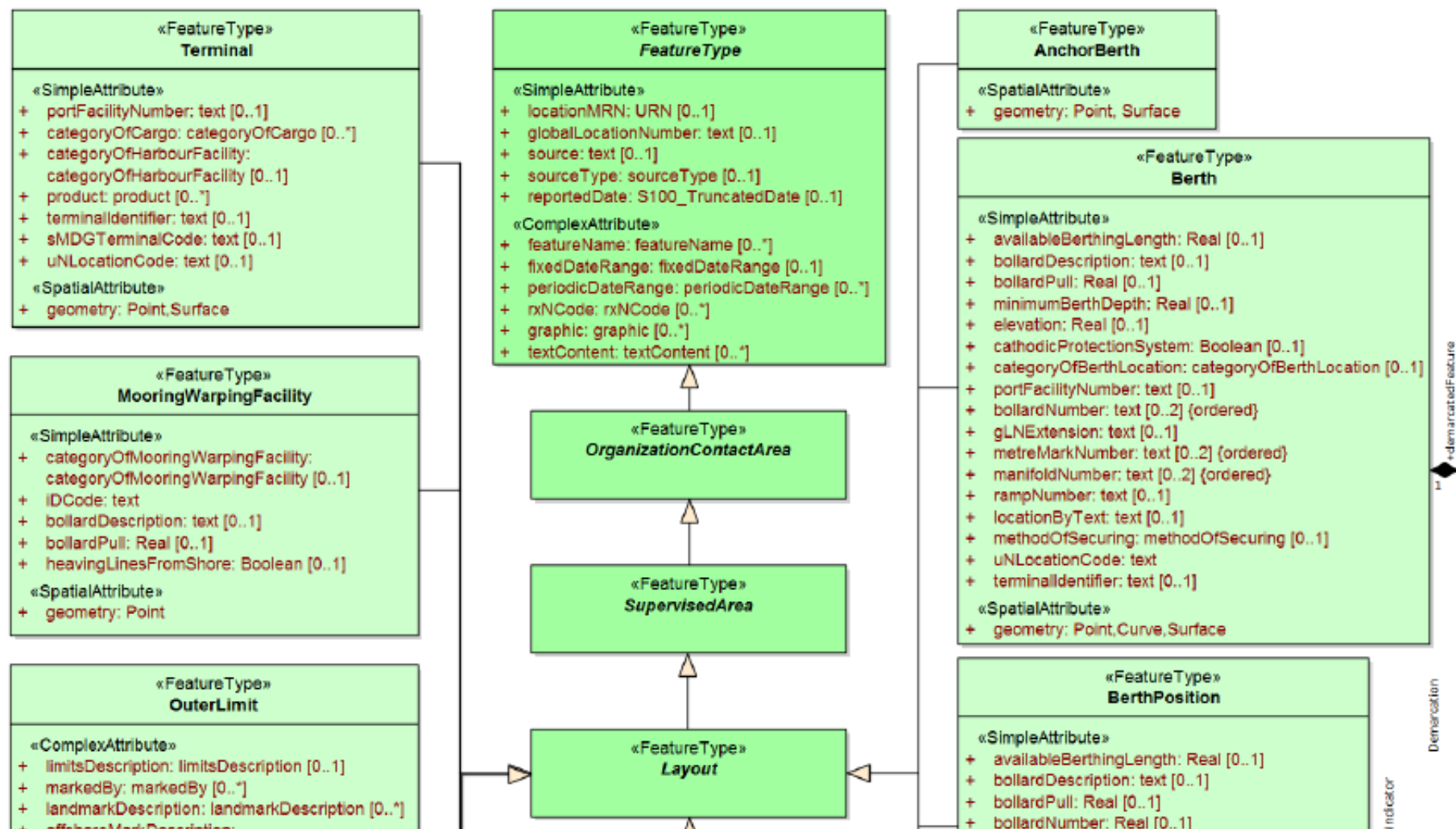
The diagram illustrates the relationships between various classes in the S100 standard:

- «FeatureType» FeatureType** (green box) is associated with **«InformationType» Applicability** (light blue box) via the **+appliesInLocation** association, with multiplicity **1..*** at FeatureType and **0..*** at Applicability. A note states: "any feature can have Applicability associated".
- «InformationType» Applicability** is associated with **«InformationType» AbstractRXN** (light blue box) via the **AssociatedRxN** association, with multiplicity **1..*** at Applicability and **0..*** at AbstractRXN.
- «InformationType» AbstractRXN** is associated with **«InformationType» Regulations** (light blue box) via the **+theApplicableRXN** association, with multiplicity **0..*** at AbstractRXN and **0..*** at Regulations.
- «InformationType» Regulations** is associated with **«InformationType» Applicability** via the **+isApplicableTo** association, with multiplicity **0..*** at Regulations and **0..*** at Applicability. A note states: "and other specializations of AbstractRXN".
- «InformationType» Applicability** contains two internal sections:
 - «SimpleAttribute»** with attributes:
 - + inBallast**: Boolean [0..1]
 - + categoryOfCargo**: categoryOfCargo [0..*]
 - + categoryOfDangerousOrHazardousCargo**: categoryOfDangerousOrHazardousCargo [0..*]
 - + categoryOfVessel**: categoryOfVessel [0..1]
 - + categoryOfVesselRegistry**: categoryOfVesselRegistry [0..1]
 - + logicalConnectives**: logicalConnectives [0..1]
 - + thicknessOfCap**: Integer [0..1]
 - + vesselPerformance**: text [0..1]
 - «ComplexAttribute»** with attributes:
 - + information**: information [0..*]
 - + vesselsMeasurements**: vesselsMeasurements [0..*]
- «S100_AssociationClass» PermissionType** (light blue box) is associated with **«InformationType» Applicability** via the **+permission** association, with multiplicity **0..*** at PermissionType and **0..*** at Applicability. A note states: "any feature can have Applicability associated".
- «S100_AssociationClass» PermissionType** contains a **«SimpleAttribute»** with attribute:
 - + categoryOfRelationship**: categoryOfRelationship
- «ComplexAttributeType» vesselsMeasurements** (light blue box) contains a **«SimpleAttribute»** with attributes:
 - + comparisonOperator**: comparisonOperator
 - + vesselsCharacteristics**: vesselsCharacteristics
 - + vesselsCharacteristicsValue**: real
 - + vesselsCharacteristicsUnit**: vesselsCharacteristicsUnit
- «S100_AssociationClass» InclusionType** (light blue box) contains a **«SimpleAttribute»** with attribute:
 - + membership**: membership
- «enumeration» categoryOfRelationship** (orange box) has values:
 - Prohibited = 1
 - Not Recommended = 2
 - Permitted = 3
 - Recommended = 4
 - Required = 5
 - Not Required = 6
- «enumeration» membership** (orange box) has values:
 - Included = 1
 - Excluded = 2

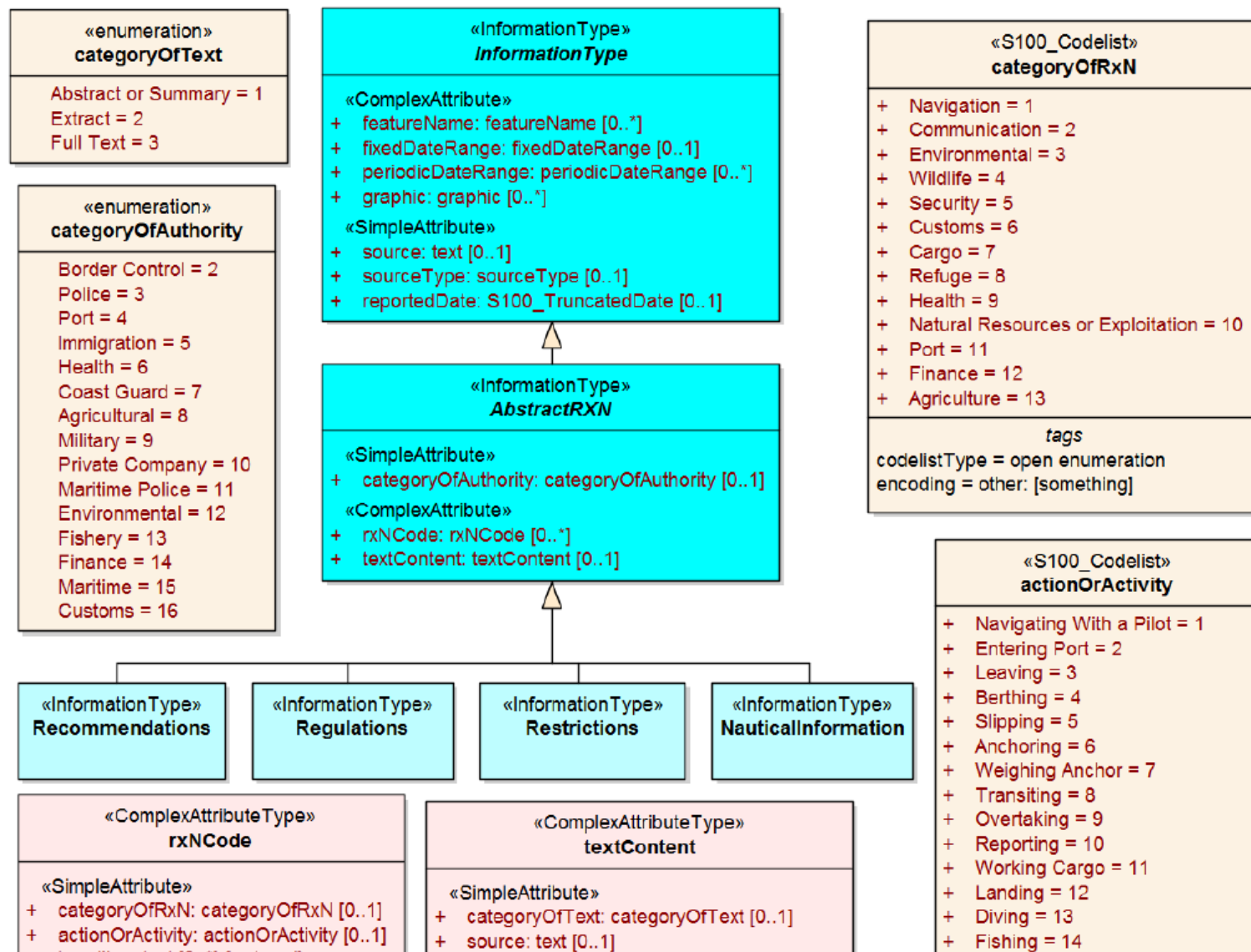
Data modeling examples - Associations



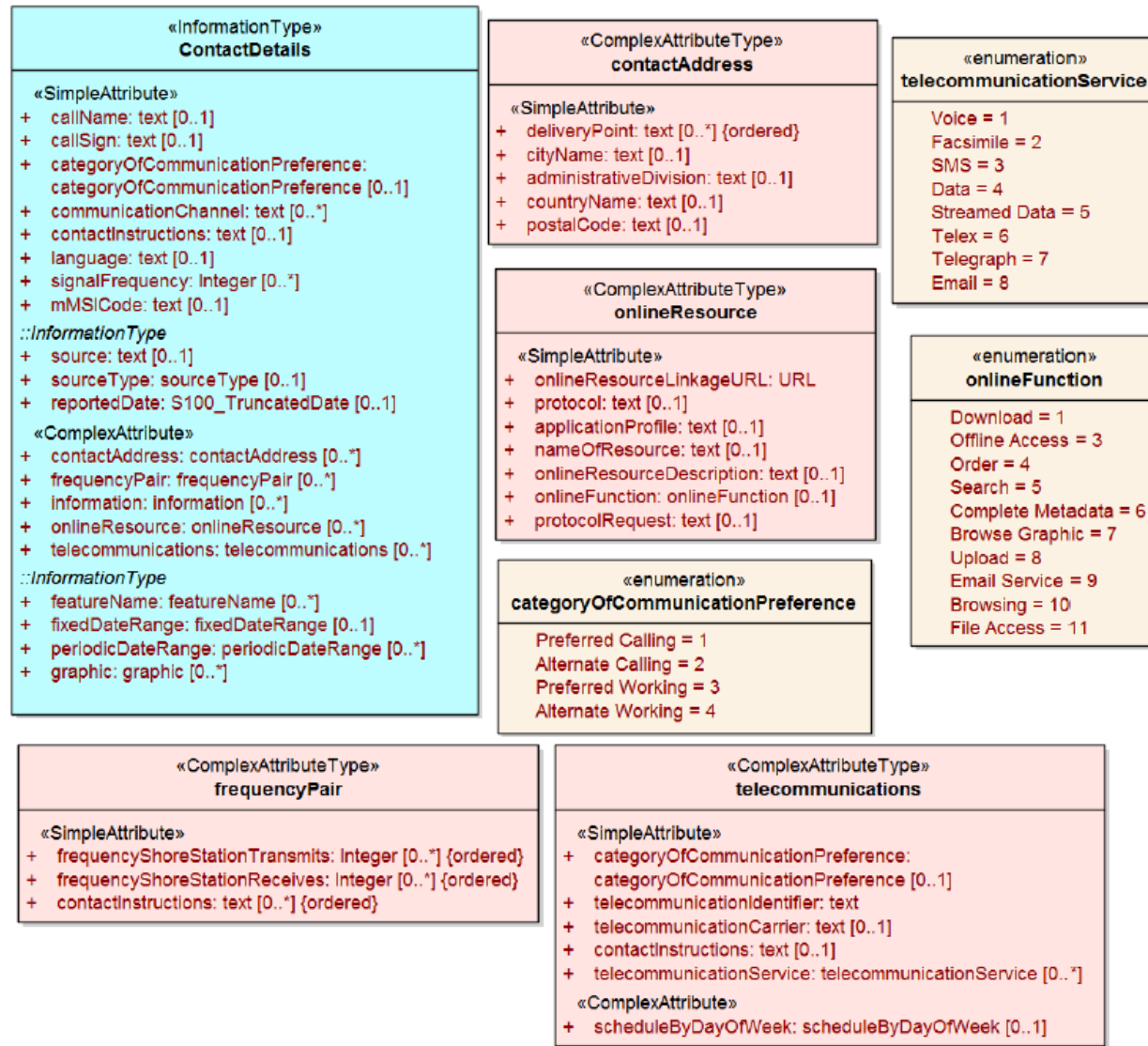
Some Feature type examples



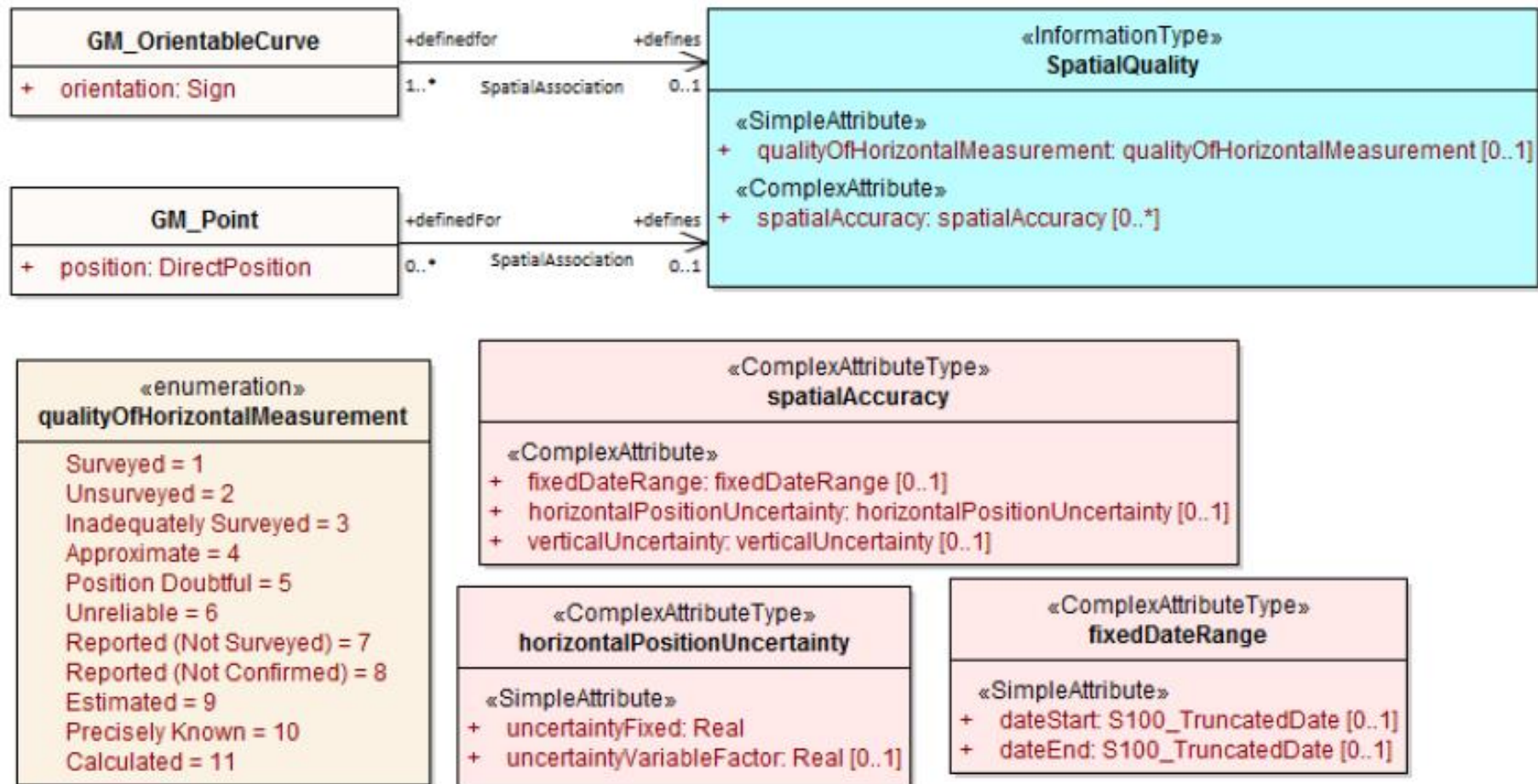
Information type example - Regulations



Information type example Contact details



Information type example Contact details



Attributes as Codelists

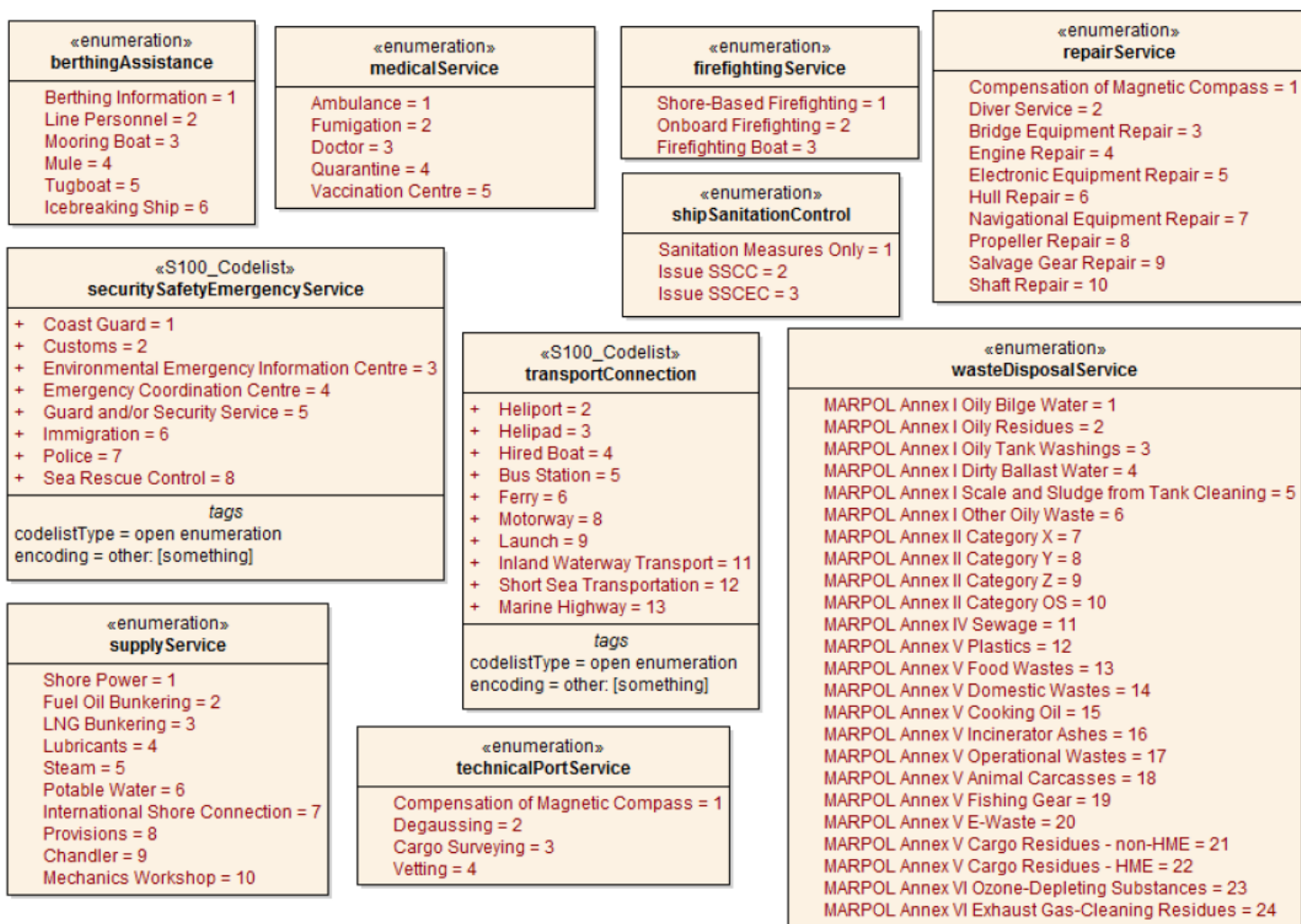


Figure 4.10 - Service enumerations and codelists

IHO S-131 Testbed

Action 5A: Continue to provide input to IHO S-131 for nautical data

On going

Paper specs are not sufficient.

Digital test-bed or public software is needed

Operational: API with Clarkson, MarineTraffic (Keppler), ISS

On 26/10/23 meeting re. API for S-131 testing with IHO

Investment API: less than building an app or a website

Initial testing Q1 2024

Initial demo Q2 2024

Between two trusted parties, digital corridor

Next step is how to connect 8000 ports – July 3 2024

Provinces and Territories of Canada / Provinces et Territoires du Canada

S-131

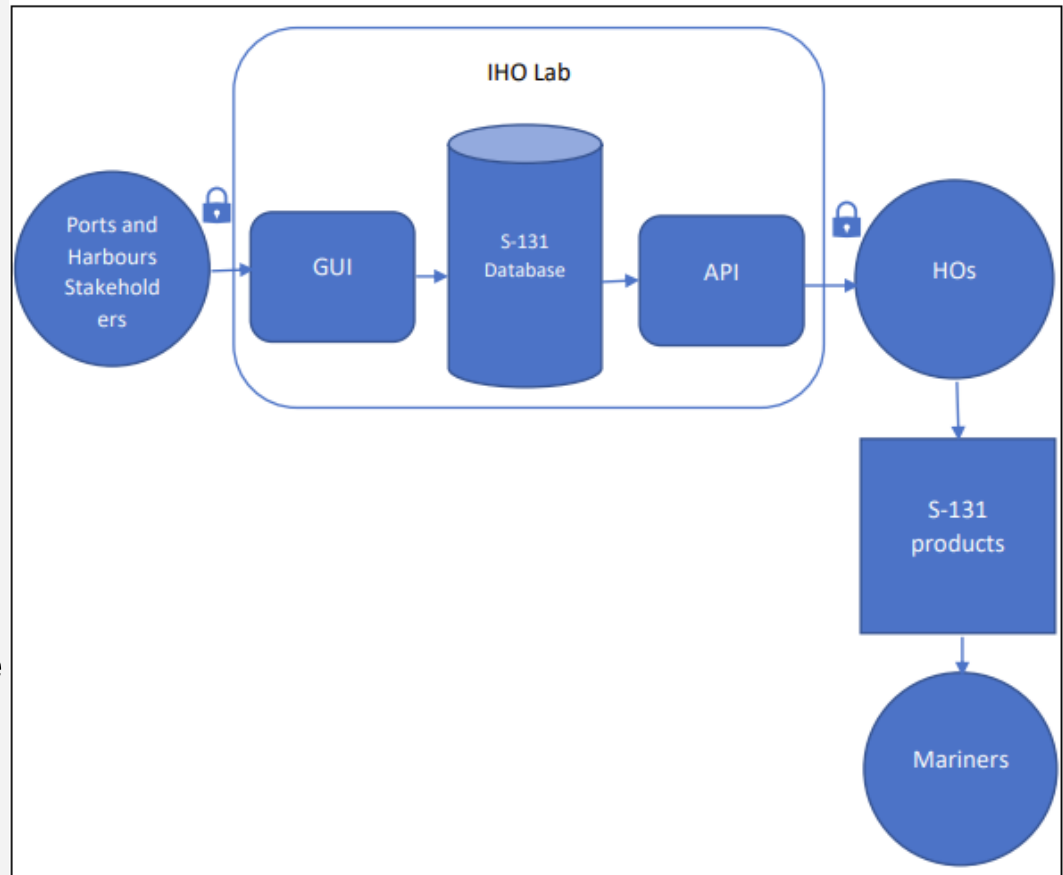
- S-131: Marine Harbour Infrastructure
- Dual purpose:
 - assisting data exchange
 - distribution to end users
- Development underway by S-131 project team under the IHO Lab

Canada

Canadian Hydrographic Service / Service hydrographique du Canada

Marine Harbour Infrastructure Database

- **Ports face difficulties when gathering data from all data owners in the port;** as the port authority is not data owner of all port data (e.g, terminals may be the data owner of the soundings of the berthing pocket).
- Marine Harbour Infrastructure database will facilitate the information exchange between harbours and HOs.



Visible & Interoperable Port Database

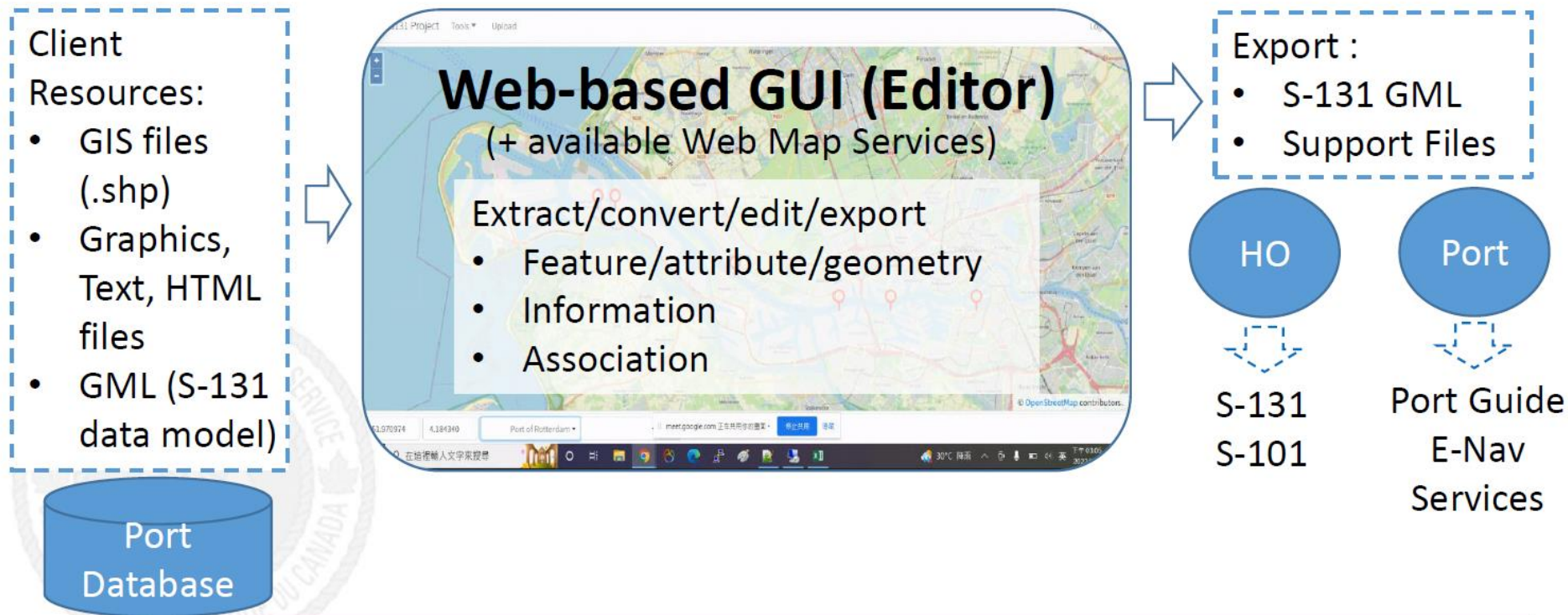
- S-131 Marine Harbour Infrastructure Database Project is the IHO-Singapore Innovation and Technology Lab Project
<https://iho.int/en/projects>.
- **Create a S-131 database infrastructure and a database** that will improve the information exchange between harbours and hydrographic offices by acting as a neutral repository of harbour information
- **Facilitate the exchange of information between harbours, HOs and port users**(e.g., mariners, shipping lines, trading floors) compliant with the S-101 and S-131 standards

Visible & Interoperable Port Database

- **Support the creation of S-131 (and S-101 ENC) products** that help ports and shipping to be compliant with IMO A.893(21): safe berth to berth navigation and IMO A.862(20): recommended contents of port information books.
- Demonstrating that Hydrographic Offices and Port Authorities have worked together to discharge their collective SOLAS responsibilities as per Chapter V Regulation 9: Hydrographic Services.

Visible & Interoperable Port Database

- Collaborative effort, Server: IHO Lab, Back end: IIC. GUI: NTOU, Feature Catalogue: Portolan Sciences, API – tbd(Swagger), Hydrographic offices (Canada, Norway, MPA, etc)



<https://www.port-data.net/s131/S-131 GUI UserGuide.htm>

www.port-data.net

S-131 Project

Database Resource View Save

https://www.port-data.net/s131/index/

Settings Help mikus.ranka@ecc.no

NOKRS - Kristiansand

Search

InformationTypes

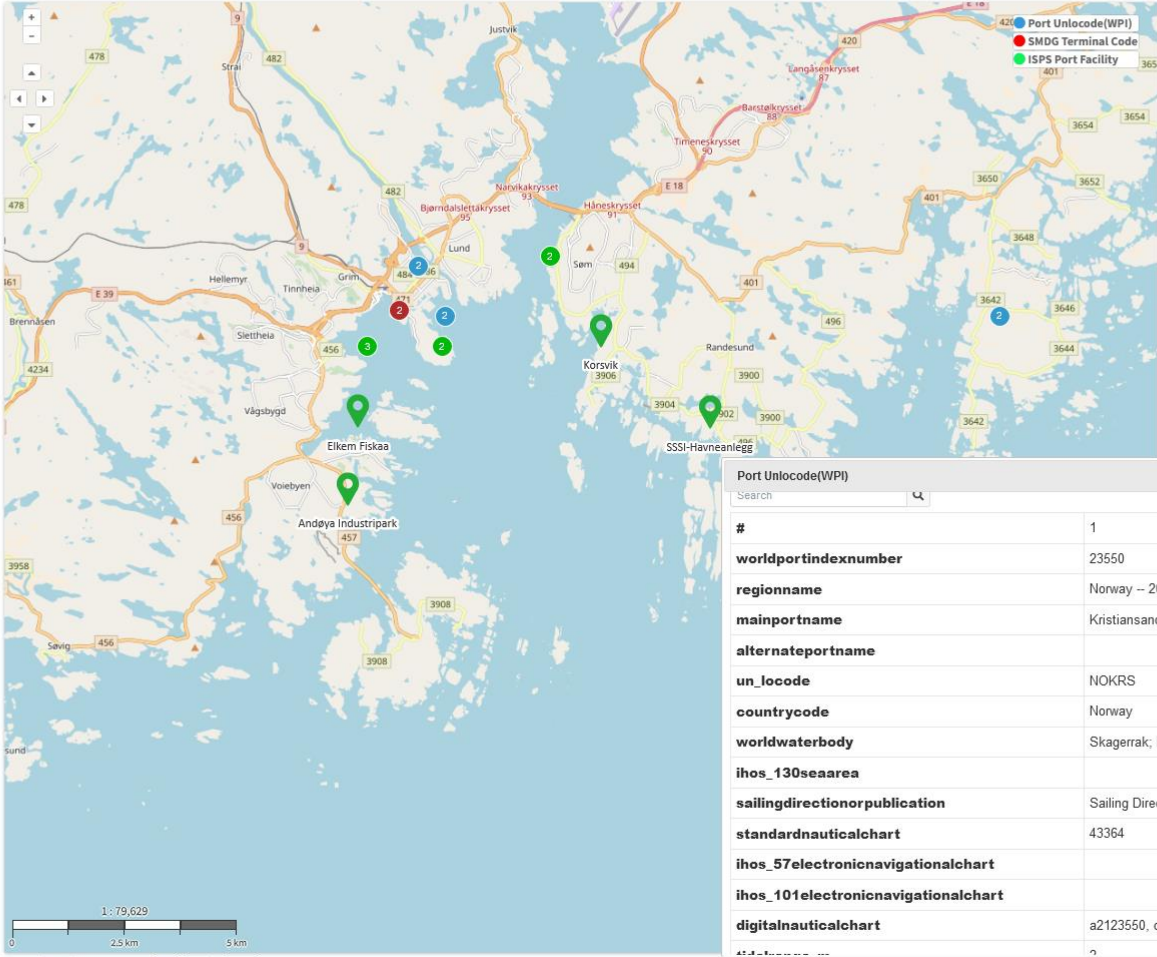
HarbourAreaAdministrative

HarbourAreaSection

Terminal

Berth

BerthPosition



Port Unlocode(WPI)

Search

#	1
worldportindexnumber	23550
regionname	Norway -- 20620
mainportname	Kristiansand
alternateportname	
un_locode	NOKRS
countrycode	Norway
worldwaterbody	Skagerrak, North Atlantic Ocean
ihos_130seaarea	
sailingdirectionorpublication	Sailing Directions Pub. 193 (Enroute) - Skagerrak and Kattegat
standardnauticalchart	43364
ihos_57electronicnavigationalchart	
ihos_101electronicnavigationalchart	
digitalnauticalchart	a2123550, coa21f, gen21a, h2123550

Properties

NOKRS | KRISTIANSAND CONTAINER TERMINAL

TERMINAL

name : NOKRS | KRISTIANSAND CONTAINER TERMINAL

unlocode : NOKRS

terminal_code : KRSCT

terminal_company_name : GREENCARRIER FREIGHT SERVICES / SEAFRONT PORT SERVICES AS

terminal_facility_name : KRISTIANSAND CONTAINER TERMINAL

terminal_website : https://www.portofkristiansand.no/

+Feature Layer Expand Collapse

58.096926 7.857131

1:79,629

0 2.5 km 5 km

100% T L

View mode

Default Port Database Resources

- There are three layers/default resources:
 - Port Unlocode extracted from UN locationCode database and combined with NGA's World Port Index data;
 - SMDG Terminal Code retrieved from SMDG.org
 - ISPS port facility extracted from IMO's GISIS
 - ... and potentially others as agreed or required

Port Database functionality examples

S131 Project

User Name

Password

5c7wd

Login

TWKHH - Kaohsiung

Search

- InformationTypes
 - Applicability
 - Applicability.313
 - ContactDetails
 - ContactDetails.315
 - HarbourAreaAdministrative
 - HarbourAreaAdministrative.1
 - featureName
 - featureName
 - uNLocationCode
 - geometry
 - HarbourAreaSection
 - Terminal
 - Berth
 - BerthPosition
 - AnchorageArea
 - WaterwayArea
 - TurningBasin

+Feature Layer Expand Collapse

Database Resource

Add Port

Remove Port

Save

S131 Upload

S131 Export

TWTP - Taipei

CAHAL - Halifax

NOKRS - Kristiansand

CAMTR - Montreal

SGSIN - Singapore

TWKHH - Kaohsiung

TWTXG - Taichung

Resource View

Upload Resource

Port Unload(WPI)

SMDG Terminal Code

ISPS Port Facility

SGSIN_BERTHS_Berth

SGSIN_PILBOP_PilotBoardingPlace

SGSIN_MORFAC_MooringWarpingFacility

SGSIN_ACHARE_AnchorageArea

SGSIN_TSSPLT_WaterwayArea

TWTP - Taipei

Search

- InformationTypes
 - AvailablePortServices
 - AvailablePortServices.3
 - HarbourAreaAdministrative
 - HarbourAreaSection
 - Terminal
 - Berth
 - BerthPosition

Add Attribute

Key Attribute

Feature Name

Key Attribute

Specific Attribute

Firefighting Service

Medical Service

Repair Service

Technical Port Service

Ship Sanitation Control

Transport Connection

Deterring Assistance

Cargo Services

Secur Classification of assistance for mooring or anchoring operations.

Waste Unload Service

Supply Service

Tug Information

Text Content

General Attribute

Fixed Date Range

Periodic Date Range

Graphic

distance:0.33 km

angle:2°

Brani Terminal Berth B4

Brani Terminal

AvailablePortServices_242

feature	AssociationName	Role	Type	Objects
Information	Additional information	providesInformation	NauticalInformation	--select-- NauticalInformation_3 NauticalInformation_6

OK Close

Attributes

Attribute	Value
featureName	Name
source	CA57003B
sourceType	Products Issued by IHO Services
categoryOfHarbourFacility	Ferry Terminal

Association

Role	Object
componentOf	AAA.CAHAL.HarbourAreaSection.187

View

Earlier identified testbed challenges

- Identity management – Maritime Connectivity Platform? Who is the authority?
- Establishing good information flow between ports and hydrographic offices
- Ports and terminal operators: source providers; hydrographic offices to develop and maintain?
- How to cultivate relationships with ports?

Underway and Next

- DB population
- Testing; data model v1.1
- Port users adding the data
- Port feedback
- National databases conversion/import options testing
- The tools code management for IHO at GitHub

- Questions and discussions

- Additional resources

- [S-131 Marine harbour Infrastructure – AEGIS](#) (Earlier ECC presentation)
- <https://www.port-data.net/s131/> (IHO Lab S-131 Project tool)
- [S-131 Marine Harbour Infrastructure](#) (IHO GI REGISTRY)