D4.6 – METOC SejlRute Service Specification

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1 Introduction

The bulk of work on this document has been made as a deliverable D4.6 for the EfficienSea2 project funded by the European Commission.

1.1 METOC SejlRute

METOC SejlRute provides model based MetOcean prognoses/forecasts from the Danish Meteorological Institute along a given route or location(s). On-route parameters are:

- Wind and air-temperature
- Ocean currents, salinity, temperature and sea-level.
- Sea-ice concentration, thickness and drift
- Wave height, direction and period

Forecasts are present up to 6 days ahead depending on the desired parameter(s).

Further description and interactive mode is found in this address:

http://ocean.dmi.dk/apps/SejlRute/SejlRute.php

1.2 Purpose of the Document

The purpose of this service specification document is to provide a holistic overview of the *METOC SejlRute* service and its building blocks in a technology-independent way, according to the guidelines given in [1].

1.3 Intended Readership

This service specification is intended to be read by service architects, system engineers and developers in charge of designing and developing an instance of the *METOC SejlRute* service.

Furthermore, this service specification is intended to be read by enterprise architects, service architects, information architects, system engineers and developers in pursuing architecting, design and development activities of other related services.

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2 Service Identification

The purpose of this chapter is to provide a unique identification of the service and describe where the service is in terms of the engineering lifecycle.

Name	DMI Route METOC service
ID	urn:mrn:mcl:service:specification:dmi:METOC_SejlRute-service
Version	0.1
Description	Model based MetOcean prognoses from Danish Meteorological Institute along a given route or location(s)
Keywords	DMI metocean forecasts prognoses currents waves wind sea-ice
Architect(s)	Mads Hvid Ribergaard; Kim Bisgaard; Till Rasmussen; Danish Meteorological Institute Lyngbyvej 100 DK-2100 Copenhagen Ø Telephone: +45 39 15 75 00 Email: tar@dmi.dk
Status	Released

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3 Operational Context

METOC SejlRute provides model based MetOcean prognoses/forecasts from Danish Meteorological Institute along a given route or location(s). Input and output from the service is provided as JSON files.

The service can be accessed in two ways:

1) Interactive via. this page – a kind of GUI:

   http://ocean.dmi.dk/apps/SejlRute/SejlRute.php

2) via cURL:

   ```
   curl --noproxy \* -g --data-urlencode req@json URL
   ```

   where

   URL = http://sejlrute.dmi.dk/SejlRute/SR

   json = <JSON-input-text-file>

Output: <JSON-output-text-file> written to <std-out>

The <JSON-input-text-file> and <JSON-output-text-file> is explained on the http-page above and also explained below in this document

3.1 Functional and Non-functional Requirements

The table below defines requirements for the *METOC SejlRute* service.

Table 1: Requirements Definition

Requirement Id	**urn:mrn:mcl:service:specification:dmi:METOC_SejlRute-service**
Requirement Name	DMI Route METOC service
Requirement Text	Provides the best prognoses for the requested parameters based on all the available met-ocean-wave models at DMI
Rationale	Get met-ocean-ice-wave prognoses on a given route defined by a <JSON-input-text-file> and returned as a <JSON-output-text-file>

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3.2 Other Constraints

3.2.1 Operational Nodes

Table 2: Operational Nodes providing the *METOC SejlRute* service

Operational Node	Remarks
Danish Meteorological Institute	Operational met-ocean models providing forecasts for atmospheric and oceanographic parameters including wind, temperatures, currents, salinity, sea-ice, waves etc.

Table 3: Operational Nodes consuming the *METOC SejlRute* service

Operational Node	Remarks
Ships, websites and apps	Planning tool for optimal ship routing including safety

3.2.2 Operational Activities

Examples of activities, which can benefit of the service provided by METOC SejlRute service.

Table 4: Operational Activities supported by the *METOC SejlRute* service

Operational Activity	Remarks
Safe ship routing	Based on criterions in an application, the METOC SejlRute can provide necessary information to calculate risks along a given route
Optimize ship routing	Based on criterions in an application, a number of calls to the METOC SejlRute can provide an optimal ship route

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4 Service Overview

4.1 Service Interfaces

The METOC SejlRute service consists of a single service, exposing a single operation to query the published METOC SejlRute response (Request/Response).

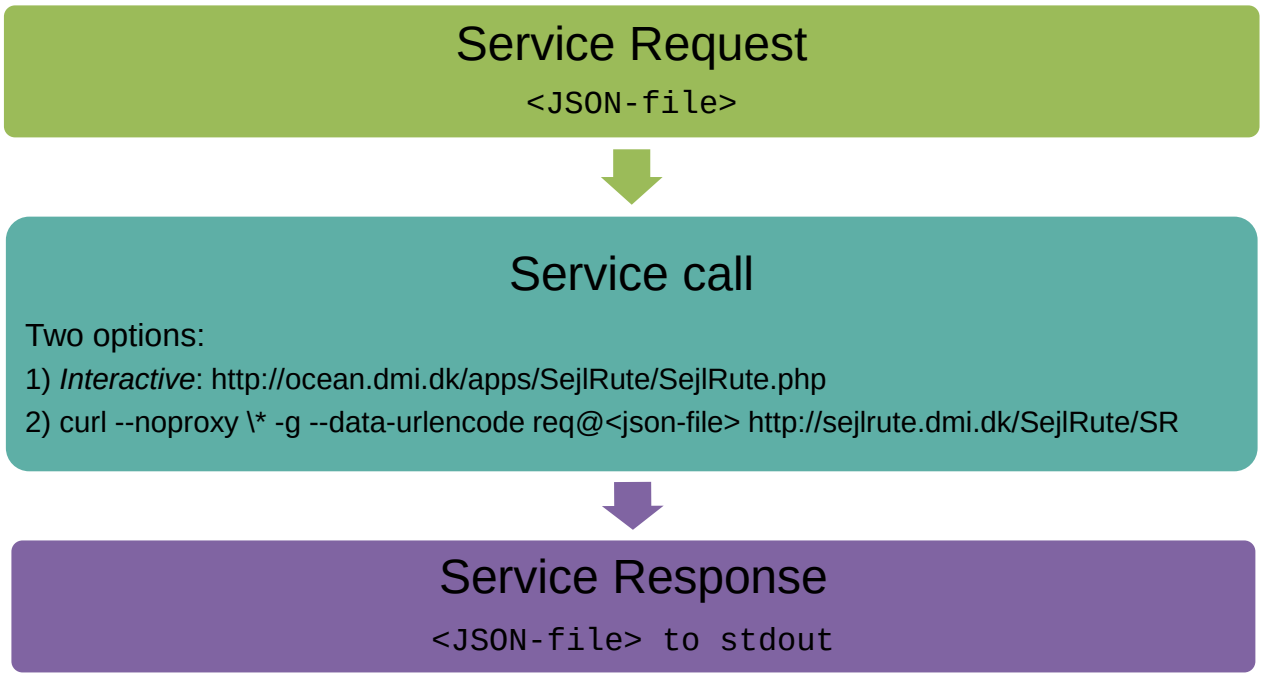

Figure 1: METOC SejlRute Interface Definition diagram

Table 5: Service Interfaces

ServiceInterface	Role (from service provider point of view)	ServiceOperation
interactive	Provided	http://ocean.dmi.dk/apps/SejlRute/SejlRute.php
request	Provided	curl --noproxy * -g --data-urlencode req@<json-file> http://sejlrute.dmi.dk/SejlRute/SR

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5 Service Data Model

This section describes the logical data structures to be exchanged between providers and consumers of the service.

Table 6: Service Data Model

Element Name	Description
Request	JSON input text file
Response	JSON output text file

A schematic visualisation diagram is given in Figure 1

An XML schema for this data model is included in the formal service specification xml file attached in Appendix A. An XML schema for the formal JSON input file is attached in Appendix B and it is further described in chapter 6. Note that the S-100 specification [4] describes in its Appendix 9-B how S-100 based data models shall be formulated in XML schema format.

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6 Service Interface Specifications

This chapter describes the details of the METOC SejlRute service interface.

6.1 Service Interface METOC SejlRute service

The METOC SejlRute service is comprised of a single service and operation, which follows a JSON request/Response exchange pattern as illustrated in Figure 1.

It can be done in two ways:

1. Interactive via.: http://ocean.dmi.dk/apps/SejlRute/SejlRute.php
2. Using “cURL” call from a prompt.

6.1.1 Operation “cURL”

The following “cURL” operation returns the response `<JSON-output-text-file>` as a result of a request `<JSON-input-text-file>`:

```
curl --noproxy \* -g --data-urlencode req@json URL
```

where

```
URL = http://sejlrute.dmi.dk/SejlRute/SR
```

```
json = <JSON-input-text-file>
```


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6.1.2 Condensated JSON input and output description

The following table briefly describes the JSON input and output file.

Table 7: JSON input and output objects and parameters

Input			Output	
object	**Parameter**	**description**	**parameter / description**	**unit**
"waypoints"	"eta"	Datestring	datestring	[yyyy-mm-ddTHH:MM:SS.sss+HHMM]
	"heading"	"RL" / "GC"	Rumb Line or Great Circle route	
	"lat"	Latitude	Latitude	decimal degrees [-90. 90.]
	"lon"	Longitude	Longitude	decimal degrees [-180. 180.]
"dt"	{integer value}	Time interval between waypoint(s)	Large dt => Only values at waypoint times Minval: 15	[minutes]
"datatypes"	"sealevel"	Water level	"sealevel"	[m]
	"current"	Ocean surface current speed and direction	"current-dir" "current-speed"	[degrees: 0-360] [m/s]
	"wind"	Wind speed and direction	"wind-dir" "wind-speed"	[degrees: 0-360] [m/s]
	"wave"	Significant wave height, direction and period	"wave-dir" "wave-height" "wave-period"	[degrees: 0-360] [m] [s]
	"sea-ice"	Sea-ice concentration and thickness	"sea-ice-cover" "sea-ice-thickness"	[fraction: 0-1] [m]
	"sea-ice-drift"	Sea-ice drift velocity and direction	"sea-ice-drift-dir" "sea-ice-drift-speed"	[degrees: 0-360] [m/s]
	"sea-temperature"	Sea surface temperature	"sea-temperature"	[degC]
	"salinity"	Sea surface salinity	"salinity"	[-]
	"temperature"	Air temperature	"temperature"	[degC]

6.1.3 JSON input object

Table 8: JSON input object for METOC SejlRute

Object Name	**Type**	**Description**
"dt"	*Integer*	*Time interval in minutes between waypoints*
"datatypes"	*Array, strings*	*Array of requested datatypes*

	Name	**Value**
	"sealevel"	*Water level [m]*
	"current"	*Ocean surface current speed [m/s] and direction [0-360]*
	"wind"	*Wind speed [m/s] and direction [0-360]*
	"wave"	*Wave height [m], direction [0-360] and period [s]*
	"sea-ice"	*Sea-ice concentration [0-1] and thickness [m]*
	"sea-ice-drift"	*Sea-ice drift speed [m/s] and direction [0-360]*
	"sea-temperature"	*Ocean surface temperature [degrees Celcius]*
	"salinity"	*Ocean surface salinity. Unitless, but comparable with [psu]*
	"temperature"	*Air temperature [degrees Celcius]*

"waypoints"	*Object(s)*	*Waypoints along route*

	Properties	**Type**	**Description**
	"eta"	*String*	Time: yyyy-mm-ddTHH:MM:SS.sss+HHMM
	"heading"	*String*	"Great circle" or "Rump line" calculation: "GC" / "RL"
	"lat"	*number*	Latitude [-90. 90.]
	"lon"	*number*	Longitude [-180. 180]

An XML schema for the formal JSON input file is attached in Appendix B

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6.1.4 JSON output object

Table 9: JSON output object from METOC SejlRute

Object Name	Type	Description
"error"	*Integer*	*0: no error*
"metocForecast"	*Object*	

Name	Type	Description
"created"	*String*	Time: yyyy-mm-ddTHH:MM:SS.sss+HHMM
"forecasts"	*Array of objects*	

Name	Type	Description
"lat"	*Number*	Latitude [-90. 90.]
"lon"	*Number*	Longitude [-180. 180.]
"time"	*String*	Time: yyyy-mm-ddTHH:MM:SS.sss+HHMM
"Parameter 1"	*Object*	

Name	Type	Description
"forecast"	*number*	Value 1

...		
"Parameter n"	*Object*	

Name	Type	Description
"forecast"	*number*	Value n

Parameters	Description
"sealevel"	Water level [m]
"current-dir"	Ocean surface current direction [0-360]
"current-speed"	Ocean surface current speed [m/s]
"wind-dir"	Wind direction [0-360]
"wind-speed"	Wind speed [m/s]
"wave-dir"	Significant wave direction [0-360]
"wave-height"	Significant wave height [m]
"wave-period"	Significant wave period [s]
"sea-ice-cover"	Sea-ice cover [fraction: 0-1]
"sea-ice-thickness"	Sea-ice thickness [m]
"sea-ice-drift-dir"	Sea-ice drift direction [0-360]
"sea-ice-drift-speed"	Sea-ice drift speed [m/s]
"sea-temperature"	Ocean surface temperature [degrees Celcius]
"salinity"	Ocean surface salinity [-]
"temperature"	Air temperature [degrees Celcius]

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6.1.5 Example of JSON input/output files and a cURL operation

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Oct 18, 17 20:01 **inout.json** Page 1/1

```
> curl --noproxy \* -g --data-urlencode req@input.json http://sejlrute.dmi.dk/SejlRute/SR > outout.json
>
>
> cat input.json
{ "dt":300,
  "datatypes":["sealevel","current","wave","wind","sea-ice","sea-ice-drift","sea-temperature","salinity
","temperature"],
  "waypoints":[
    {
      "eta":"2017-10-19T00:00:00.000+0100",
      "heading":"GC",
      "lat":72.0,
      "lon":-22.0},
    {
      "eta":"2017-10-19T20:00:00.000+0100",
      "heading":"GC",
      "lat":72.5,
      "lon":-21.5}
  ]
}
>
>
>
> cat output.json
{"error":0,"metocForecast":{"created":"2017-10-18T17:54:12.014+0000","forecasts":[{"lat":72.0,"lon":-22
.0,"time":"2017-10-18T23:00:00.000+0000","wind-dir":{"forecast":191.00466918945312},"wind-speed":{"fore
cast":0.9718771576881409},"current-dir":{"forecast":336.8879089355469},"current-speed":{"forecast":0.21
363922953605652},"wave-dir":{"forecast":66.1260986328125},"wave-height":{"forecast":0.7871368527412415}
,"wave-period":{"forecast":7.336320877075195},"sealevel":{"forecast":0.6488189697265625},"sea-temperatu
re":{"forecast":0.8974924087524414},"salinity":{"forecast":30.461563110351562},"sea-ice-cover":{"foreca
st":0.08308743685483932},"sea-ice-thickness":{"forecast":0.1205880343914032},"sea-ice-drift-dir":{"fore
cast":36.5070915222168},"sea-ice-drift-speed":{"forecast":0.16838061809539795},"temperature":{"forecast
":-1.082244873046875}},{"lat":72.12511791820505,"lon":-21.877538487925673,"time":"2017-10-19T04:00:00.0
00+0000","wind-dir":{"forecast":208.8980255126953},"wind-speed":{"forecast":2.9550673961639404},"curren
t-dir":{"forecast":350.7591247558594},"current-speed":{"forecast":0.10807830095291138},"wave-dir":{"for
ecast":75.75341796875},"wave-height":{"forecast":0.8148163557052612},"wave-period":{"forecast":7.133906
364440918},"sealevel":{"forecast":-0.18350505828857422},"sea-temperature":{"forecast":0.209510803222656
25},"salinity":{"forecast":30.989328384399414},"sea-ice-cover":{"forecast":0.09036421030759811},"sea-ic
e-thickness":{"forecast":0.1311848908662796},"sea-ice-drift-dir":{"forecast":12.167465209960938},"sea-i
ce-drift-speed":{"forecast":0.09181533008813858},"temperature":{"forecast":-1.4956207275390625}},{"lat"
:72.25023554867457,"lon":-21.754241832443665,"time":"2017-10-19T09:00:00.000+0000","wind-dir":{"forecas
t":209.28199768066406},"wind-speed":{"forecast":3.656342029571533},"current-dir":{"forecast":62.0045967
1020508},"current-speed":{"forecast":0.10354239493608475},"wave-dir":{"forecast":101.3804931640625},"wa
ve-height":{"forecast":0.9359098672866821},"wave-period":{"forecast":6.777916908264416},"sealevel":{"for
ecast":-0.012278556823730469},"sea-temperature":{"forecast":0.16299819946289062},"salinity":{"forecast"
:30.885963439941406},"sea-ice-cover":{"forecast":0.09195508807897568},"sea-ice-thickness":{"forecast":0
.13472743332386017},"sea-ice-drift-dir":{"forecast":351.6353759765625},"sea-ice-drift-speed":{"forecast
":0.08802946656942368},"temperature":{"forecast":-0.927276611328125}},{"lat":72.37535288745556,"lon":-2
1.630097970501794,"time":"2017-10-19T14:00:00.000+0000","wind-dir":{"forecast":194.52061462402344},"win
d-speed":{"forecast":4.389973163604736},"current-dir":{"forecast":322.256591796875},"current-speed":{"f
orecast":0.1203903779387474},"wave-dir":{"forecast":122.0009765625},"wave-height":{"forecast":1.0859657
526016235},"wave-period":{"forecast":6.854722976684457},"sealevel":{"forecast":0.5549955368041992},"sea-
temperature":{"forecast":0.02384662628173828},"salinity":{"forecast":30.286468505859375},"sea-ice-cover
":{"forecast":0.08561202138662338},"sea-ice-thickness":{"forecast":0.12624354660511017},"sea-ice-drift-
dir":{"forecast":291.52569580078125},"sea-ice-drift-speed":{"forecast":0.22275254130363464},"temperatur
e":{"forecast":0.0613555908203125}},{"lat":72.50046993051056,"lon":-21.505094580594267,"time":"2017-10-
19T19:00:00.000+0000","wind-dir":{"forecast":189.13926696777344},"wind-speed":{"forecast":4.77320861816
40625},"current-dir":{"forecast":311.8773498535156},"current-speed":{"forecast":0.28592759370803833},"w
ave-dir":{"forecast":132.38006591796875},"wave-height":{"forecast":1.232738733291626},"wave-period":{"f
orecast":7.094738960266113},"sealevel":{"forecast":-0.5569591522216797},"sea-temperature":{"forecast":0
.08267879486083984},"salinity":{"forecast":30.35393524169922},"sea-ice-cover":{"forecast":0.07695940881
967545},"sea-ice-thickness":{"forecast":0.11123980581760406},"sea-ice-drift-dir":{"forecast":299.921905
5175781},"sea-ice-drift-speed":{"forecast":0.1960265040397644},"temperature":{"forecast":0.011581420898
4375}}]}
>
>
```

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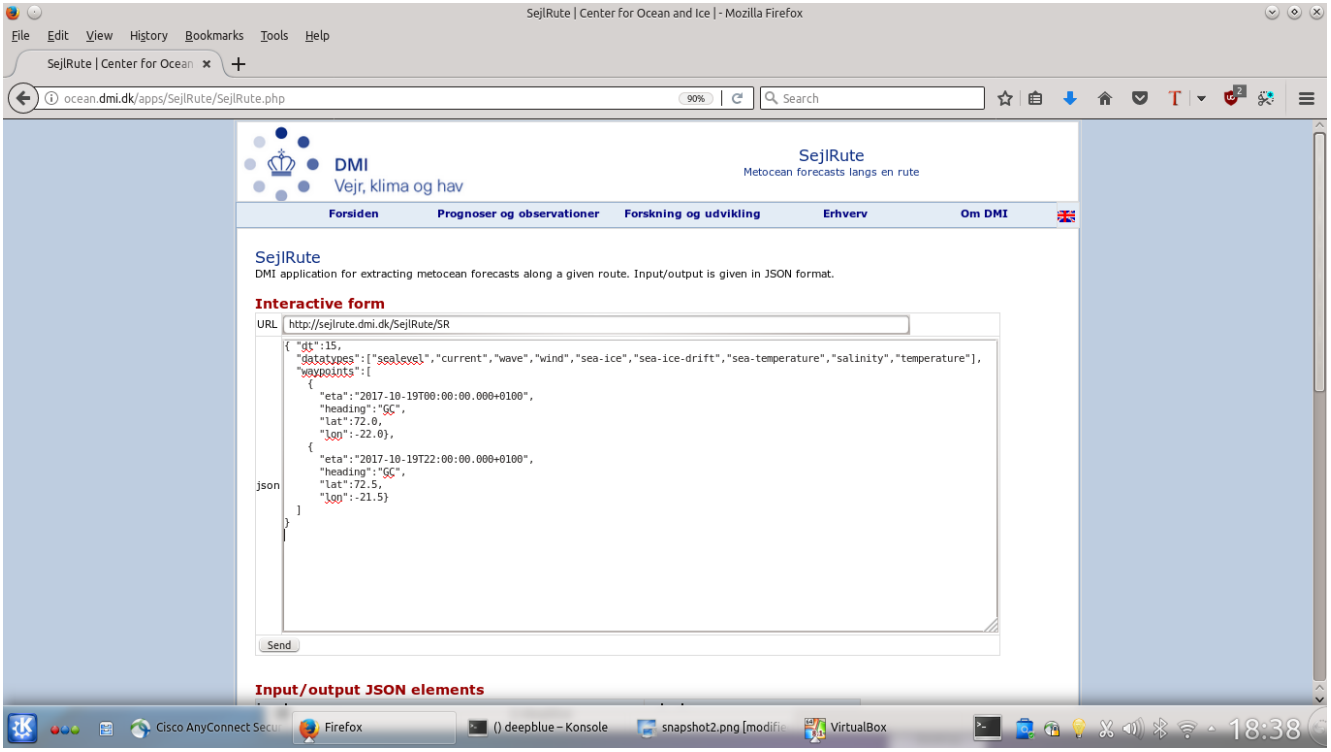
6.1.6 Example of interactive service including JSON input



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7 Service Dynamic Behaviour

7.1 Service Interface METOC SejlRute

The METOC SejlRute service consists of a single service, exposing a single operation to query the published METOC SejlRute response (Request/Response).

See illustration in Figure 1 and Table 6.

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8 References

Nr.	Version	Reference
[1] Service Documentation Guidelines	01.00	SG_Annex_A_Service_Documentation_Guidelines
[3] Maritime Resource Name		Maritime Resource Name, ENAV17-n.n.n
[4] S-100 Universal Hydrographic Data Model	2.0.0	S-100 – UNIVERSAL HYDROGRAPHIC DATA MODEL http://www.iho.int/iho_pubs/standard/S-100/S-100_Ed_2/S_100_V2.0.0_June-2015.pdf

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9 Acronyms and Terminology

9.1 Acronyms

Term	Definition
API	Application Programming Interface
MC	Maritime Cloud
MEP	Message Exchange Pattern
MRN	Maritime Resource Name
NAF	NATO Architectural Framework
REST	Representational State Transfer
SOA	Service Oriented Architecture
SOAP	Simple Object Access Protocol
SSD	Service Specification Document
UML	Unified Modelling Language
URL	Uniform Resource Locator
VTS	Vessel Traffic Service
WSDL	Web Service Definition Language
XML	Extendible Mark-up Language
XSD	XML Schema Definition

9.2 Terminology

Term	Definition
External Data Model	Describes the semantics of the “maritime world” (or a significant part thereof) by defining data structures and their relations. This could be at logical level (e.g., in UML) or at physical level (e.g., in XSD schema definitions), as for example standard data models, or S-100 based data produce specifications.
Message Exchange Pattern	Describes the principles how two different parts of a message passing system (in our case: the service provider and the service consumer) interact and communicate with each other. Examples: In the Request/Response MEP, the service consumer sends a request to the service provider in order to obtain certain information; the service provider provides the requested information in a dedicated response. In the Publish/Subscribe MEP, the service consumer establishes a subscription with the service provider in order to obtain certain information; the service provider publishes information (either in regular intervals or upon change) to all subscribed service consumers.
Operational Activity	An activity performed by an operational node. Examples of operational activities in the maritime context are: Route Planning, Route Optimization, Logistics, Safety, Weather Forecast Provision, …
Operational Model	A structure of operational nodes and associated operational activities and their inter-relations in a process model.

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Operational Node	A logical entity that performs activities. Note: nodes are specified independently of any physical realisation. Examples of operational nodes in the maritime context are: Maritime Control Center, Maritime Authority, Ship, Port, Weather Information Provider, …
Service	The provision of something (a non-physical object), by one, for the use of one or more others, regulated by formal definitions and mutual agreements. Services involve interactions between providers and consumers, which may be performed in a digital form (data exchanges) or through voice communication or written processes and procedures.
Service Consumer	A service consumer uses service instances provided by service providers. All users within the maritime domain can be service customers, e.g., ships and their crew, authorities, VTS stations, organizations (e.g., meteorological), commercial service providers, etc.
Service Data Model	Formal description of one dedicated service at logical level. The service data model is part of the service specification. Is typically defined in UML and/or XSD. If an external data model exists (e.g., a standard data model), then the service data model shall refer to it: each data item of the service data model shall be mapped to a data item defined in the external data model.
Service Design Description	Documents the details of a service technical design (most likely documented by the service implementer). The service design description includes (but is not limited to) a service physical data model and describes the used technology, transport mechanism, quality of service, etc.
Service Implementation	The provider side implementation of a dedicated service technical design (i.e., implementation of a dedicated service in a dedicated technology).
Service Implementer	Implementers of services from the service provider side and/or the service consumer side. Anybody can be a service implementer but mainly this will be commercial companies implementing solutions for shore and ship.
Service Instance	One service implementation may be deployed at several places by same or different service providers; each such deployment represents a different service instance, being accessible via different URLs.
Service Instance Description	Documents the details of a service implementation (most likely documented by the service implementer) and deployment (most likely documented by the service provider). The service instance description includes (but is not limited to) service technical design reference, service provider reference, service access information, service coverage information, etc.
Service Interface	The communication mechanism of the service, i.e., interaction mechanism between service provider and service consumer. A service interface is characterised by a message exchange pattern and consists of service operations that are either allocated to the provider or the consumer of the service.
Service Operation	Functions or procedure which enables programmatic communication with a service via a service interface.

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Service Physical Data Model	Describes the realisation of a dedicated service data model in a dedicated technology. This includes a detailed description of the data payload to be exchanged using the chosen technology. The actual format of the service physical data model depends on the chosen technology. Examples may be WSDL and XSD files (e.g., for SOAP services) or swagger (Open API) specifications (e.g., for REST services). If an external data model exists (e.g., a standard data model), then the service physical data model shall refer to it: each data item of the service physical data model shall be mapped to a data item defined in the external data model. In order to prove correct implementation of the service specification, there shall exist a mapping between the service physical data model and the service data model. This means, each data item used in the service physical data model shall be mapped to a corresponding data item of the service data model. (In case of existing mappings to a common external (standard) data model from both the service data model and the service physical data model, such a mapping is implicitly given.)
Service Provider	A service provider provides instances of services according to a service specification and service instance description. All users within the maritime domain can be service providers, e.g., authorities, VTS stations, organizations (e.g., meteorological), commercial service providers, etc.
Service Specification	Describes one dedicated service at logical level. The Service Specification is technology-agnostic. The Service Specification includes (but is not limited to) a description of the Service Interfaces and Service Operations with their data payload. The data payload description may be formally defined by a Service Data Model.
Service Specification Producer	Producers of service specifications in accordance with the service documentation guidelines.
Service Technical Design	The technical design of a dedicated service in a dedicated technology. One service specification may result in several technical service designs, realising the service with different or same technologies.
Service Technology Catalogue	List and specifications of allowed technologies for service implementations. Currently, SOAP and REST are envisaged to be allowed service technologies. The service technology catalogue shall describe in detail the allowed service profiles, e.g., by listing communication standards, security standards, stacks, bindings, etc.
Spatial Exclusiveness	A service specification is characterised as “spatially exclusive”, if in any geographical region just one service instance of that specification is allowed to be registered per technology. The decision, which service instance (out of a number of available spatially exclusive services) shall be registered for a certain geographical region, is a governance issue.

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Appendix A Service Specification XML

This appendix contains the formal definition of the service specification.

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```
<?xml version="1.0" encoding="UTF-8"?>
<ServiceSpecificationSchema:serviceSpecification
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
        xmlns:ServiceSpecificationSchema="http://efficiensea2.org/maritime-cloud/service-registry/v1/ServiceSpecific
ationSchema.xsd"
        xsi:schemaLocation="http://efficiensea2.org/maritime-cloud/service-registry/v1/ServiceSpecificationSchema.xs
d ServiceSpecificationSchema.xsd ">
    <name>DMI Route METOC service</name>
    <status>provisional</status>
    <id>urn:mrn:mcl:service:specification:dmi:METOC_SejlRute-service</id>
    <version>0.1</version>
    <description>Model based MetOcean prognoses from Danish Meteorological Institute along a given route or location
(s)</description>

    <keywords>DMI metocean forecasts prognoses currents waves wind sea-ice</keywords>
    <isSpatialExclusive>false</isSpatialExclusive>

    <authorInfos>
        <authorInfo>
            <id>urn:mrn:mcl:user:dmi:tar</id>
            <name>Till Rasmussen</name>
            <description>Senior researcher/oceanographer at DMI</description>
            <contactInfo>tar@dmi.dk</contactInfo>
        </authorInfo>
        <authorInfo>
            <id>urn:mrn:mcl:user:dmi:mhri</id>
            <name>Mads Hvid Ribergaard</name>
            <description>Senior researcher/oceanographer at DMI</description>
            <contactInfo>mhri@dmi.dk</contactInfo>
        </authorInfo>
    </authorInfos>

    <serviceInterfaces>
        <serviceInterface>
            <name>METOC_SejlRute</name>
            <description>Works according to the request response pattern.</description>
            <dataExchangePattern>REQUEST_RESPONSE</dataExchangePattern>
            <operations>
                <operation>
                    <name>METOC_SejlRute</name>
                    <description>Retrieve metocean forecast along a given route</description>
                    <parameterTypes>
                        <parameterType>
                            <typeReference>request</typeReference>
                        </parameterType>
                    </parameterTypes>
                    <returnValueType>
                        <typeReference>response</typeReference>
                    </returnValueType>
                </operation>
            </operations>
        </serviceInterface>
    </serviceInterfaces>

    <requirements>
        <requirement>
            <id>1.</id>
            <name>Req 1.</name>
            <text>Provide metocean forecasts along a given route</text>
            <rationale>Assess metocean forecasts along a given route</rationale>
        </requirement>
    </requirements>

    <serviceDataModel>
        <definitionAsXSD>
            <schema xmlns="http://www.w3.org/2001/XMLSchema"
                    xmlns:tns="http://dma.dk/service/specification/logical/model"
                    targetNamespace="http://dma.dk/service/specification/logical/model">
                <element name="request" type="tns:Request" />
                <element name="response" type="tns:Response" />

                <complexType name="Request">
                    <sequence>
                        <element name="STDIN" type="JSON" />
                    </sequence>
                </complexType>
                <complexType name="Response">
                    <sequence>
                        <element name="STDOUT" type="JSON" />
                    </sequence>
                </complexType>
            </schema>
        </definitionAsXSD>
    </serviceDataModel>
</ServiceSpecificationSchema:serviceSpecification>
```

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Appendix B JSON input schema

This appendix contains the formal definition of the JSON input text file.

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```
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "id": "http://ocean.dmi.dk/apps/SejlRute/",
  "description": "Extract DMI metocean forecast along a given route",
  "type": "object",
  "properties": {
    "mssi": {
      "type": "integer"
    },
    "dt": {
      "type": "integer"
    },
    "datatypes": {
      "type": "array",
      "items": { "type": "string" },
      "minItems": 1,
      "uniqueItems": false
    },
    "waypoints": {
      "type": "array",
      "items": {
        "type": "object",
        "properties": {
          "eta": { "type": "string" },
          "heading": { "type": "string" },
          "lat": { "type": "number" },
          "lon": { "type": "number" }
        }
      },
      "required": ["eta","heading","lat","lon"],
      "minItems": 1
    }
  },
  "required": ["dt","datatypes","waypoints"]
}
```

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D4.6 - Service Design Description for the METOC SejlRute Service

Project no.	636329
Project acronym:	EfficienSea2
	EFFICIENSEA2 – efficient, safe and sustainable traffic at sea
Funding scheme:	Innovation Action (IA)
Start date of project:	1 May 2015
End date of project:	30 April 2018
Duration:	36 months
Due date of deliverable:	31.10.2017
Actual submission date:	31.10.2017
Organisation in charge of deliverable:	Danish Meteorological Institute

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Document Status

Authors

Name	Organisation
Till Rasmussen	DMI
Mads Hvid Ribergaard	DMI

Document History

Version	Date	Initials	Description
1	25.10.2017	MHRI	
2	29.10.2017	TAR	

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1 Introduction

The bulk of work on this document has been made as deliverable D4.6 for the EfficienSea2 project co-funded by the European Commission.

1.1 Purpose of the Document

This document covers a REST-based technical design of the METOC SejlRute service specification [3], according to the guidelines given in the Service Description Guidelines [1].

1.2 Intended Readership

This service design description document is intended to be read by service architects, designers, system engineers and developers in charge of designing and developing an instance of the METOC SejlRute service.

Furthermore, this service design description is intended to be read by service architects, information architects, system engineers and developers in pursuing architecting, design and development activities of other related services.

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2 Service Design Identification

Name	DMI Route METOC service design
ID	urn:mrn:mcl:service:design:dmi:METOC_SejlRute-service
Version	0.1
Technology	REST
Service Specification ID	urn:mrn:mcl:service:specification:dmi:METOC_SejlRute-service
Service Specification Version	0.1
Description	Model based MetOcean prognoses from Danish Meteorological Institute along a given route or location(s). The service is available as a REST service over HTTP. It use JSON object as input and returns JSON object as output
Keywords	DMI metocean forecasts prognoses currents waves wind sea-ice
Architect(s)	Mads Hvid Ribergaard; Kim Bisgaard; Till Rasmussen; Danish Meteorological Institute Lyngbyvej 100 DK-2100 Copenhagen Ø Telephone: +45 39 15 75 00 Email: tar@dmi.dk
Status	Released

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3 Technology Introduction

From the Tide Level Information Technical Design:

> *REST (REpresentational State Transfer) is one way of providing interoperability between system on the internet. It allows requesting systems to access and manipulate textual representations of web resources using a uniform and predefined set of stateless operations: more than efficiently WSDL and SOAP.*
>
> *In a web service which using REST, requests made to a resource's URI will elicit a response that maybe in XML, HTML, JSON or some other defined format. The response may confirm that some alteration has been made to the stored resource, and it may provide hypertext links to other related resources or collections of resources.*
>
> *Using HTTP, as is most common, the kind of operations available include those predefined by the HTTP verbs GET, POST, PUT, DELETE and so on. By making use of a stateless protocol and standard operations, REST aim for fast performance, reliability, and the ability to grow, by re-using components that can be managed and updated without affecting the system as a whole, even while it is running.*

For more details, please refer to https://en.wikipedia.org/wiki/Representational_state_transfer

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4 Service Design Overview

This chapter will outline the REST implementation of the service described in the Service Specification [3].

4.1 Service Interfaces

The METOC SejlRute service consists of a single REST endpoint to query a cURL command (Request/Response exchanges of JSON files). Alternative, an interactive version is also available via. HTTP.

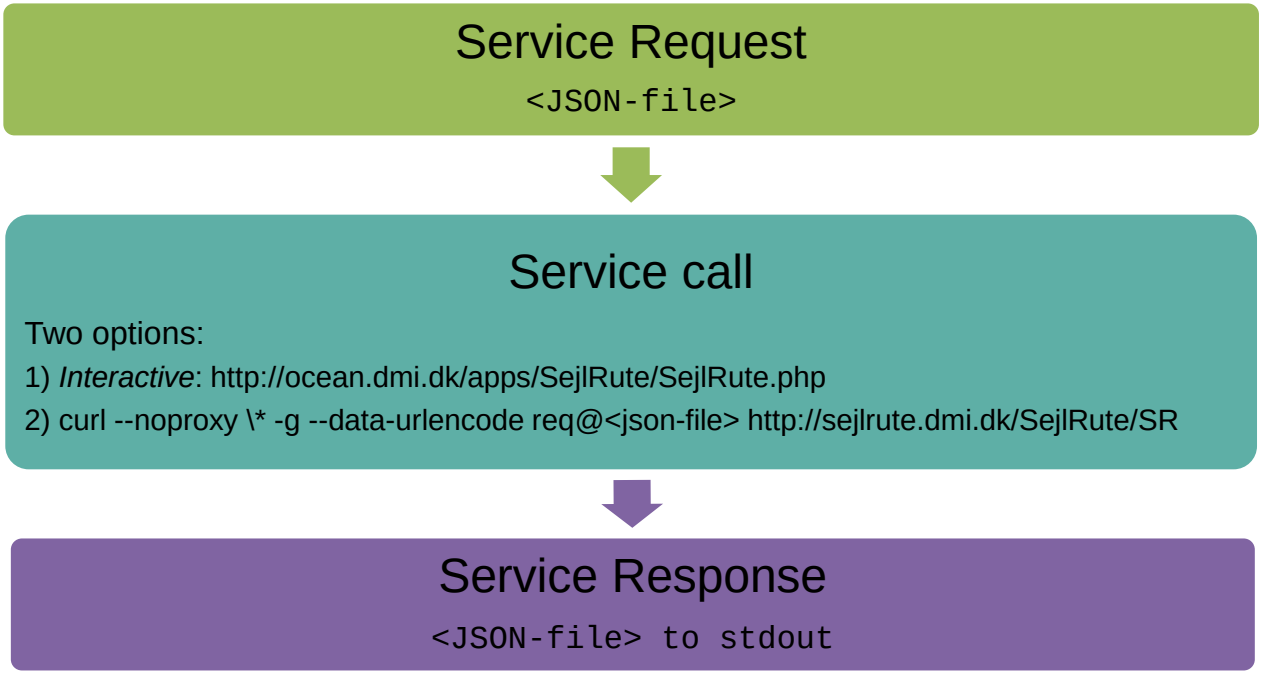

Figure 1: <Service **Name> Interface Definition diagram**

Table 1: Service Interface Mapping

ServiceInterface	**Role** (from service provider point of view)	**ServiceOperation**
Interactive	Provided	http://ocean.dmi.dk/apps/SejlRute/SejlRute.php
Request	Provided	curl --noproxy * -g --data-urlencode req@<json-file> http://sejlrute.dmi.dk/SejlRute/SR

The returned data model is detailed in chapter 5 and the service operation in chapter **Fejl! Henvisningskilde ikke fundet.**.

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5 Physical Data Model

This chapter details the concrete JSON data model implementation of the data model described in Service Specification [3].

There is a direct 1:1 mapping between the model detailed in the Service Specification and the JSON data model adopted in this technical design. Hence, this technical design does not provide an explicit mapping table between the Service Specification JSON model and the Technical Design JSON model.

An XML schema for this data model is included in the formal service specification xml file attached in Appendix A. An XML schema for the formal JSON input file is attached in Appendix B and it is further described in chapter 6.

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6 Service Design

This chapter describes details of the METOC SejlRute service interface.

6.1 Service Interface METOC SejlRute

The METOC SejlRute service is comprised of a single service and operation, which follows a JSON request/Response exchange pattern as illustrated in Figure 1.

It can be done in two ways:

1. Interactive via.: http://ocean.dmi.dk/apps/SejlRute/SejlRute.php
2. Using “cURL” call from a prompt.

6.1.1 Operation “cURL”

The following “cURL” operation returns the response `<JSON-output-text-file>` as a result of a request `<JSON-input-text-file>`:

```
curl --noproxy \* -g --data-urlencode req@json URL
```

where

```
URL = http://sejlrute.dmi.dk/SejlRute/SR
json = <JSON-input-text-file>
```


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6.1.2 Condensated JSON input and output description

The following table briefly describes the JSON input and output file.

Table 2: JSON input and output objects and parameters

Input			Output	
Object	**Parameter**	**Description**	**parameter / description**	**unit**
"waypoints"	"eta"	Datestring	datestring	[yyyy-mm-ddTHH:MM:SS.sss+HHMM]
	"heading"	"RL" / "GC"	Rumb Line or Great Circle route	
	"lat"	Latitude	Latitude	decimal degrees [-90. 90.]
	"lon"	Longitude	Longitude	decimal degrees [-180. 180.]
"dt"	{integer value}	Time interval between waypoint(s)	Large dt => Only values at waypoint times Minval: 15	[minutes]
"datatypes"	"sealevel"	Water level	"sealevel"	[m]
	"current"	Ocean surface current speed and direction	"current-dir" "current-speed"	[degrees: 0-360] [m/s]
	"wind"	Wind speed and direction	"wind-dir" "wind-speed"	[degrees: 0-360] [m/s]
	"wave"	Significant wave height, direction and period	"wave-dir" "wave-height" "wave-period"	[degrees: 0-360] [m] [s]
	"sea-ice"	Sea-ice concentration and thickness	"sea-ice-cover" "sea-ice-thickness"	[fraction: 0-1] [m]
	"sea-ice-drift"	Sea-ice drift velocity and direction	"sea-ice-drift-dir" "sea-ice-drift-speed"	[degrees: 0-360] [m/s]
	"sea-temperature"	Sea surface temperature	"sea-temperature"	[degC]
	"salinity"	Sea surface salinity	"salinity"	[-]
	"temperature"	Air temperature	"temperature"	[degC]

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6.1.3 JSON input object

Table 3: JSON input object for METOC SejlRute

Object Name		Type	Description
"dt"		*Integer*	*Time interval in minutes between waypoints*
"datatypes"		*Array, strings*	*Array of requested datatypes*
	Name	**Value**	
	"sealevel"	*Water level [m]*	
	"current"	*Ocean surface current speed [m/s] and direction [0-360]*	
	"wind"	*Wind speed [m/s] and direction [0-360]*	
	"wave"	*Wave height [m], direction [0-360] and period [s]*	
	"sea-ice"	*Sea-ice concentration [0-1] and thickness [m]*	
	"sea-ice-drift"	*Sea-ice drift speed [m/s] and direction [0-360]*	
	"sea-temperature"	*Ocean surface temperature [degrees Celcius]*	
	"salinity"	*Ocean surface salinity. Unitless, but comparable with [psu]*	
	"temperature"	*Air temperature [degrees Celcius]*	
"waypoints"		*Object(s)*	*Waypoints along route*
	Properties	**Type**	**Description**
	"eta"	*String*	Time: yyyy-mm-ddTHH:MM:SS.sss+HHMM
	"heading"	*String*	"Great circle" or "Rump line" calculation: "GC" / "RL"
	"lat"	*number*	Latitude [-90. 90.]
	"lon"	*number*	Longitude [-180. 180]

An XML schema for the formal JSON input file is attached in Appendix B

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6.1.4 JSON output object

Table 4: JSON output object from METOC SejlRute

Object Name	Type	Description
"error"	*Integer*	*0: no error*
"metocForecast"	*Object*	

Name	Type	Description
"created"	*String*	Time: yyyy-mm-ddTHH:MM:SS.sss+HHMM
"forecasts"	*Array of objects*	

Name	Type	Description
"lat"	*Number*	Latitude [-90. 90.]
"lon"	*Number*	Longitude [-180. 180.]
"time"	*String*	Time: yyyy-mm-ddTHH:MM:SS.sss+HHMM
"Parameter 1"	*Object*	

Name	Type	Description
"forecast"	*number*	Value 1
...		
"Parameter n"	*Object*	

Name	Type	Description
"forecast"	*number*	Value n

Parameters	Description
"sealevel"	Water level [m]
"current-dir"	Ocean surface current direction [0-360]
"current-speed"	Ocean surface current speed [m/s]
"wind-dir"	Wind direction [0-360]
"wind-speed"	Wind speed [m/s]
"wave-dir"	Significant wave direction [0-360]
"wave-height"	Significant wave height [m]
"wave-period"	Significant wave period [s]
"sea-ice-cover"	Sea-ice cover [fraction: 0-1]
"sea-ice-thickness"	Sea-ice thickness [m]
"sea-ice-drift-dir"	Sea-ice drift direction [0-360]
"sea-ice-drift-speed"	Sea-ice drift speed [m/s]
"sea-temperature"	Ocean surface temperature [degrees Celcius]
"salinity"	Ocean surface salinity [-]
"temperature"	Air temperature [degrees Celcius]

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6.1.5 Example of JSON input/output files and a cURL operation

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```
> curl --noproxy \* -g --data-urlencode req@input.json http://sejlrute.dmi.dk/SejlRute/SR > outout.json
>
>
> cat input.json
{ "dt":300,
  "datatypes":["sealevel","current","wave","wind","sea-ice","sea-ice-drift","sea-temperature","salinity
","temperature"],
  "waypoints":[
    {
      "eta":"2017-10-19T00:00:00.000+0100",
      "heading":"GC",
      "lat":72.0,
      "lon":-22.0},
    {
      "eta":"2017-10-19T20:00:00.000+0100",
      "heading":"GC",
      "lat":72.5,
      "lon":-21.5}
  ]
}
>
>
>
> cat output.json
{"error":0,"metocForecast":{"created":"2017-10-18T17:54:12.014+0000","forecasts":[{"lat":72.0,"lon":-22
.0,"time":"2017-10-18T23:00:00.000+0000","wind-dir":{"forecast":191.00466918945312},"wind-speed":{"fore
cast":0.9718771576881409},"current-dir":{"forecast":336.8879089355469},"current-speed":{"forecast":0.21
363922953605652},"wave-dir":{"forecast":66.1260986328125},"wave-height":{"forecast":0.7871368527412415}
,"wave-period":{"forecast":7.336320877075195},"sealevel":{"forecast":0.6488189697265625},"sea-temperatu
re":{"forecast":0.8974924087524414},"salinity":{"forecast":30.461563110351562},"sea-ice-cover":{"foreca
st":0.08308743685483932},"sea-ice-thickness":{"forecast":0.1205880343914032},"sea-ice-drift-dir":{"fore
cast":36.5070915222168},"sea-ice-drift-speed":{"forecast":0.16838061809539795},"temperature":{"forecast
":-1.082244873046875}},{"lat":72.12511791820505,"lon":-21.877538487925673,"time":"2017-10-19T04:00:00.0
00+0000","wind-dir":{"forecast":208.89802551269531},"wind-speed":{"forecast":2.9550673961639404},"curren
t-dir":{"forecast":350.7591247558594},"current-speed":{"forecast":0.10807830095291138},"wave-dir":{"for
ecast":75.75341796875},"wave-height":{"forecast":0.8148163557052612},"wave-period":{"forecast":7.133906
364440918},"sealevel":{"forecast":-0.18350505828857422},"sea-temperature":{"forecast":0.209510803222656
25},"salinity":{"forecast":30.989328384399414},"sea-ice-cover":{"forecast":0.09036421030759811},"sea-ic
e-thickness":{"forecast":0.1311848908662796},"sea-ice-drift-dir":{"forecast":12.167465209960938},"sea-i
ce-drift-speed":{"forecast":0.09181533008813858},"temperature":{"forecast":-1.4956207275390625}},{"lat"
:72.25023554867457,"lon":-21.754241832443665,"time":"2017-10-19T09:00:00.000+0000","wind-dir":{"forecas
t":209.28199768066406},"wind-speed":{"forecast":3.656342029571533},"current-dir":{"forecast":62.0045967
1020508},"current-speed":{"forecast":0.10354239493608475},"wave-dir":{"forecast":101.3804931640625},"wa
ve-height":{"forecast":0.9359098672866821},"wave-period":{"forecast":6.77791690826416},"sealevel":{"for
ecast":-0.012278556823730469},"sea-temperature":{"forecast":0.16299819946289062},"salinity":{"forecast"
:30.885963439941406},"sea-ice-cover":{"forecast":0.09195508807897568},"sea-ice-thickness":{"forecast":0
.13472743332386017},"sea-ice-drift-dir":{"forecast":351.6353759765625},"sea-ice-drift-speed":{"forecast
":0.08802946656942368},"temperature":{"forecast":-0.9272766113281125}},{"lat":72.37535288745556,"lon":-2
1.630097970501794,"time":"2017-10-19T14:00:00.000+0000","wind-dir":{"forecast":194.52061462402344},"win
d-speed":{"forecast":4.389973163604736},"current-dir":{"forecast":322.256591796875},"current-speed":{"f
orecast":0.1203903779387474},"wave-dir":{"forecast":122.0009765625},"wave-height":{"forecast":1.0859657
526016235},"wave-period":{"forecast":6.85472297668457},"sealevel":{"forecast":0.5549955368041992},"sea-
temperature":{"forecast":0.02384662628173828},"salinity":{"forecast":30.286468505859375},"sea-ice-cover
":{"forecast":0.085612021386623338},"sea-ice-thickness":{"forecast":0.12624354660511017},"sea-ice-drift-
dir":{"forecast":291.52569580078125},"sea-ice-drift-speed":{"forecast":0.22275254130363464},"temperatur
e":{"forecast":0.0613555908203125}},{"lat":72.50046993051056,"lon":-21.505094580594267,"time":"2017-10-
19T19:00:00.000+0000","wind-dir":{"forecast":189.13926696777344},"wind-speed":{"forecast":4.77320861816
40625},"current-dir":{"forecast":311.8773498535156},"current-speed":{"forecast":0.28592759370803833},"w
ave-dir":{"forecast":132.38006591796875},"wave-height":{"forecast":1.232738733291626},"wave-period":{"f
orecast":7.094738960266113},"sealevel":{"forecast":-0.5569591522216797},"sea-temperature":{"forecast":0
.08267879486083984},"salinity":{"forecast":30.35393524169922},"sea-ice-cover":{"forecast":0.07695940881
967545},"sea-ice-thickness":{"forecast":0.11123980581760406},"sea-ice-drift-dir":{"forecast":299.921905
5175781},"sea-ice-drift-speed":{"forecast":0.1960265040397644},"temperature":{"forecast":0.011581420898
4375}}]}}
>
>
```

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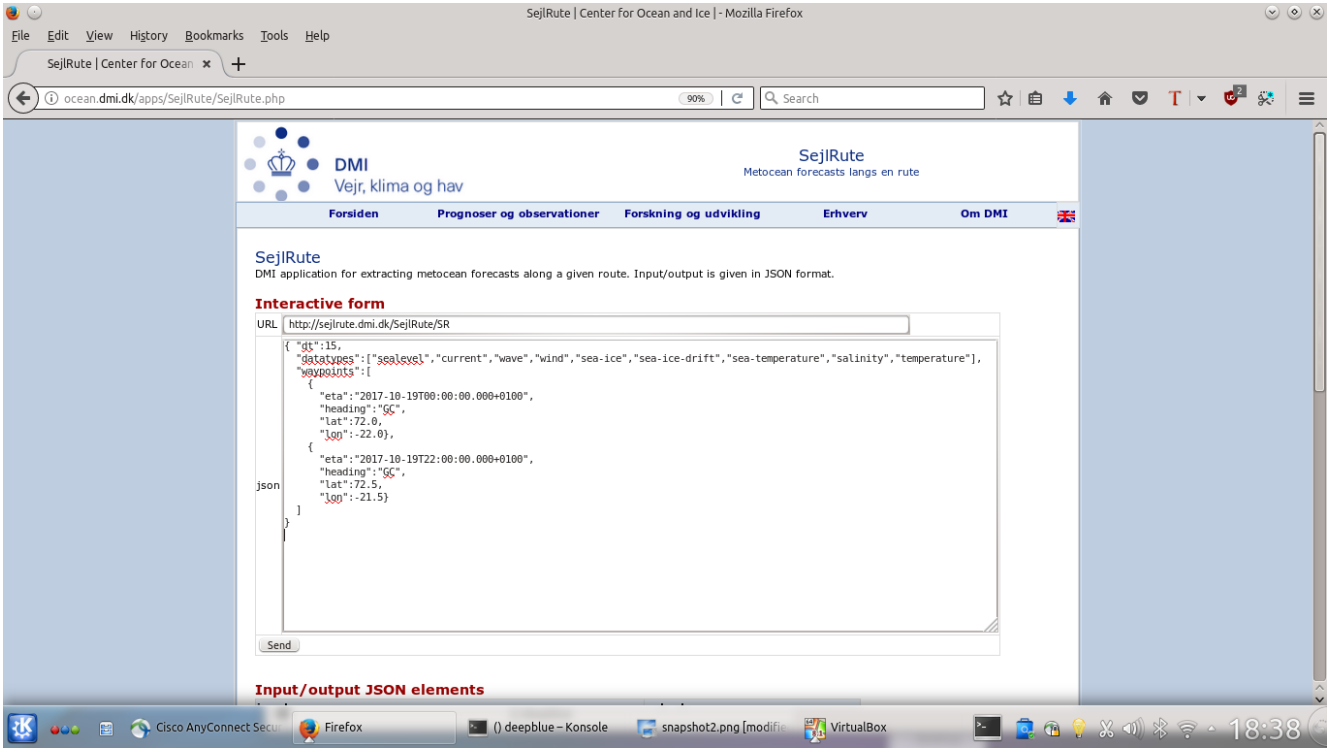
6.1.6 Example of interactive service including JSON input



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7 References

Nr.	Reference
[1] Service Documentation Guidelines	SG_Annex_A_Service_Documentation_Guidelines
[3] METOC SejlRute Service Specification	Service Specification for the METOC SejlRute service.

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8 Acronyms and Terminology

8.1 Acronyms

Term	Definition
API	Application Programming Interface
MC	Maritime Cloud
MEP	Message Exchange Pattern
NAF	NATO Architectural Framework
REST	Representational State Transfer
SOAP	Simple Object Access Protocol
SSD	Service Specification Document
UML	Unified Modelling Language
URL	Uniform Resource Locator
VTS	Vessel Traffic Service
WSDL	Web Service Definition Language
XML	Extendible Mark-up Language
XSD	XML Schema Definition

8.2 Terminology

Term	Definition
External Data Model	Describes the semantics of the "maritime world" (or a significant part thereof) by defining data structures and their relations. This could be at logical level (e.g., in UML) or at physical level (e.g., in XSD schema definitions), as for example standard data models, or S-100 based data produce specifications.
Message Exchange Pattern	Describes the principles two different parts of a message passing system (in our case: the service provider and the service consumer) interact and communicate with each other. Examples: In the Request/Response MEP, the service consumer sends a request to the service provider in order to obtain certain information; the service provider provides the requested information in a dedicated response. In the Publish/Subscribe MEP, the service consumer establishes a subscription with the service provider in order to obtain certain information; the service provider publishes information (either in regular intervals or upon change) to all subscribed service consumers.
Operational Activity	An activity performed by an operational node. Examples of operational activities in the maritime context are: Route Planning, Route Optimization, Logistics, Safety, Weather Forecast Provision, …
Operational Model	A structure of operational nodes and associated operational activities and their inter-relations in a process model.
Operational Node	A logical entity that performs activities. Note: nodes are specified independently of any physical realisation.

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	Examples of operational nodes in the maritime context are: Maritime Control Center, Maritime Authority, Ship, Port, Weather Information Provider, …
Service	The provision of something (a non-physical object), by one, for the use of one or more others, regulated by formal definitions and mutual agreements. Services involve interactions between providers and consumers, which may be performed in a digital form (data exchanges) or through voice communication or written processes and procedures.
Service Consumer	A service consumer uses service instances provided by service providers. All users within the maritime domain can be service customers, e.g., ships and their crew, authorities, VTS stations, organizations (e.g., meteorological), commercial service providers, etc.
Service Data Model	Formal description of one dedicated service at logical level. The service data model is part of the service specification. Is typically defined in UML and/or XSD. If an external data model exists (e.g., a standard data model), then the service data model shall refer to it: each data item of the service data model shall be mapped to a data item defined in the external data model.
Service Design Description	Documents the details of a service technical design (most likely documented by the service implementer). The service design description includes (but is not limited to) a service physical data model and describes the used technology, transport mechanism, quality of service, etc.
Service Implementation	The provider side implementation of a dedicated service technical design (i.e., implementation of a dedicated service in a dedicated technology).
Service Implementer	Implementers of services from the service provider side and/or the service consumer side. Anybody can be a service implementer but mainly this will be commercial companies implementing solutions for shore and ship.
Service Instance	One service implementation may be deployed at several places by same or different service providers; each such deployment represents a different service instance, being accessible via different URLs.
Service Instance Description	Documents the details of a service implementation (most likely documented by the service implementer) and deployment (most likely documented by the service provider). The service instance description includes (but is not limited to) service technical design reference, service provider reference, service access information, service coverage information, etc.
Service Interface	The communication mechanism of the service, i.e., interaction mechanism between service provider and service consumer. A service interface is characterised by a message exchange pattern and consists of service operations that are either allocated to the provider or the consumer of the service.
Service Operation	Functions or procedure which enables programmatic communication with a service via a service interface.

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Service Physical Data Model	Describes the realisation of a dedicated service data model in a dedicated technology. This includes a detailed description of the data payload to be exchanged using the chosen technology. The actual format of the service physical data model depends on the chosen technology. Examples may be WSDL and XSD files (e.g., for SOAP services) or swagger (Open API) specifications (e.g., for REST services). If an external data model exists (e.g., a standard data model), then the service physical data model shall refer to it: each data item of the service physical data model shall be mapped to a data item defined in the external data model. In order to prove correct implementation of the service specification, there shall exist a mapping between the service physical data model and the service data model. This means, each data item used in the service physical data model shall be mapped to a corresponding data item of the service data model. (In case of existing mappings to a common external (standard) data model from both the service data model and the service physical data model, such a mapping is implicitly given.)
Service Provider	A service provider provides instances of services according to a service specification and service instance description. All users within the maritime domain can be service providers, e.g., authorities, VTS stations, organizations (e.g., meteorological), commercial service providers, etc.
Service Specification	Describes one dedicated service at logical level. The Service Specification is technology-agnostic. The Service Specification includes (but is not limited to) a description of the Service Interfaces and Service Operations with their data payload. The data payload description may be formally defined by a Service Data Model.
Service Specification Producer	Producers of service specifications in accordance with the service documentation guidelines.
Service Technical Design	The technical design of a dedicated service in a dedicated technology. One service specification may result in several technical service designs, realising the service with different or same technologies.
Service Technology Catalogue	List and specifications of allowed technologies for service implementations. Currently, SOAP and REST are envisaged to be allowed service technologies. The service technology catalogue shall describe in detail the allowed service profiles, e.g., by listing communication standards, security standards, stacks, bindings, etc.
Spatial Exclusiveness	A service specification is characterised as “spatially exclusive”, if in any geographical region just one service instance of that specification is allowed to be registered per technology. The decision, which service instance (out of a number of available spatially exclusive services) shall be registered for a certain geographical region, is a governance issue.

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Appendix A Service Design Description XML

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```
<?xml version="1.0" encoding="UTF-8"?>
<serviceDesign
        xmlns:xs="http://www.w3.org/2001/XMLSchema"
        xsi:schemaLocation="http://efficiensea2.org/maritime-cloud/service-registry/v1/ServiceDesignSchema.xsd ServiceDesignSchema.x
sd "
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
        xmlns:ServiceDesignSchema="http://efficiensea2.org/maritime-cloud/service-registry/v1/ServiceDesignSchema.xsd"
        xmlns:ServiceSpecificationSchema="http://efficiensea2.org/maritime-cloud/service-registry/v1/ServiceSpecificationSchema.xsd"

        xmlns="http://efficiensea2.org/maritime-cloud/service-registry/v1/ServiceDesignSchema.xsd">
   <name>DMI Route METOC service design</name>
   <id>urn:mrn:mcl:service:design:dmi:METOC_SejlRute-service</id>
   <version>0.1</version>
   <status>released</status>
   <description>Model based MetOcean prognoses from Danish Meteorological Institute along a given route or location(s)</description>

   <designsServiceSpecifications>
   <designsServiceSpecifications>
     <id>urn:mrn:mcl:service:specification:dmi:METOC_SejlRute-service</id>
     <version>0.1</version>
   </designsServiceSpecifications>
   </designsServiceSpecifications>

   <offersTransport>
   <offersTransport>
     <name>REST</name>
     <description>The service is available as a REST service over HTTP. It use JSON object as input and returns JSON object as outpu
t</description>
     <protocol>http://ocean.dmi.dk/apps/SejlRute/SejlRute.php</protocol>
   </offersTransport>
   </offersTransport>

   <designedBy>
     <ServiceSpecificationSchema:id>urn:mrn:mcl:user:dmi:tar</ServiceSpecificationSchema:id>
     <ServiceSpecificationSchema:name>Till Rasmussen and Mads Hvid Ribergaard</ServiceSpecificationSchema:name>
     <ServiceSpecificationSchema:description>Senior researchers/oceanographers at DMI</ServiceSpecificationSchema:description>
     <ServiceSpecificationSchema:contactInfo>tar@dmi.dk and mhri@dmi.dk</ServiceSpecificationSchema:contactInfo>
   </designedBy>

   <servicePhysicalDataModel>
       <name>METOC_SejlRute</name>
       <description>Access to DMI MetOcean prognoses along a given route or location(s) via. JSON request and response</description>
       <model>
           Interactive and command-line requests, JSON schema and parameters given at:
           http://ocean.dmi.dk/apps/SejlRute/SejlRute.php
       </model>
       <modelType>Metocean forecasts based on DMI operational numerical metocean models</modelType>
   </servicePhysicalDataModel>
</serviceDesign>
```

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Appendix B JSON input schema

This appendix contains the formal definition of the JSON input text file.

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Oct 18, 17 18:44 **METOC_SejlRute_schema.json** Page 1/1

```
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "id": "http://ocean.dmi.dk/apps/SejlRute/",
  "description": "Extract DMI metocean forecast along a given route",
  "type": "object",
  "properties": {
    "mssi": {
      "type": "integer"
    },
    "dt": {
      "type": "integer"
    },
    "datatypes": {
      "type": "array",
      "items": { "type": "string" },
      "minItems": 1,
      "uniqueItems": false
    },
    "waypoints": {
      "type": "array",
      "items": {
        "type": "object",
        "properties": {
          "eta": { "type": "string" },
          "heading": { "type": "string" },
          "lat": { "type": "number" },
          "lon": { "type": "number" }
        }
      },
      "required": ["eta","heading","lat","lon"],
      "minItems": 1
    }
  },
  "required": ["dt","datatypes","waypoints"]
}
```

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D4.6 - Service Instance Description for the Weather on Route

Project no.	636329
Project acronym:	EfficienSea2
	EFFICIENSEA2 – efficient, safe and sustainable traffic at sea
Funding scheme:	Innovation Action (IA)
Start date of project:	1 May 2015
End date of project:	30 April 2018
Duration:	36 months
Due date of deliverable:	31.10.2017
Actual submission date:	31.10.2017
Organisation in charge of deliverable:	Danish Meteorological Institute

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Document Status

Authors

Name	Organisation
Till Rasmussen	DMI

Document History

Version	Date	Initials	Description
1	19.10.2017	TAR	

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1 Introduction

The bulk of work on this document has been made as a deliverable (D4.6) for the EfficienSea2 project co-funded by the European Commission.

1.1 Purpose of the Document

This document covers a DMI Service instance of the METOC Sejlrute service.

1.2 Intended Readership

This service instance is intended to be read by service architects, system engineers and developers in charge of designing and developing client services that consumes the *METOC SejlRute* service.

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2 Service Instance Identification

The purpose of this chapter is to provide a unique identification of the service instance and describe where the service is in terms of the engineering lifecycle.

The table below shall be completed.

Name	DMI Route METOC service
ID	urn:mrn:mcl:service:instance:dmi:METOC_SejlRute-service
Version	0.1
Technology	JSON
Service specification ID	urn:mrn:mcl:service:specification:dmi:METOC_SejlRute-service
Version	0.1
Service Design ID	urn:mrn:mcl:service:design:dmi:METOC_SejlRute-service
Version	0.1
Description	Model based MetOcean prognoses from Danish Meteorological Institute along a given route or location(s)
Keywords	DMI metocean forecasts prognoses currents waves wind sea-ice
Supplier	Mads Hvid Ribergaard; Kim Bisgaard; Till Rasmussen; Danish Meteorological Institute Lyngbyvej 100 DK-2100 Copenhagen Ø Telephone: +45 39 15 75 00 Email: tar@dmi.dk
Status	Released

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3 Service Implementation and Instantiation Details

METOC SejlRute provides model based MetOcean prognoses/forecasts from Danish Meteorological Institute along a given route or location(s). Input and output from the service is provided as JSON files.

The service can be accessed in two ways:

1) Interactive via. this page – a kind of GUI:

   http://ocean.dmi.dk/apps/SejlRute/SejlRute.php

2) via cURL:

   ```
   curl --noproxy \* -g --data-urlencode req@json URL
   ```

   where

   URL = http://sejlrute.dmi.dk/SejlRute/SR

   json = <JSON-input-text-file>

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4 Coverage area

The coverage of the service instance is

Figure 1 Service instance domain

The area is defined within the xml file in appendix A.

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5 Service level

The service is not guaranteed to be available at all time.

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6 Commercial information

Service is free as part of the Efficiensea2 project. This may change at the end of the project.

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7 References

Nr.	Version	Reference
[1] METOC sejlrute Service specifaction	0.1	
[2] METOC sejlrute Service design	*0.1*	

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8 Acronyms and Terminology

8.1 Acronyms

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NAF	NATO Architectural Framework
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SOAP	Simple Object Access Protocol
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UML	Unified Modelling Language
URL	Uniform Resource Locator
VTS	Vessel Traffic Service
WSDL	Web Service Definition Language
XML	Extendible Mark-up Language
XSD	XML Schema Definition

8.2 Terminology

Term	Definition
External Data Model	Describes the semantics of the “maritime world” (or a significant part thereof) by defining data structures and their relations. This could be at logical level (e.g., in UML) or at physical level (e.g., in XSD schema definitions), as for example standard data models, or S-100 based data produce specifications.
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Operational Node	A logical entity that performs activities. Note: nodes are specified independently of any physical realisation.

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	Examples of operational nodes in the maritime context are: Maritime Control Center, Maritime Authority, Ship, Port, Weather Information Provider, …
Service	The provision of something (a non-physical object), by one, for the use of one or more others, regulated by formal definitions and mutual agreements. Services involve interactions between providers and consumers, which may be performed in a digital form (data exchanges) or through voice communication or written processes and procedures.
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Service Interface	The communication mechanism of the service, i.e., interaction mechanism between service provider and service consumer. A service interface is characterised by a message exchange pattern and consists of service operations that are either allocated to the provider or the consumer of the service.
Service Operation	Functions or procedure which enables programmatic communication with a service via a service interface.
Service Physical Data Model	Describes the realisation of a dedicated service data model in a dedicated technology. This includes a detailed description of

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	the data payload to be exchanged using the chosen technology. The actual format of the service physical data model depends on the chosen technology. Examples may be WSDL and XSD files (e.g., for SOAP services) or swagger (Open API) specifications (e.g., for REST services). If an external data model exists (e.g., a standard data model), then the service physical data model shall refer to it: each data item of the service physical data model shall be mapped to a data item defined in the external data model. In order to prove correct implementation of the service specification, there shall exist a mapping between the service physical data model and the service data model. This means, each data item used in the service physical data model shall be mapped to a corresponding data item of the service data model. (In case of existing mappings to a common external (standard) data model from both the service data model and the service physical data model, such a mapping is implicitly given.)
Service Provider	A service provider provides instances of services according to a service specification and service instance description. All users within the maritime domain can be service providers, e.g., authorities, VTS stations, organizations (e.g., meteorological), commercial service providers, etc.
Service Specification	Describes one dedicated service at logical level. The Service Specification is technology-agnostic. The Service Specification includes (but is not limited to) a description of the Service Interfaces and Service Operations with their data payload. The data payload description may be formally defined by a Service Data Model.
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Service Technical Design	The technical design of a dedicated service in a dedicated technology. One service specification may result in several technical service designs, realising the service with different or same technologies.
Service Technology Catalogue	List and specifications of allowed technologies for service implementations. Currently, SOAP and REST are envisaged to be allowed service technologies. The service technology catalogue shall describe in detail the allowed service profiles, e.g., by listing communication standards, security standards, stacks, bindings, etc.
Spatial Exclusiveness	A service specification is characterised as “spatially exclusive”, if in any geographical region just one service instance of that specification is allowed to be registered per technology. The decision, which service instance (out of a number of available spatially exclusive services) shall be registered for a certain geographical region, is a governance issue.

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Appendix A

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Oct 27, 17 15:11 **METOC_SejlRute_Service_Instance.xml** Page 1/1

```
<?xml version="1.0" encoding="UTF-8"?>
<serviceInstance
        xmlns:xs="http://www.w3.org/2001/XMLSchema"
        xsi:schemaLocation="http://efficiensea2.org/maritime-cloud/service-registry/v1/ServiceInstanceSchema.xsd ServiceInstanceSche
ma.xsd "
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
        xmlns:ServiceInstanceSchema="http://efficiensea2.org/maritime-cloud/service-registry/v1/ServiceInstanceSchema.xsd"
        xmlns:ServiceSpecificationSchema="http://efficiensea2.org/maritime-cloud/service-registry/v1/ServiceSpecificationSchema.xsd"

        xmlns="http://efficiensea2.org/maritime-cloud/service-registry/v1/ServiceInstanceSchema.xsd">

  <id>urn:mrn:mcl:service:instance:dmi:METOC_SejlRute-service</id>
  <version>0.2</version>
  <name>DMI Route METOC service</name>
  <status>released</status>
  <description>Model based MetOcean prognoses from Danish Meteorological Institute along a given route or location(s) covering the N
orth Atlantic region</description>
  <keywords>DMI metocean forecasts prognoses currents waves wind sea-ice</keywords>
  <URL>http://ocean.dmi.dk/apps/SejlRute/SejlRute.php</URL>
  <requiresAuthorization>true</requiresAuthorization>
  <implementsServiceDesign>
      <id>urn:mrn:mcl:service:design:dmi:METOC_SejlRute-service</id>
      <version>0.1</version>
  </implementsServiceDesign>
  <coversAreas>
    <coversArea>
        <name>North Atlantic</name>
        <description>North Atlantic including the North Sea and Baltic Sea</description>
        <geometryAsWKT>POLYGON((-98.9000 20.0000, -98.9000 66.0000, -180.0000 66.0000, -180.0000 89.9500, 180.0000 89.9500, 180.0000
 66.0000, 36.2000 66.0000, 36.2000 20.0000, -98.9000 20.0000))</geometryAsWKT>
    </coversArea>
  </coversAreas>

  <offersServiceLevel>
      <availability>99.9</availability>
      <name>METOC_SejlRute-service Level</name>
      <description>Service should always be available</description>
  </offersServiceLevel>

  <producedBy>
      <ServiceSpecificationSchema:id>urn:mrn:mcl:user:dmi:tar</ServiceSpecificationSchema:id>
      <ServiceSpecificationSchema:name>Till Rasmussen and Mads Hvid Ribergaard</ServiceSpecificationSchema:name>
      <ServiceSpecificationSchema:description>Senior researchers/oceanographers at DMI</ServiceSpecificationSchema:description>
      <ServiceSpecificationSchema:contactInfo>tar@dmi.dk, mhri@dmi.dk</ServiceSpecificationSchema:contactInfo>
  </producedBy>

  <providedBy>
      <ServiceSpecificationSchema:id>urn:mrn:mcl:org:dmi</ServiceSpecificationSchema:id>
      <ServiceSpecificationSchema:name>DMI</ServiceSpecificationSchema:name>
      <ServiceSpecificationSchema:description>Danish Meteorological Institute</ServiceSpecificationSchema:description>
      <ServiceSpecificationSchema:contactInfo>dmi@dmi.dk</ServiceSpecificationSchema:contactInfo>
  </providedBy>

</serviceInstance>
```

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