European ATM Service Description for the METGriddedForecast Service

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Abstract

The METGriddedForecast service will enable the Local, sub-regional and regional OUE stakeholders to be provided with forecasts of en-route meteorological conditions (upper wind, upper-air temperature, upper-air humidity, geopotential altitude of flight levels, etc.).

The format in which the information will be provided is a gridded standard format like GRIB2 or NetCDF.

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Name & Company	Position & Title	Date

Rational for rejection

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This deliverable consists of SJU foreground.

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Executive summary

The METGriddedForecast service addresses the delivery of information on forecast of en-route meteorological conditions for air traffic. Interested consumers can subscribe to the service and will then receive the publication messages in the cyclical they already requested for in their subscription.

In addition the service provides a request/reply mechanism to deliver the same information.

The meteorological information as regards en-route conditions for pre-flight and in-flight planning and for the selection of organized tracks comprises forecasts of:

- upper wind
- upper-air temperature
- flight level and temperature of tropopause
- direction, speed and flight level of maximum wind
- upper-air humidity
- horizontal extent and flight levels of base and top of cumulonimbus clouds
- geopotential altitude of flight levels
- In-cloud turbulence
- Clear-air turbulence
- Icing for a set of flight levels

The subscription can also be defined by a bilateral contract (e.g. a service lever agreement (SLA)) between the MET service provider and the stakeholder (e.g. an air navigation service provider). From the logical point of view the service design exposing a subscription operation is valid, even if this subscription is done “offline”.

The subscription mechanism implements a filter, consumers can specify for which areas (e.g. airspaces) they want to receive updates on MET aloft elements. Consumers also have the same level of control for unsubscribing.

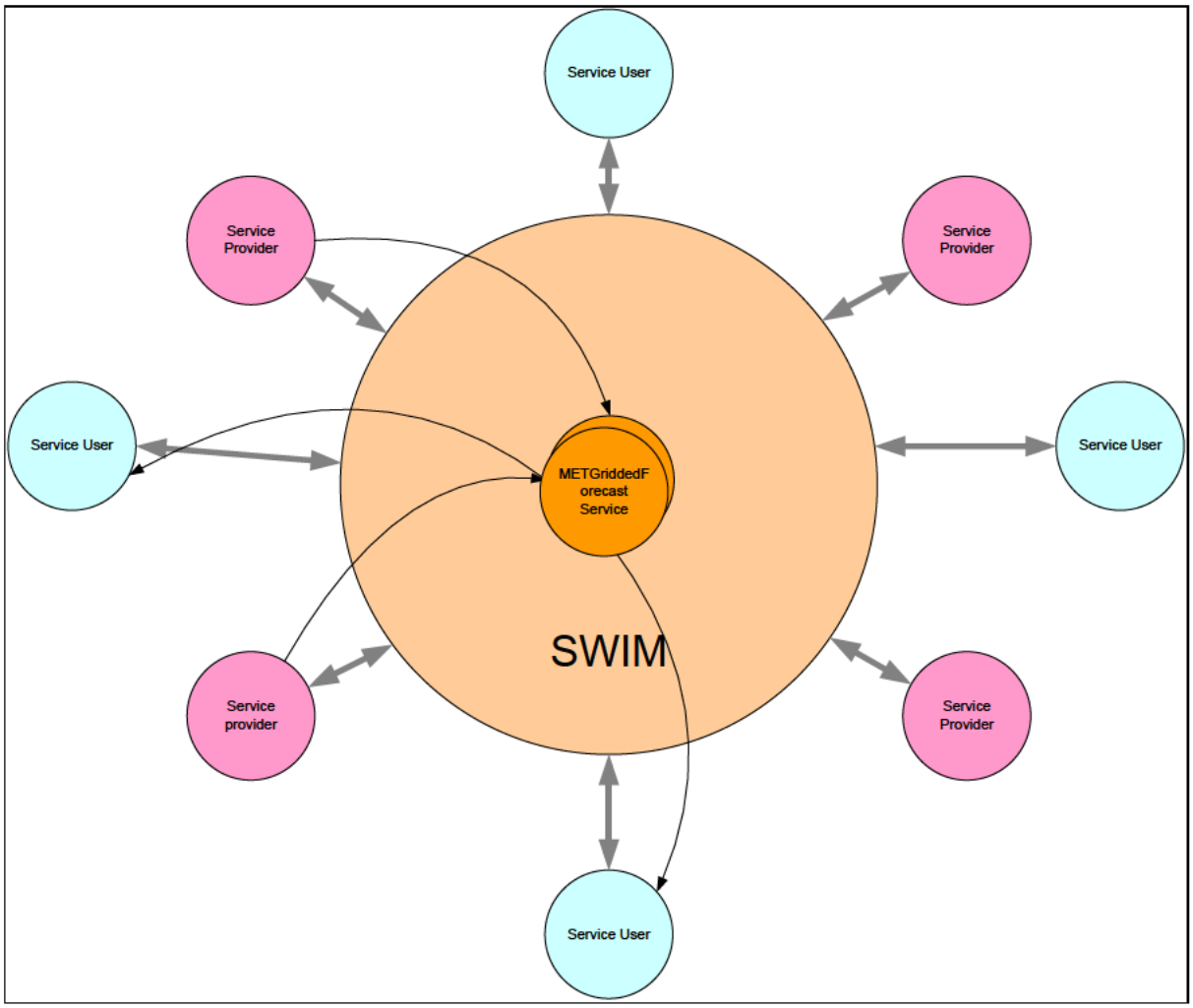

Figure 1: SWIM Context

Figure 1: SWIM Context shows a generalised service in the SWIM environment. It is proposed that the METGriddedForecast Service become a Publish and Subscribe (P&S) Service interface and as such its context can be further refined in the next figure.

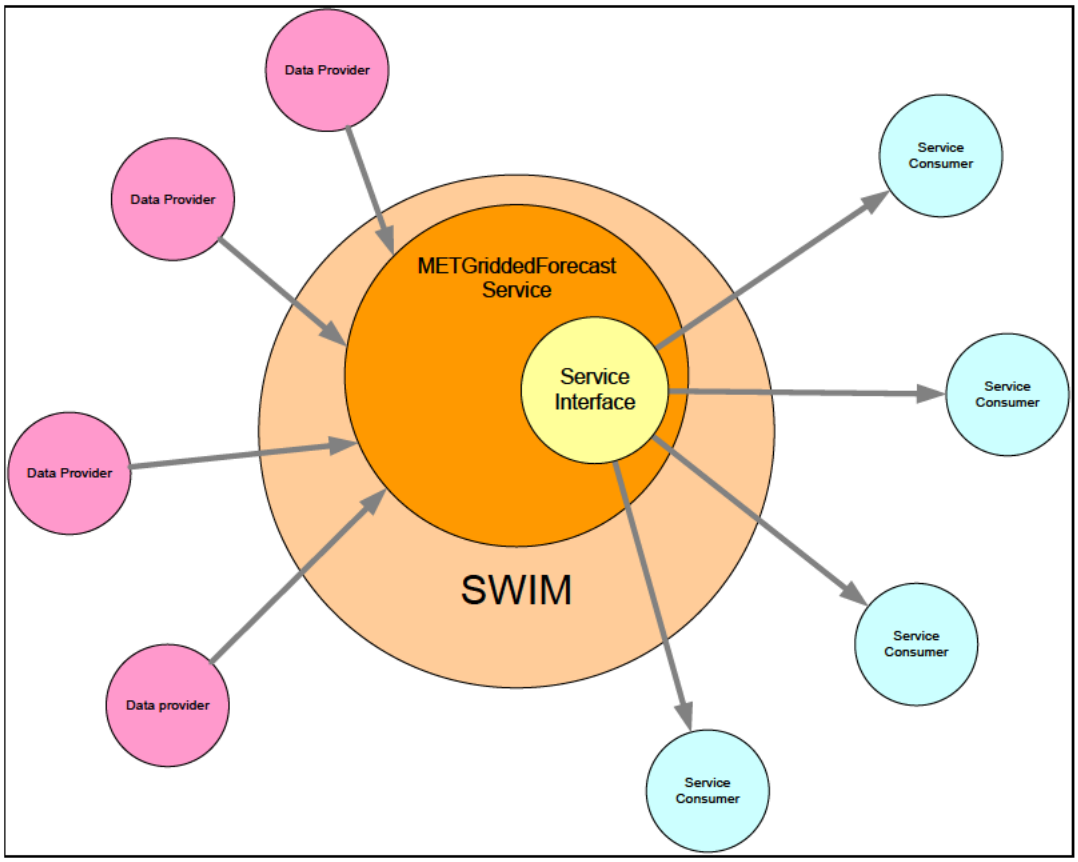

Figure 2: SWIM Context detailed

"Figure 2: SWIM Context detailed" shows the proposed METGriddedForecast service. The figure renders the consumers and providers and shows the paths of the Data provision and consumption. The subscription to the service occurs via one standardised interface for every service consumer. The data provision can be operated by a single or a group of different service providers. In this construct every service consumers can ask for a provision by a special service provider to fulfil local requirements that might be present.

This service implements the OGC (Open Geospatial Consortium) Standard on Coverage, the web coverage services (WCS) as specified in [15] and also offers the provided content in publish and subscribe technique.

Implicitly this service will be compliant with ICAO Annex 3 [16].

1 Introduction

1.1 Purpose of the document

The purpose of the SDD is to provide a complete design description of each service, to describe the services to such a level that it is possible to make decisions on the implementation of the services in activities such as Service Implementation and evolution planning. The document serves as a complement to a model based description and supports the configuration management process by providing well-defined baselines.

1.2 Intended readership

This service description document is intended to be read by Enterprise Architects, Service Architects, Information Architects, System Engineers and Developers in pursuing architecting, design and development activities.

1.3 Inputs from other projects

- Step 1 OSED by P07.06.01 [14]
- P11.02.01 D23 MET OSED [13]
- P 06.05.04 D16 OSED [17]

1.4 Glossary of terms

N.A.

1.5 Acronyms and Terminology

1.5.1 Acronyms

Term	Definition
4DWxCube	4D Weather Cube
ADD	Architecture Description Document
ATM	Air Traffic Management
CC	Capability Configuration
EATMA	European Air Traffic Management Architecture
E-ATMS	European Air Traffic Management System
FAA	Federal Aviation Administration
IER	Information Exchange Requirement
ISRM	Information Service Reference Model
MET	METEO

Term	Definition
METSP	MET Service Provider
NAF	NATO Architecture Framework
NSOV	NATO Service-Oriented View
NOV	NATO Operational View
NSV	NATO System View
OSED	Operational Service and Environment Definition
OUE	Operational User Environment
QoS	Quality of Service
SDD	Service Description Document
SESAR	Single European Sky ATM Research Programme
SESAR Programme	The programme which defines the Research and Development activities and Projects for the SJU.
SJU	SESAR Joint Undertaking (Agency of the European Commission)
SJU Work Programme	The programme which addresses all activities of the SESAR Joint Undertaking Agency.
SoaML	Service Oriented Architecture Modelling Language
SWIM	System Wide Information Management
UML	Unified Modelling Language
V&V	Validation and Verification
WSDL	Web Services Definition Language
XSD	XML Schema Definition

1.5.2 Terminology

Term	Definition	Source
Capability	The collective ability to deliver a specified type of effect or a specified course of action. Within the context of the SESAR Programme a capability is therefore the ability to support the delivery of a specific operational concept to an agreed level of performance.	Common working meeting between B41 EA study and B43 T5

Term	Definition	Source
Capability Configuration	A combination of organisational aspects (with their competencies) and equipment that combine to provide a capability. A Capability Configuration represents a recognisable set of resources (technical systems, human roles, and physical assets) derived from a generic stakeholder organisation. Note: Capability Configuration is a term used in NAF. The equivalent SoaML stereotype to be used is Participant. Also see note in Node term definition.	B43 ADD
Node	A logical entity that performs Operational Activities specified independently of any physical realisation e.g. a stakeholder type providing and/or consuming operational information within a network of others. Note: Node is a term used in NAF. The equivalent SoaML stereotype to be used is Participant. Be aware that the original intention of SoaML is that Participants are physical items and not logical constructs. Service architects must indicate whether the Participant is a logical (Node) or a physical (Capability Configuration) construct.	Common working meeting between B41 EA study and B43 T5
Service	The contractual provision of something (a non-physical object), by one, for the use of one or more others. 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.	B43 T5 study
Service attribute	A Service Attribute defines a property of a service. Examples: Response time, Frequency of invocation, Message Exchange Pattern.	B43 T5 study
Service contract	A service contract represents an agreement between the stakeholders involved for how a service is to be provided and consumed.	B43 T5 study
Service function	A Service function describes what functionality is needed to provide or consume a service; it is the trigger for or is triggered by the Service interactions. A Service function can be automated to different extents depending on the context e.g. a Service function supporting a complex activity may need more automation than a Service function for a simple activity. Note: The equivalent SoaML stereotype is Capability, in WP8 Foundation documentation referred to as Service Capability.	B43 T5 study
Service interaction	A Service interaction is a description of an information exchange between ATM stakeholders' systems which can potentially be automated; phone calls / voice exchanges are considered as non-automated service interactions. In considering automated interactions, a service interaction is described by several modelling artefacts depicting the static and dynamic behaviour of a service. This includes service	B43 T5 study

Term	Definition	Source
	operations, data messages model and interaction behaviour.	
Service interface	The mechanism by which a service communicates. Service providers and consumers need to implement service interfaces to be able to collaborate. A service interface includes service operations that enable access to the functionality of the services identified, as well as the data used in the service interaction.	B43 T5 study

2 Service identification

Name	METGriddedForecast
ID	960F8087-7FA2-446d-B556-BD08A7D8FAF0
Version	2.0
Keywords	Nowcast, Forecast, MET, Hazard
Architect(s)	Service Architect: [redacted] (DFS) Information Architect: [redacted] (DFS)

Lifecycle status	Date	References
Identified	21/04/2015	See reference [19]
Allocated		Not yet allocated
Designed	10/11/2015, 15/05/2016	This document.
Validated	*Date when validated. Filled by WP3*	*Name of protocol documenting the decision*
IOC	*Date for Initial Operational Capability*	*Reference to technical enabler hosting the service in the ATM master plan*
FOC	*Date for Full Operational Capability*	*Reference to technical enabler hosting the service in the ATM master plan*

3 Operational and Business context

Today's European ATM Operations do not yet fully integrate weather information in a consistent and collaborative way.

The different local planning processes at both airports, ACCs and eventually FABs do not use the same weather information and do not share in a consistent way the different processes that may lead to ATM measures in the event of certain weather phenomena affecting their area of responsibility. The Regional Network Manager also uses its own processes and data to evaluate the potential impact of forecasted weather phenomena in points of the European Network eventually influencing the Network beyond their specific local impact.

In the future, the Network Operation Planning process will be improved through the use of meteorological network relevant data provided by the 4DwxCube. This data will be used as the basis to launch the necessary DCB processes that in a collaborative way agree on the Network Operations Plan that achieves the best feasible and performing Network for a given day "D".

Two types of weather conditions can be differentiated, nominal and adverse (degraded) or significant weather conditions.

Significant Weather Conditions

The significant weather conditions may have a negative impact on airspace performance unless a proper response is organized. This would be the case when in-cloud turbulence is critical in the sector and/or in case of icing conditions at the mainly used flight levels is happening.

The 4DWxCube significant weather information (forecast) permits the Network to anticipate and prepare effective mitigations on potential reduction of capabilities that can have an impact on the network performance with or without causing a severe disruption.

The horizon of the forecast is from 6 to 48 hours but it is anticipated to be extended in the future if deemed necessary.

The anticipation and preparation of mitigations for potential reduction of capabilities in one or more parts of the network will lead to a NOP produced at D-1 closer to the actual execution of the plan. With this, the ATM community will increase their trust in the NOP and improve the Network performance. Forecast closer to the target time (on D day) provide more confident predictions that improve the NOP and the subsequent actions and decisions.

The 4DWxCube should also provide the actual significant weather information (observations) that will be used in post-analysis. Comparison between the forecast and the subsequent actions and decisions taken in NOP versus the actual weather and actual network situation will be analyzed, and lessons learnt/derived/knowledge base will be enriched to improve weather management procedures.

Nominal Weather Conditions

The nominal Weather Forecasts for MET aloft elements is the scope of the service at hand.

This service will enable the local OUE stakeholders, the sub-regional OUE stakeholders and network OUE stakeholders to be provided with all nominal MET information for an airport or an en-route airspace and approach areas.

The information includes the aloft elements (e.g. wind and temperature). The required elements should be selectable by the stakeholder.

It is also expected that for this service, a user selectable temporal resolution (update rate or time steps for forecast data) is foreseen and for the aloft data also spatial resolution (horizontal grid and vertical steps) is foreseen. In addition it is expected that the user can select multiple airports and that the forecast data will be differentiated into data for deterministic and for probabilistic forecasts.

It is envisaged that the METSP will make the data available with a high resolution and that the MET-SWIM Node (the METGATE) will rescale the data to the desired user output resolution.

The METGriddedForecast services are a first set of services aiming at demonstrating the increase in ATM performance through the efficient and coordinated use of weather information within the framework of IOP VLD.

3.1 Information Exchange Requirements

The service identification is based on IERs from the P11.02.01 OSED [13] for general MET requirements. Figure 3 shows the tracing of the service to the relevant requirements.

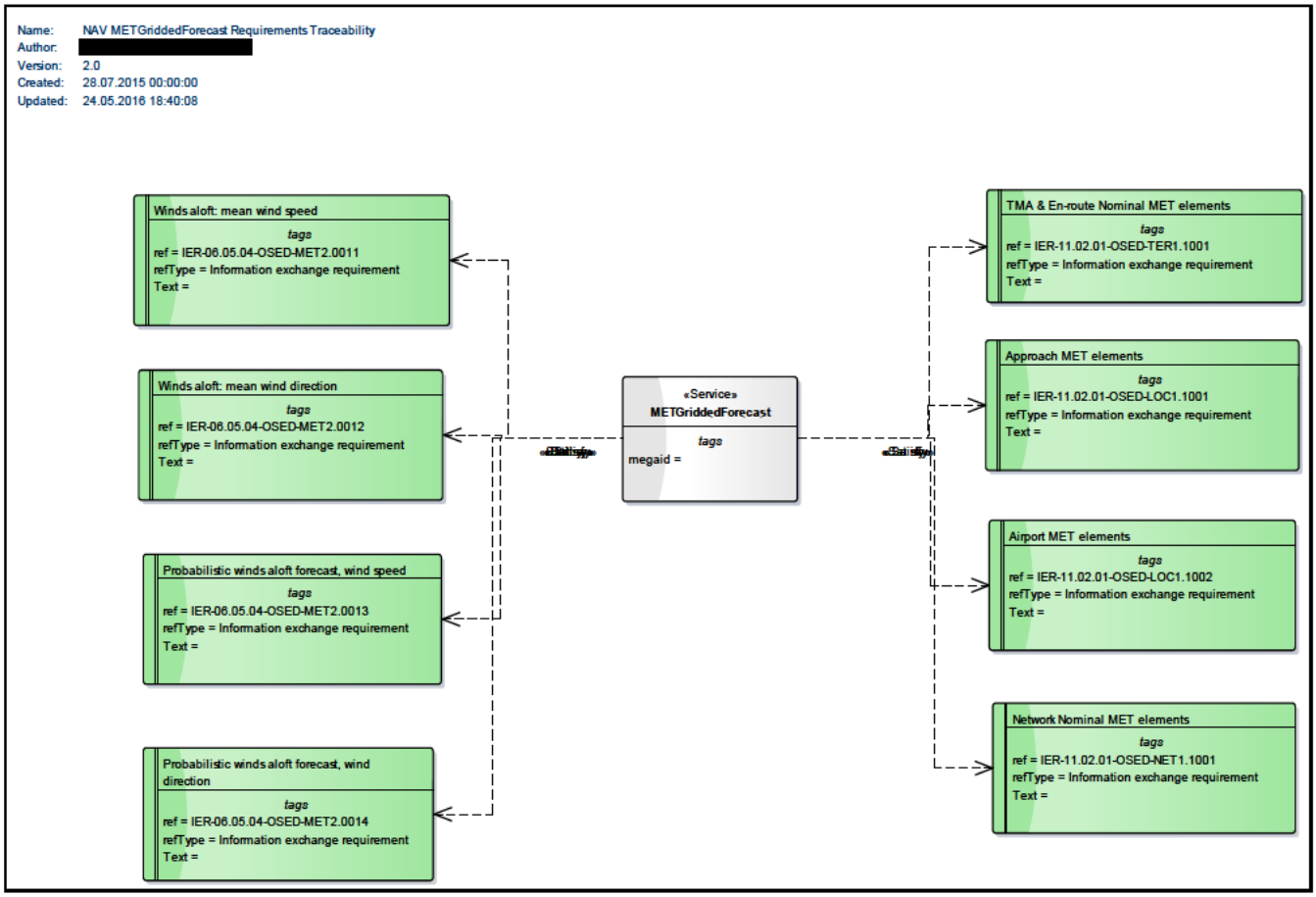

Figure 3: NAV METGriddedForecast Requirements Traceability

Element Name	Author	Notes
Airport MET elements	[redacted]	Airport MET elements

	Element Tagged Value Name	Value
	ref	IER-11.02.01-OSED-LOC1.1002
	refType	Information exchange requirement
	Text	

Element Name	Author	Notes
Approach MET elements	[redacted]	Approach MET elements
Element Tagged Value Name		Value
ref		IER-11.02.01-OSED-LOC1.1001
refType		Information exchange requirement
Text		
Element Name	Author	Notes
Network Nominal MET elements	[redacted]	Network Nominal MET elements
Element Tagged Value Name		Value
ref		IER-11.02.01-OSED-NET1.1001
refType		Information exchange requirement
Text		
Element Name	Author	Notes
TMA & En-route Nominal MET elements	[redacted]	TMA & En-route Nominal MET elements
Element Tagged Value Name		Value
ref		IER-11.02.01-OSED-TER1.1001
refType		Information exchange requirement
Text		
Element Name	Author	Notes
Probabilistic winds aloft forecast, wind direction	[redacted]	Probabilistic winds aloft forecast
Element Tagged Value Name		Value
ref		IER-06.05.04-OSED-MET2.0014
refType		Information exchange requirement
Text		
Element Name	Author	Notes
Probabilistic winds aloft forecast, wind speed	[redacted]	Probabilistic winds aloft forecast
Element Tagged Value Name		Value
ref		IER-06.05.04-OSED-MET2.0013
refType		Information exchange requirement
Text		
Element Name	Author	Notes
Winds aloft: mean wind direction	[redacted]	Winds aloft: mean wind direction
Element Tagged Value Name		Value
ref		IER-06.05.04-OSED-MET2.0012
refType		Information exchange requirement
Text		
Element Name	Author	Notes
Winds aloft: mean wind speed	[redacted]	Winds aloft: mean wind speed
Element Tagged Value Name		Value
ref		IER-06.05.04-OSED-MET2.0011
refType		Information exchange requirement
Text		

Table 1: Requirements Traceability

3.2 Other Requirements

3.2.1 Non-Functional Requirements

No proper NFRs have yet been identified by operational projects.

3.2.2 Relevant Industrial Standards

- WMO Gridded Data Format Standards like GRIB 1 and GRIB 2 [12]
- OGC (Open Geospatial Consortium) Standard on Coverage [15]
- ICAO Annex 3 [16]

3.2.3 Nodes

This chapter shows the Service to Nodes Mapping diagram.

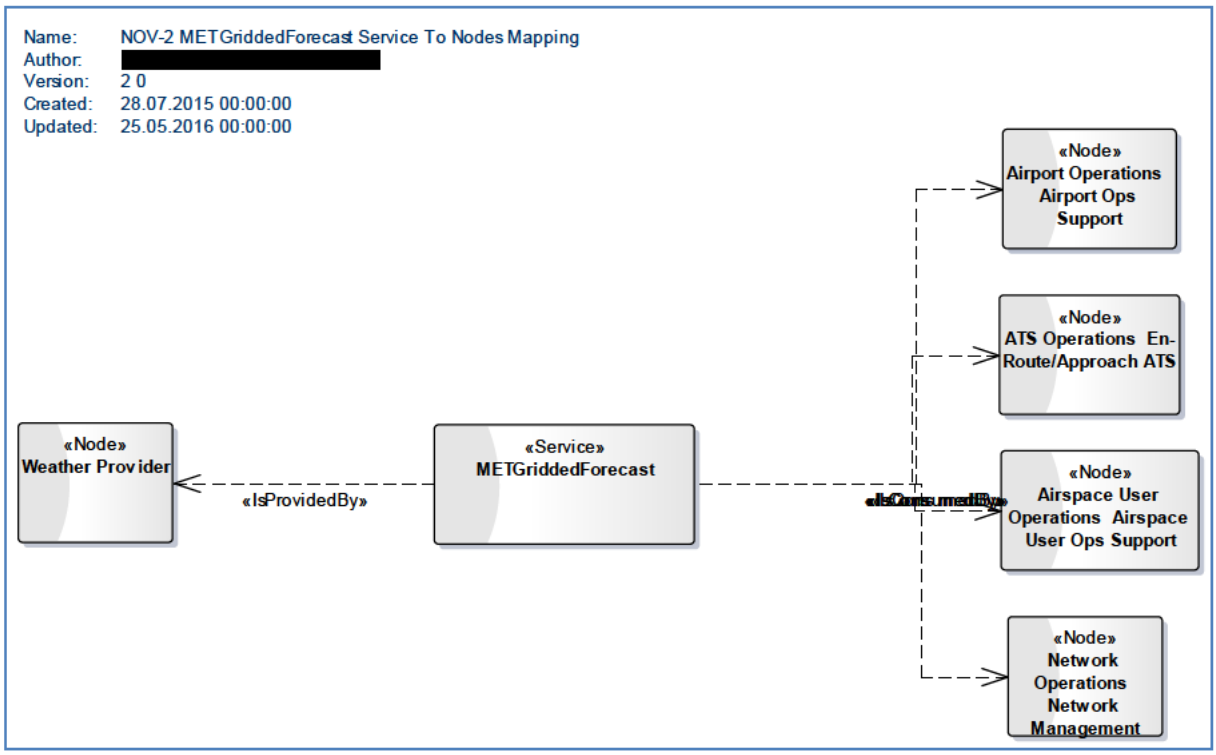

Figure 4: NOV-2 METGriddedForecast Service to Nodes Mapping diagram

4 Service overview

4.1 Service Taxonomy

The service taxonomy is described in the ISRM Service Portfolio document [11].

4.2 Service Levels (NfRs)

Non Functional Requirements are described in section 3.2.1.

4.3 Service Functions and Capabilities

The mapping to Operational Activities is as described in the following figure. The capability mapping is shown in combination with the interface definition in chapter 4.4.

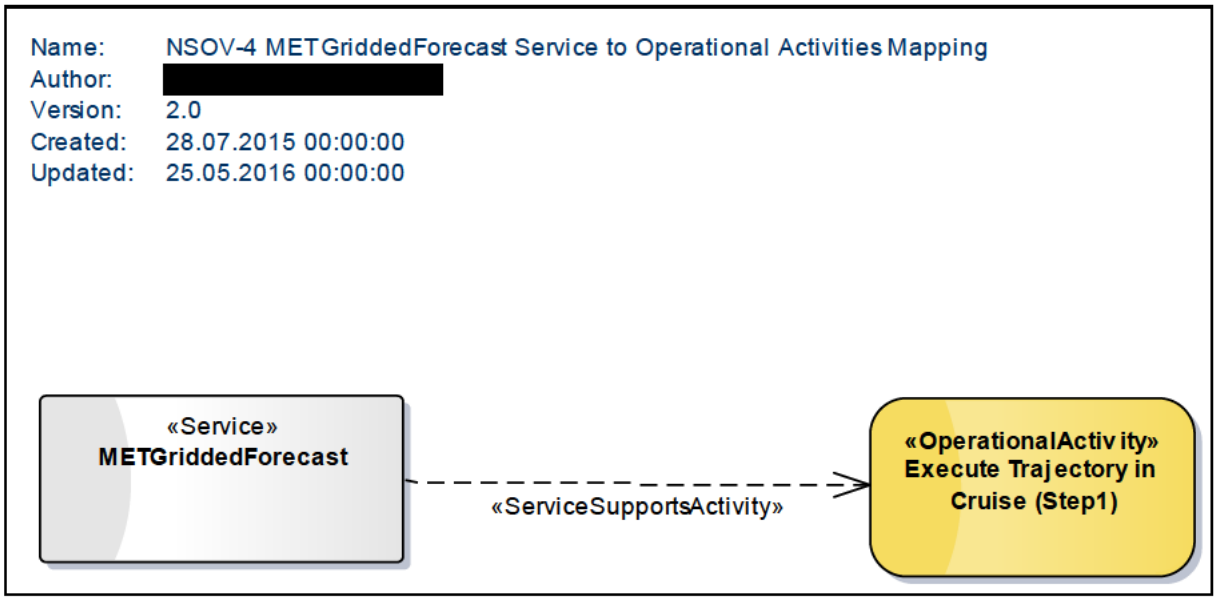

Figure 5: NSOV-4 METGriddedForecast Service to Operational Activities Mapping diagram

4.4 Service Interfaces

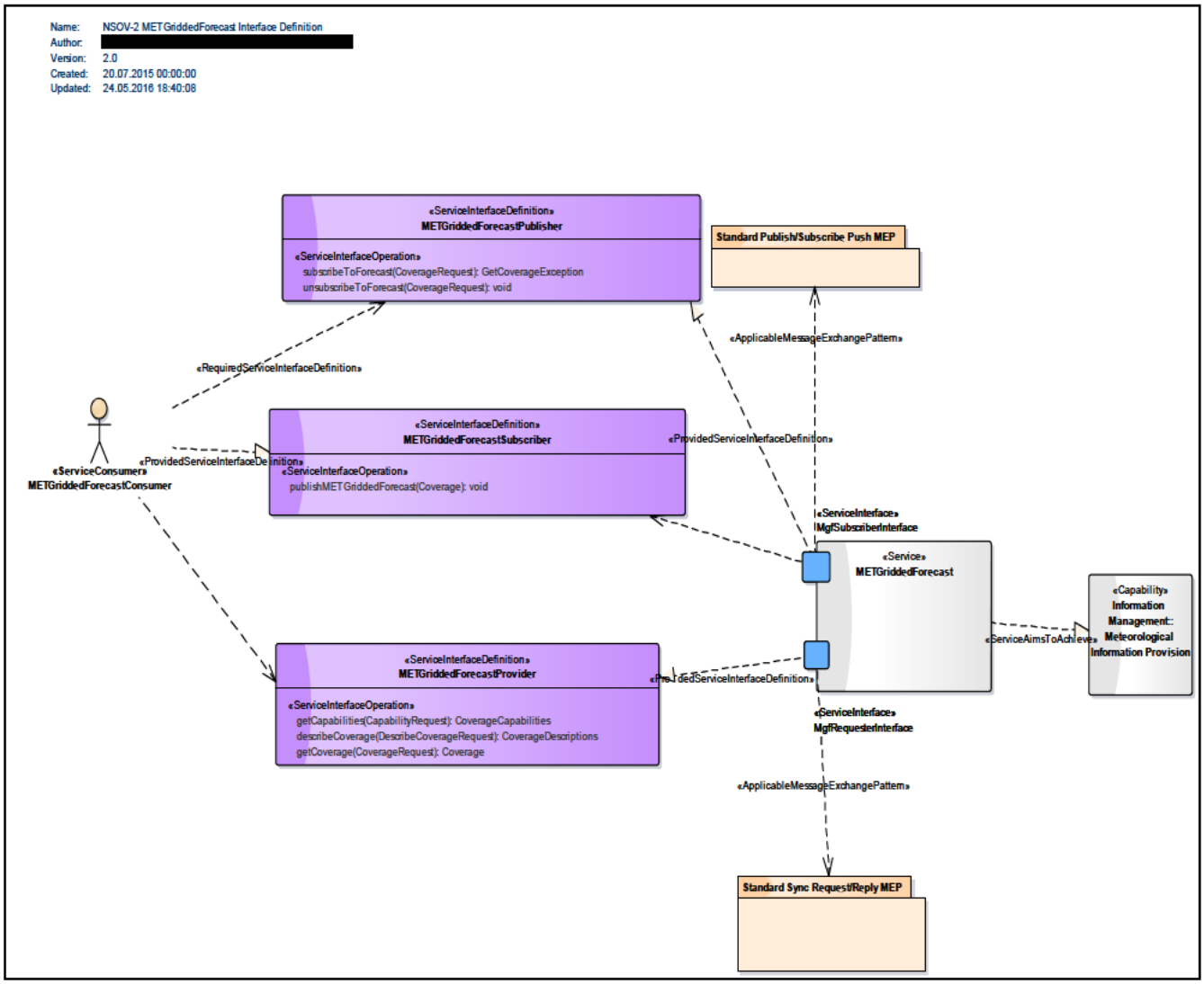

Figure 6: NSOV-2 METGriddedForecast Interface Definition diagram

Within the table below an overview on the service interface design is provided.

ServiceInterface	ServiceInterfaceDefinition	ServiceInterfaceOperation	Role
MgfSubscriberInterface	METGriddedForecastPublisher	subscribeToForecast	provided
	METGriddedForecastPublisher	unsubscribeToForecast	provided
	METGriddedForecastSubscriber	publishMETGriddedForecast	required
MgfRequesterInterface	METGriddedForecastProvider	getCapabilities	provided
	METGriddedForecastProvider	describeCoverage	provided
	METGriddedForecastProvider	getCoverage	provided

Table 2: Service Interfaces

5 Service interface specifications

This chapter describes the details of each interface. The Service Interface specification only covers the static design description while the dynamic design (behaviour) is described in chapter 6.

The static interface description is vital since it describes how the interfaces shall be constructed.

Architectural elements applicable for this description are:

- Service Interfaces
- Service Interface Definitions
- Operations
  Function or procedures which enable programmatic communication with a Service via a Service interface.
- Parameters
  Constants or variables passed into or out of a Service interface as part of the execution of an Operation.

The service interface design is based on the specifications provided by the OGC Web Coverage Services [15].

The WCS interface herein specified supports retrieval of geospatial coverage data – that is, digital geospatial information representing space/time-varying phenomena [OGC 07-011]. To this end, the WCS interface specifies the following operations that may be invoked by a WCS client and performed by a WCS server:

a) **GetCapabilities** – This operation allows a client to request information about the server's capabilities and coverages offered.

b) **DescribeCoverage** – This operation allows a client to request detailed metadata on selected coverages offered by a server.

c) **GetCoverage** – This operation allows a client to request a coverage comprised of selected range properties at a selected set of spatio-temporal locations, expedited in some coverage encoding format.

A client should first, during a sequence of WCS requests, issue a GetCapabilities request to the server to obtain an up-to-date listing of available data. Then, it may issue a DescribeCoverage request to find out more details about particular coverages offered.

This afore mentioned operations just offer metadata according to the coverages provided by the server in question. To retrieve a coverage or a part thereof, meaning the content (parameter values) of the requested area, a client needs to issue a GetCoverage request.

5.1 Service Interface MgfRequesterInterface

5.1.1 Service Interface Definition METGriddedForecastProvider

The interface definition consists of a total of 3 operations and represents a standard synchronous request/reply message exchange pattern. It is the interface provided by the service provider.

5.1.1.1 Operation getCapabilities

This operation allows a client to request information about the server's capabilities and coverages offered.

5.1.1.1.1 Operation Parameters

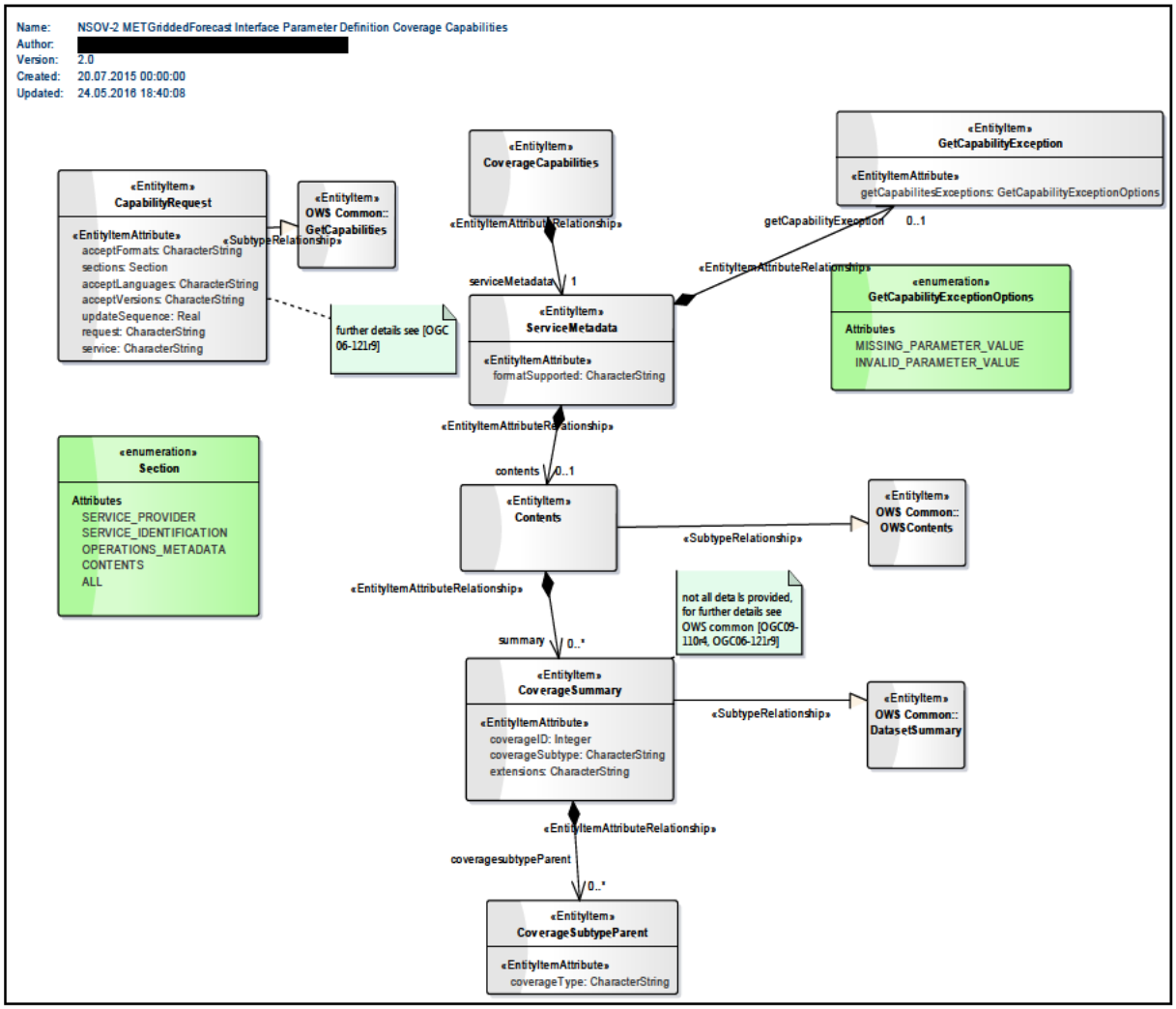

Figure 7: NSOV-2 METGriddedForecast Interface Parameter Definition Coverage Capabilities

Input parameters: The payload for the request (top level class "CapabilityRequest") is shown on the upper left part of the figure.

Element Name	Author	Notes
CapabilityRequest	[redacted]	A *GetCapabilities* operation, as required by OWS Common [OGC 06-121r9], allows a WCS client to retrieve service and coverage metadata offered by a WCS server. This clause partially specifies the GetCapabilities operation provided by each OWS. The mandatory GetCapabilities operation allows any client to retrieve metadata about the capabilities provided by any server that implements an OWS interface Implementation Specification. The normal response to the GetCapabilities operation is a service metadata document that is returned to the requesting client. This service metadata document primarily contains metadata about the specific server abilities (such as about the specific data and formats available from that server). This service metadata also makes an OWS server partially self-describing, supporting late binding of clients.

	Attribute Name	Type	Notes
	acceptFormats	CharacterString	Prioritized sequence of zero or more response formats desired by client, with preferred formats listed first. Sequence of Character String type, each not empty Value is list of format identifiers Identifiers are MIME types of formats useful for service metadata documents When a server implements the AcceptFormats parameter and receives a value for it, the server shall return the Capabilities document in the format of the first MIME type in this list that it is capable of returning. When not received or not implemented, the server shall return the Capabilities document in normal XML, using the MIME type "text/xml". All clients and servers shall implement the "text/xml" MIME type for the GetCapabilities operation. Since "text/xml" is always an implicit last option, the server always has an implemented MIME type to use to return a Capabilities document to the client.

	Tagged Value Name	Value
	CLDMSemanticTrace	CLDM out of scope

	Attribute Name	Type	Notes
	sections	Section	Unordered list of zero or more names of requested sections in complete service metadata document. When omitted or not supported by server, return complete service metadata.

	Tagged Value Name	Value
	CLDMSemanticTrace	CLDM_out_of_scope

	Attribute Name	Type	Notes
	acceptLanguages	CharacterString	Sequence of one or more languages for human readable text requested by the client.

	Tagged Value Name	Value
	CLDMSemanticTrace	CLDM_out_of_scope

	Attribute Name	Type	Notes
	acceptVersions	CharacterString	Prioritized sequence of one or more specification versions accepted by client, with preferred versions listed first

	Tagged Value Name	Value
	CLDMSemanticTrace	CLDM_out_of_scope

	Attribute Name	Type	Notes
	updateSequence	Real	Service metadata document version, value is increased whenever any change is made in complete service metadata document.

	Tagged Value Name	Value
	CLDMSemanticTrace	CLDM_out_of_scope

	Attribute Name	Type	Notes
	request	CharacterString	operation name

	Tagged Value Name	Value
	CLDMSemanticTrace	CLDM_out_of_scope

	Attribute Name	Type	Notes
	service	CharacterString	service Type Identifier, value needs to be OWS type abbreviation (e,g. WCS)

	Tagged Value Name	Value
	CLDMSemanticTrace	CLDM_out_of_scope

Element Name	Author	Notes
OWS Common::GetCapabilities	[redacted]	This class partially specifies the GetCapabilities operation provided by each OWS. The mandatory GetCapabilities operation allows any client to retrieve metadata about the capabilities provided by any server that implements an OWS interface Implementation Specification. The normal response to the GetCapabilities operation is a service metadata document that is returned to the requesting client. This service metadata document primarily contains metadata about the specific server abilities (such as about the specific data and formats available from that server). This service metadata also makes an OWS server partially self-describing, supporting late binding of clients.

Element Name	Author	Notes
Section	[redacted]	Unordered list of zero or more names of requested sections in complete service metadata document.

	Attribute Name	Type	Notes
	SERVICE_PROVIDER		Return ServiceProvider metadata element in service metadata document.

	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	
	Attribute Name	Type	Notes
	SERVICE_IDENTIFICATION		Return ServiceIdentification element in service metadata document
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	
	Attribute Name	Type	Notes
	OPERATIONS_METADATA		Return OperationsMetadata element in service metadata document
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	
	Attribute Name	Type	Notes
	CONTENTS		Return Contents metadata element in service metadata document
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	
	Attribute Name	Type	Notes
	ALL		Return complete service metadata document, containing all elements
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	

Table 3: Input Parameters for the getCapabilities operation

Output parameters: The payload for the capabilities provision is shown in the center of the figure (top level class “CoverageCapability”).

Element Name	Author	Notes
CoverageCapabilities	[redacted]	Coverage is a feature that acts as a function to return values from its range for any direct position within its spatial, temporal or spatiotemporal domain.

Element Name	Author	Notes
ServiceMetadata	[redacted]	Service metadata and functionality specific information.

	Attribute Name	Type	Notes
	formatSupported	CharacterString	Coverage encoding formats supported by this server

	Tagged Value Name	Value
	CLDMSemanticTrace	CLDM_out_of_scope

Element Name	Author	Notes
Contents	[redacted]	The Contents section provides details about the coverages offered by the service. Its structure is derived from the Contents definition in OWS Common [OGC 06-121r9] along the mechanism prescribed there:

Element Name	Author	Notes
CoverageSummary	[redacted]	This CoverageSummary is extended (over datasetSummary) with two additional components: coverageId for the coverage identification and the coverageSubtype/coverageSubtypeParent for unambiguously describing the coverage’s type.

	Attribute Name	Type	Notes
	coverageID	Integer	Identifier of a coverage offered by the service on hand

	Tagged Value Name	Value
	CLDMSemanticTrace	CLDM_out_of_scope

	Attribute Name	Type	Notes
	coverageSubtype	CharacterString	Type name of the coverage on hand

	Tagged Value Name	Value
	CLDMSemanticTrace	CLDM_out_of_scope

	Attribute Name	Type	Notes
	extensions	CharacterString	Further metadata

	Tagged Value Name	Value
	CLDMSemanticTrace	CLDM_out_of_scope

Element Name	Author	Notes
CoverageSubtypeParent	[redacted]	Recursive list of the coverage’s supertypes

	Attribute Name	Type	Notes
	coverageType	CharacterString	Type name of the coverage at hand.

	Tagged Value Name	Value
	CLDMSemanticTrace	CLDM_out_of_scope

Element Name	Author	Notes
GetCapabilityException	[redacted]	In the event that an OWS server encounters an error servicing a

			GetCapabilities operation request, it shall return an exception report message.
	Attribute Name	Type	Notes
	getCapabilitesExceptions	GetCapabilityException Options	error message
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	
Element Name		Author	Notes
OWS Common::OWSContents		[redacted]	Metadata about the data served by this server. The contents and organization of this section are specific to each OWS type, as defined by that Implementation Specification. Whenever applicable, this section shall contain a set of dataset descriptions, which should each be based on the MD_DataIdentification class specified in ISO 19115 and used in ISO 19119.
Element Name		Author	Notes
OWS Common::DatasetSummary		[redacted]	Metadata describing one top-level dataset available from this server.
Element Name		Author	Notes
GetCapabilityExceptionOptions		[redacted]	The allowed exception codes
	Attribute Name	Type	Notes
	MISSING_PARAMETER_VALUE		Operation request does not include a parameter value
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	
	Attribute Name	Type	Notes
	INVALID_PARAMETER_VALUE		Operation request contains an invalid parameter value
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	

Table 4: Output Parameters for getCapabilities operation

5.1.1.2 Operation describeCoverage

This operation allows a client to request detailed metadata on selected coverages offered by a MET server.

5.1.1.2.1 Operation Parameters

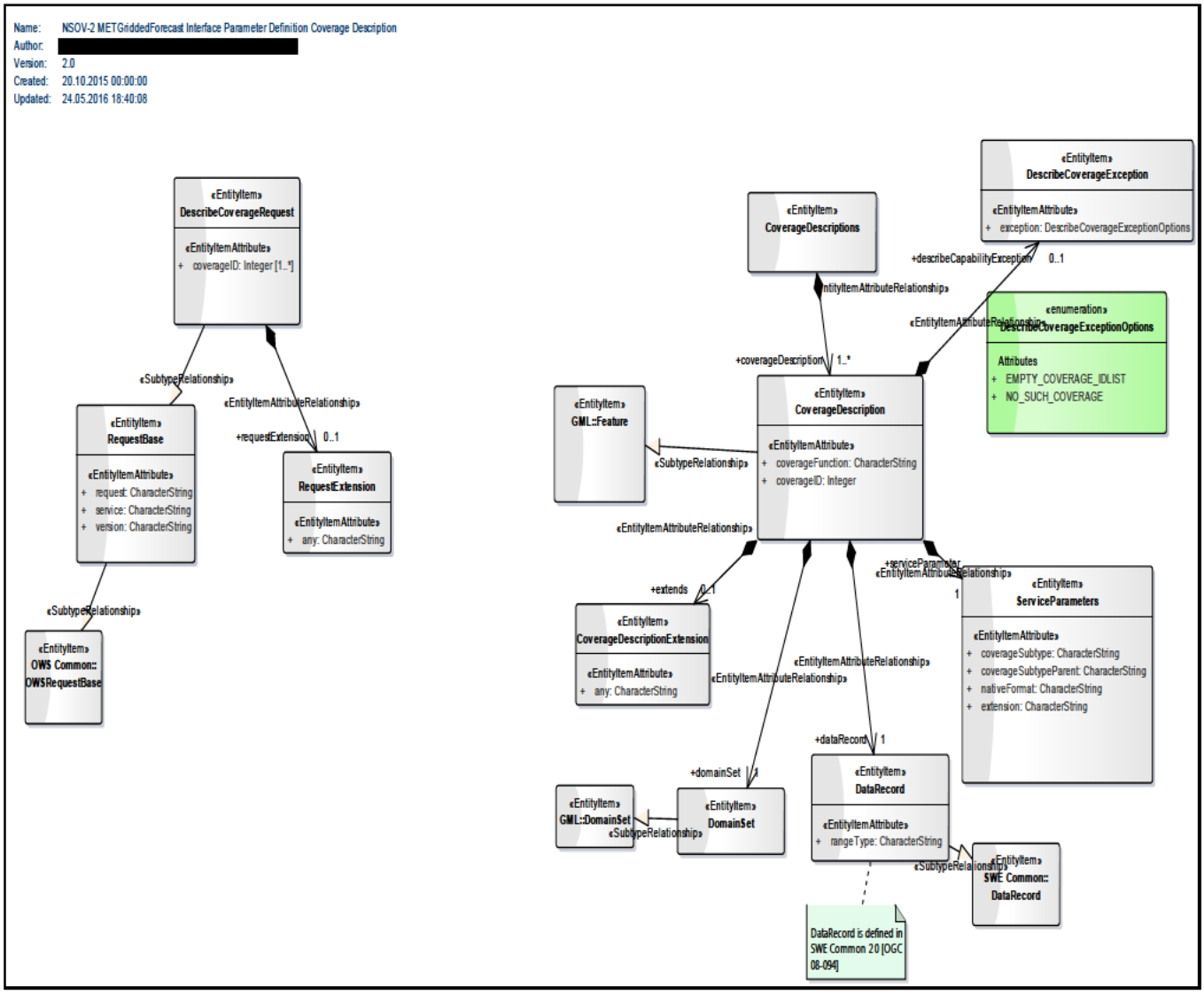

Figure 8: NSOV-2 METGriddedForecast Interface Parameter Definition Coverage Description

Input parameters: The payload for the description request is shown in the upper left part of figure (top level class “DescribeCoverageRequest”).

Element Name			Author	Notes
DescribeCoverageRequest			[redacted]	Message representing the request for a coverage description.
	Attribute Name	Type		Notes
	coverageID	Integer		Identifier of the coverage described
	Tagged Value Name	Value		
	CLDMSemanticTrace	CLDM out of scope		
Element Name			Author	Notes

RequestBase	[redacted]		The *DescribeCoverage* and *GetCoverage* request types make use of the RequestBase structure which mimics the OWS Common [OGC 06-121r9] RequestBase data structure.
	Attribute Name	Type	Notes
	request	CharacterString	Operation name
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	
	Attribute Name	Type	Notes
	service	CharacterString	Service type identifier, String, fixed to "WCS"
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	
	Attribute Name	Type	Notes
	version	CharacterString	WCS service version indicator
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	
Element Name	Author		Notes
RequestExtension	[redacted]		Any ancillary information to be sent from client to server
	Attribute Name	Type	Notes
	any	CharacterString	Any ancillary information to be sent from client to server
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	
Element Name	Author		Notes
OWS Common::OWSRequestBase	[redacted]		A request to perform any operation except GetCapabilities shall include the request base parameter.
Element Name	Author		Notes
DescribeCoverageException	[redacted]		Failure Codes
	Attribute Name	Type	Notes
	exception	DescribeCoverageExceptionOptions	error message
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	

Table 5: Input parameters for the describeCoverage operation

Output parameters: The payload for the coverage description provision is shown in the right part of the figure (top level class "CoverageDescriptions").

Element Name	Author		Notes
CoverageDescriptions	[redacted]		A set of description of a coverage
Element Name	Author		Notes
CoverageDescription	[redacted]		description of a coverage Coverage is a feature that acts as a function to return values from its range for any direct position within its spatial, temporal or spatiotemporal domain.
	Attribute Name	Type	Notes
	coverageFunction	CharacterString	GML 3.2.1 coverage function to describe

			how range values at coverage locations can be obtained
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	
	Attribute Name	Type	Notes
	coverageID	Integer	Identifier of the coverage described
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	
Element Name		Author	Notes
CoverageDescriptionExtension		[redacted]	Application specific metadata
	Attribute Name	Type	Notes
	any	CharacterString	Any Metadata for that coverage
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	
Element Name		Author	Notes
DataRecord		[redacted]	The "*DataRecord*" class is modeled on the definition of 'Record' from ISO 11404. In this definition, a record is a composite data type composed of one to many fields, each of which having its own name and type definition. Thus it defines some logical collection of components of any type that are grouped for a given purpose.
	Attribute Name	Type	Notes
	rangeType	CharacterString	Structure definition of the coverage range values
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	
Element Name		Author	Notes
DomainSet		[redacted]	service Payload based on a standard exchange model: - GML 3.2.1 (http://portal.opengeospatial.org/files/?artifact_id=20509) This EntityItem corresponds to the following entity in te GML specification. GML 3.2.1 Definition of coverage domain
Element Name		Author	Notes
GML::DomainSet		[redacted]	GML 3.2.1 definition of coverage domain.
Element Name		Author	Notes
SWE Common::DataRecord		[redacted]	The "*DataRecord*" class is modeled on the definition of 'Record' from ISO 11404. In this definition, a record is a composite data type composed of one to many fields, each of which having its own name and type definition. Thus it defines some logical collection of components of any type that are grouped for a given purpose.
Element Name		Author	Notes
ServiceParameters		[redacted]	Service-specific parameters of this server

	[redacted]		
	Attribute Name	Type	Notes
	coverageSubtype	CharacterString	Type name of the coverage on hand
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	
	Attribute Name	Type	Notes
	coverageSubtypeParent	CharacterString	Recursive list of the coverage's supertypes
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	
	Attribute Name	Type	Notes
	nativeFormat	CharacterString	MIME type identifier of the coverage's Native Format
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM out of scope	
	Attribute Name	Type	Notes
	extension	CharacterString	Any kind of ancillary data
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM out of scope	
Element Name	Author	Notes	
DescribeCoverageExceptionOptions	[redacted]	DescribeCoverageException	
	Attribute Name	Type	Notes
	EMPTY COVERAGE ID LIST		An empty list of identifiers was passed as input argument, while at least one identifier is required
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	
	Attribute Name	Type	Notes
	NO_SUCH_COVERAGE		One of the identifiers passed does not match with any of the coverages offered by this server
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	

Table 6: Output parameters for the describeCoverage operation

5.1.1.3 Operation getCoverage

This operation allows a client to request a coverage comprised of selected range properties at a selected set of spatio-temporal locations, expedited in some coverage encoding format.

5.1.1.3.1 Operation Parameters

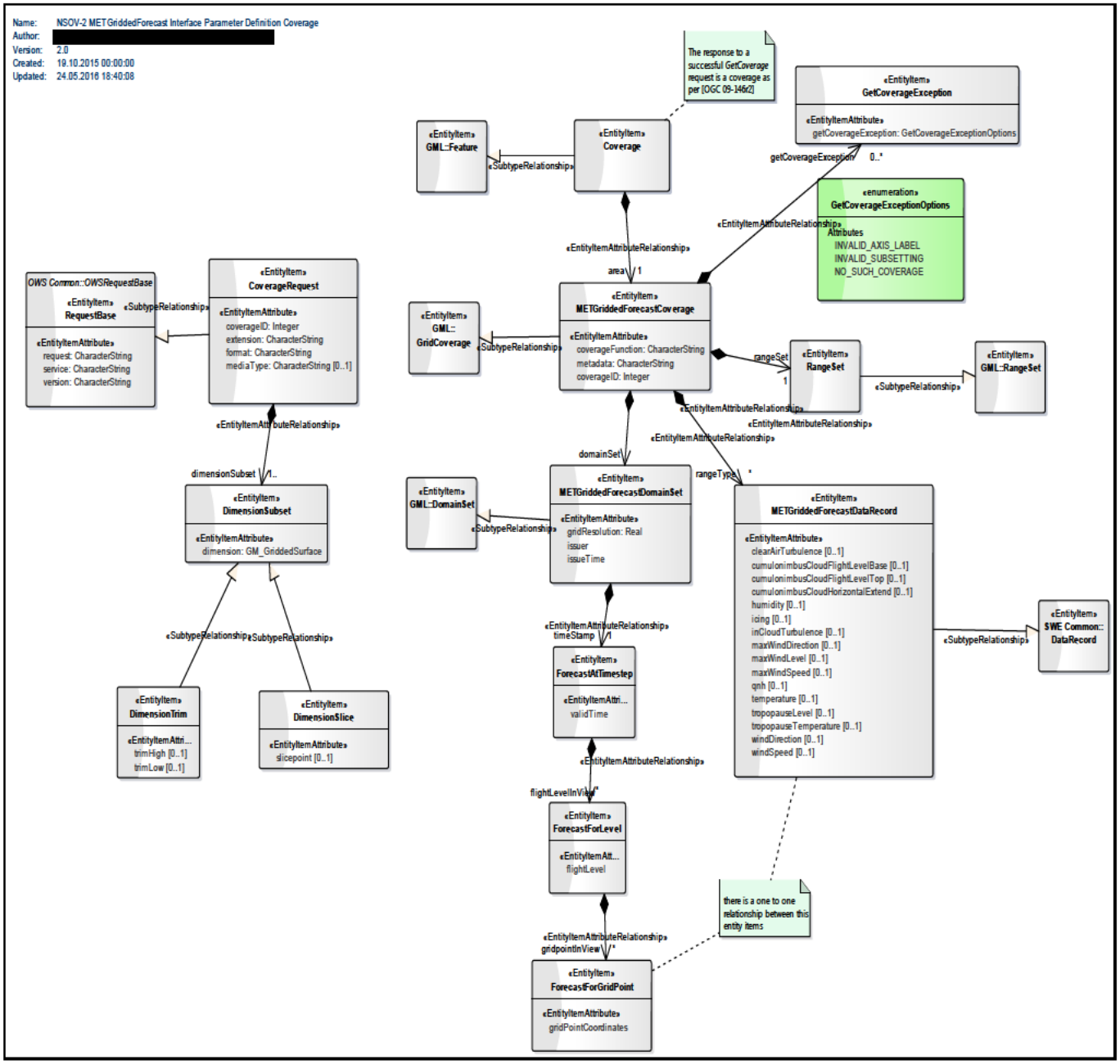

Figure 9: NSOV-2 METGriddedForecast Interface Parameter Definition Coverage

Input parameter: The payload for the description request is shown in the left part of the figure (top level class “CoverageRequest”).

Element Name	Author	Notes
CoverageRequest	[redacted]	Coverage is a feature that acts as a function to return values from its range for any direct position within its spatial, temporal or spatiotemporal domain [OGC 07011]

Attribute Name	Type	Notes
coverageID	Integer	Identifier of the coverage evaluated.

Tagged Value Name	Value
CLDMSemanticTrace	CLDM_out_of_scope

Attribute Name	Type	Notes
extension	CharacterString	Any ancillary information to be sent from client to server

Tagged Value Name	Value
CLDMSemanticTrace	CLDM_out_of_scope

Attribute Name	Type	Notes
format	CharacterString	MIME type identifier of the format in which the coverage returned is encoded

Tagged Value Name	Value
CLDMSemanticTrace	CLDM_out_of_scope

Attribute Name	Type	Notes
mediaType	CharacterString	If present, enforces a multipart encoding

Tagged Value Name	Value
CLDMSemanticTrace	CLDM_out_of_scope

Element Name	Author	Notes
RequestBase	[redacted]	The *DescribeCoverage* and *GetCoverage* request types make use of the RequestBase structure which mimics the OWS Common [OGC 06-121r9] RequestBase data structure.

Attribute Name	Type	Notes
request	CharacterString	Operation name

Tagged Value Name	Value
CLDMSemanticTrace	CLDM_out_of_scope

Attribute Name	Type	Notes
service	CharacterString	Service type identifier, String, fixed to “WCS”

Tagged Value Name	Value
CLDMSemanticTrace	CLDM_out_of_scope

Attribute Name	Type	Notes
version	CharacterString	WCS service version indicator

Tagged Value Name	Value
CLDMSemanticTrace	CLDM_out_of_scope

Element Name	Author	Notes
DimensionSubset	[redacted]	Subsetting specification per subsetting dimension

Attribute Name	Type	Notes
dimension	GM_GriddedSurface	Name of dimension along which to subset urn:x-ses:sesarju:airm:v400:FoundationLibrary:ISO:ISO 19107 Spatial Schema:Geometry:Coordinate geometry:GM_GriddedSurface

	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	
Element Name		Author	Notes
DimensionTrim		[redacted]	For trimming a coverage in a particular dimension, the corresponding dimension name is indicated as well as the lower and upper bound of the resulting coverage. Both lower and upper bound are optional. A lower bound omitted shall be substituted in the server by the coverage's lower bound in the dimension on hand, an upper bound omitted shall be substituted in the server by the coverage's upper bound. The result coverage shall contain only those range values of the original coverage which lie within the effective lower and upper bound, obtained as described.
	Attribute Name	Type	Notes
	trimHigh		Upper bound of cutout along dimension
	Tagged Value Name	Value	
	CLDMSemanticTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:Abstract:GeoEnabledEntity@position	
	Attribute Name	Type	Notes
	trimLow		Lower bound of cutout along dimension
	Tagged Value Name	Value	
	CLDMSemanticTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:Abstract:GeoEnabledEntity@position	
Element Name		Author	Notes
DimensionSlice		[redacted]	*Slicing* performs a cut at the position indicated, thereby reducing the dimension of the result coverage.
	Attribute Name	Type	Notes
	slicepoint		Slicing point along dimension
	Tagged Value Name	Value	
	CLDMSemanticTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:Abstract:GeoEnabledEntity@position	

Table 7: Input parameters for the getCoverage operation

Output parameter: The payload for the coverage description provision is shown in the right part of the figure (top level class "Coverage").

Element Name	Author	Notes
Coverage	[redacted]	Coverage is a feature that acts as a function to return values from its range for any direct position within its spatial, temporal or spatiotemporal domain.
Element Name	Author	Notes
METGriddedForecastCoverage	[redacted]	A GridCoverage is a discrete point coverage in which the domain is a geometric grid of points encoded using gml:Grid (not its subtypes gml:RectifiedGrid or a subtype of AbstractReferenceableGrid). Note that

			this is similar to the MultiPointCoverage except that a gml:Grid shall be used to describe the domain.
	Attribute Name	Type	Notes
	coverageFunction	CharacterString	GML 3.2.1 coverage function to describe how range values at coverage locations can be obtained
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	
	Attribute Name	Type	Notes
	metadata	CharacterString	Applicable specific metadata
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	
	Attribute Name	Type	Notes
	coverageID	Integer	Coverage Identification
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	
Element Name		Author	Notes
METGriddedForecastDataRecord		[redacted]	Meteorological phenomena for which the forecast is issued. This forecast may not contain all the phenomena listed. Upper-air gridded forecasts (ICAO Annex3 definition of "Upper-air gridded forecast") The forecasts of upper wind; upper-air temperature; and humidity; direction, speed and flight level of maximum wind; flight level and temperature of tropopause, areas of cumulonimbus clouds, icing, clear-air and in-cloud turbulence, and geopotential altitude of flight levels shall be prepared four times a day by a WAFC and shall be valid for fixed valid times at 6, 9, 12, 15, 18, 21, 24, 27, 30, 33 and 36 hours after the time (0000, 0600, 1200 and 1800 UTC) of the synoptic data on which the forecasts were based. The dissemination of each forecast shall be in the above order and shall be completed as soon as technically feasible but not later than 6 hours after standard time of observation.
	Attribute Name	Type	Notes
	clearAirTurbulence		g) clear-air turbulence for layers centred at flight levels 240 (400 hPa), 270 (350 hPa), 300 (300 hPa), 340 (250 hPa), 390 (200 hPa) and 450 (150 hPa);

			(see ICAO Annex3 definition of "Upper-air gridded forecast")

Tagged Value Name	Value
CLDMContextTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:SubjectFields:Meteorology:Codelists:CodeTurbulenceType@CLEAR_AIR_TURBULENCE
CLDMSemanticTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:SubjectFields:Meteorology:Turbulence
IMDefinitionTrace	urn:x-ses:sesarju:airm:v410:InformationModel:SubjectFields:Meteorology:ClearAirTurbulence

Attribute Name	Type	Notes
cumulonimbusCloudFlightLevelBase		e) ... base ... of cumulonimbus clouds; (see ICAO Annex3 definition of "Upper-air gridded forecast")

Tagged Value Name	Value
CLDMContextTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:SubjectFields:Meteorology:Codelists:CodeCloudType@CUMULONIMBUS
CLDMSemanticTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:SubjectFields:Meteorology:WeatherPhenomenon@base
IMDefinitionTrace	urn:x-ses:sesarju:airm:v410:InformationModel:SubjectFields:Meteorology:Cumulonimbus

Attribute Name	Type	Notes
cumulonimbusCloudFlightLevelTop		e) ... top of cumulonimbus clouds; (see ICAO Annex3 definition of "Upper-air gridded forecast")

Tagged Value Name	Value
CLDMContextTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:SubjectFields:Meteorology:Codelists:CodeCloudType@CUMULONIMBUS
CLDMSemanticTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:SubjectFields:Meteorology:WeatherPhenomenon@top
IMDefinitionTrace	urn:x-ses:sesarju:airm:v410:InformationModel:SubjectFields:Meteorology:Cumulonimbus

Attribute Name	Type	Notes
cumulonimbusCloudHorizontalExtend		e) horizontal extent ... of cumulonimbus clouds; (see ICAO Annex3 definition of "Upper-air gridded forecast")

Tagged Value Name	Value
CLDMContextTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:S

		ubjectFields:Meteorology:Codelists:CodeCloudType@CUMULONIMBUS	
	CLDMSemanticTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:Abstract:GeoEnabledEntity@surfaceExtent	
	IMDefinitionTrace	urn:x-ses:sesarju:airm:v410:InformationModel:SubjectFields:Meteorology:Cumulonimbus	
	Attribute Name	Type	Notes
	humidity		d) humidity data for flight levels 50 (850 hPa), 100 (700 hPa), 140 (600 hPa) and 180 (500 hPa); (see ICAO Annex3 definition of "Upper-air gridded forecast")
	Tagged Value Name	Value	
	CLDMSemanticTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:SubjectFields:Meteorology:AviationCondition@relativeHumidity	
	Attribute Name	Type	Notes
	icing		f) icing for layers centred at flight levels 60 (800 hPa), 100 (700 hPa), 140 (600 hPa), 180 (500 hPa), 240 (400 hPa) and 300 (300 hPa); (see ICAO Annex3 definition of "Upper-air gridded forecast")
	Tagged Value Name	Value	
	CLDMSemanticTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:SubjectFields:Meteorology:Icing	
	IMDefinitionTrace	urn:x-ses:sesarju:airm:v410:InformationModel:SubjectFields:Meteorology:Icing	
	Attribute Name	Type	Notes
	inCloudTurbulence		h) in-cloud turbulence for layers centred at flight levels 100 (700 hPa), 140 (600 hPa), 180 (500 hPa), 240 (400 hPa) and 300 (300 hPa); (see ICAO Annex3 definition of "Upper-air gridded forecast")
	Tagged Value Name	Value	
	CLDMContextTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:SubjectFields:Meteorology:Codelists:CodeTurbulenceType@IN_CLOUD_TURBULENCE	
	CLDMSemanticTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:SubjectFields:Meteorology:Turbulence	
	IMDefinitionTrace	urn:x-ses:sesarju:airm:v410:InformationModel:SubjectFields:Meteorology:Turbulence	
	Attribute Name	Type	Notes

	maxWindDirection		c) direction ... of maximum wind; (see ICAO Annex3 definition of "Upper-air gridded forecast")
	Tagged Value Name	Value	
	CLDMSemanticTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:SubjectFields:Meteorology:Wind@windDirection	
	Attribute Name	Type	Notes
	maxWindLevel		c) ... flight level of maximum wind; (see ICAO Annex3 definition of "Upper-air gridded forecast")
	Tagged Value Name	Value	
	CLDMContextTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:SubjectFields:Meteorology:Wind	
	CLDMSemanticTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:Abstract:GeoEnabledEntity@position	
	Attribute Name	Type	Notes
	maxWindSpeed		c) ... speed ... of maximum wind; (see ICAO Annex3 definition of "Upper-air gridded forecast")
	Tagged Value Name	Value	
	CLDMSemanticTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:SubjectFields:Meteorology:Wind@maxWindSpeed	
	Attribute Name	Type	Notes
	qnh		i) geopotential altitude data for flight levels 50 (850 hPa), 100 (700 hPa), 140 (600 hPa), 180 (500 hPa), 240 (400 hPa), 300 (300 hPa), 320 (275 hPa), 340 (250 hPa), 360 (225 hPa), 390 (200 hPa) and, 450 (150 hPa) and 530 (100 hPa). (see ICAO Annex3 definition of "Upper-air gridded forecast")
	Tagged Value Name	Value	
	CLDMSemanticTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:SubjectFields:Meteorology:AviationCondition@airPressure	
	Attribute Name	Type	Notes
	temperature		a) ... temperature data for flight levels 50 (850 hPa), 100 (700 hPa), 140 (600 hPa), 180 (500 hPa), 240 (400 hPa), 270 (350 hPa), 3 00 (300 hPa), 320 (275 hPa), 340 (250 hPa), 360 (225 hPa), 390 (200 hPa), 450 (150 hPa), and 530 (100 hPa); (see ICAO Annex3 definition of "Upper-air gridded forecast")

	Tagged Value Name	Value	
	CLDMSemanticTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:SubjectFields:Meteorology:AviationCondition@airTemperature	
	Attribute Name	Type	Notes
	tropopauseLevel		b) flight level ... of tropopause; (see ICAO Annex3 definition of "Upper-air gridded forecast")
	Tagged Value Name	Value	
	CLDMContextTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:Abstract:GeoEnabledEntity@position	
	CLDMSemanticTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:SubjectFields:Meteorology:Tropopause	
	IMDefinitionTrace	urn:x-ses:sesarju:airm:v410:InformationModel:SubjectFields:Meteorology:Tropopause	
	Attribute Name	Type	Notes
	tropopauseTemperature		b) ... temperature of tropopause; (see ICAO Annex3 definition of "Upper-air gridded forecast")
	Tagged Value Name	Value	
	CLDMSemanticTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:SubjectFields:Meteorology:Tropopause@temperature	
	IMDefinitionTrace	urn:x-ses:sesarju:airm:v410:InformationModel:SubjectFields:Meteorology:Tropopause	
	Attribute Name	Type	Notes
	windDirection		Wind Direction parameter a) wind ... data for flight levels 50 (850 hPa), 100 (700 hPa), 140 (600 hPa), 180 (500 hPa), 240 (400 hPa), 270 (350 hPa), 300 (300 hPa), 320 (275 hPa), 340 (250 hPa), 360 (225 hPa), 390 (200 hPa), 450 (150 hPa), and 530 (100 hPa); (see ICAO Annex3 definition of "Upper-air gridded forecast")
	Tagged Value Name	Value	
	CLDMSemanticTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:SubjectFields:Meteorology:Wind@windDirection	
	IMDefinitionTrace	urn:x-ses:sesarju:airm:v410:InformationModel:SubjectFields:Meteorology:WindLayer	
	Attribute Name	Type	Notes
	windSpeed		WindSpeed parameter

			a) wind ... data for flight levels 50 (850 hPa), 100 (700 hPa), 140 (600 hPa), 180 (500 hPa), 240 (400 hPa), 270 (350 hPa), 300 (300 hPa), 320 (275 hPa), 340 (250 hPa), 360 (225 hPa), 390 (200 hPa), 450 (150 hPa), and 530 (100 hPa); (see ICAO Annex3 definition of "Upper-air gridded forecast")

	Tagged Value Name	Value
	CLDMSemanticTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:SubjectFields:Meteorology:Wind@windSpeed
	IMDefinitionTrace	urn:x-ses:sesarju:airm:v410:InformationModel:SubjectFields:Meteorology:WindLayer

Element Name	Author	Notes
METGriddedForecastDomainSet	[redacted]	A grid is a network composed of two or more sets of curves in which the members of each set intersect the members of the other sets in an algorithmic way.

	Attribute Name	Type	Notes
	gridResolution	Real	These calculations are performed at a series of horizontal grid-points over a geographical area and at a series of vertical levels through the atmosphere. The horizontal spacing between the grid points describes the horizontal resolution of the model; the higher the horizontal resolution (i.e. smaller spacing between grid points), the finer the detail of weather phenomena that can be modelled, However, the higher the horizontal resolution, the more computationally expensive and time-consuming the process is.

	Tagged Value Name	Value
	CLDMSemanticTrace	CLDM_out_of_scope

	Attribute Name	Type	Notes
	issuer		Meteorological center issuing the forecast

	Tagged Value Name	Value
	CLDMContextTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:SubjectFields:Stakeholders:Codelists:CodeOrganisationType@AERONAUTICAL_METEOROLOGICAL_STATION
	CLDMSemanticTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:SubjectFields:Stakeholders:Stakeholder:Organisation@designator
	IMDefinitionTrace	urn:x-ses:sesarju:airm:v410:InformationModel:SubjectFields:Stakeholders:Organisation:MeteorologicalOffice

	Attribute Name	Type	Notes
	issueTime		Issue time of the forecast

	Tagged Value Name	Value

	CLDMSemanticTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:Abstract:TemporalEnabledEntity@lastRevision

Element Name	Author	Notes
GML::DomainSet	[redacted]	GML 3.2.1 definition of coverage domain.

Element Name	Author	Notes
GML::GridCoverage	[redacted]	A GridCoverage is a discrete point coverage in which the domain is a geometric grid of points encoded using gml:Grid (not its subtypes gml:RectifiedGrid or a subtype of AbstractReferenceableGrid). Note that this is similar to the MultiPointCoverage except that a gml:Grid shall be used to describe the domain.

Element Name	Author	Notes
RangeSet	[redacted]	Set of feature attribute values associated by a function with the elements of the domain of a coverage.

Element Name	Author	Notes
GML::RangeSet	[redacted]	The gml:rangeSet property element contains the values of the coverage (sometimes called the attribute values).

Element Name	Author	Notes
SWE Common::DataRecord	[redacted]	The "*DataRecord*" class is modeled on the definition of 'Record' from ISO 11404. In this definition, a record is a composite data type composed of one to many fields, each of which having its own name and type definition. Thus it defines some logical collection of components of any type that are grouped for a given purpose.

Element Name	Author	Notes
ForecastAtTimestep	[redacted]	Forecast (part) for a certain time in the future, e.g. for the next day at 03:00 PM. A single forecast contains of one or more forecasts issued for different times.

	Attribute Name	Type	Notes
	validTime		The time for which the forecast is valid "... and shall be valid for fixed valid times at 6, 9, 12, 15, 18, 21, 24, 27, 30, 33 and 36 hours after ... on which the forecasts were based." (see ICAO Annex3 definition of "Upper-air gridded forecast")

	Tagged Value Name	Value
	CLDMSemanticTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:Abstract:TemporalEnabledEntity@startValidity

Element Name	Author	Notes
ForecastForLevel	[redacted]	A single forecast consists of prediction of meteorological phenomena issued for certain flight levels. "ForecastForLevel"

			contains the Forecast for one level.
	Attribute Name	Type	Notes
	flightLevel		The flightLevel (or ground) for which the forecast is valid.
	Tagged Value Name	Value	
	CLDMSemanticTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:DataTypes:GeometryTypes:ThreeDimensionalPointType@elevation	
	IMDefinitionTrace	urn:x-ses:sesarju:airm:v410:InformationModel:SubjectFields:Common:UnitsOfMeasure:FlightLevel	
Element Name		Author	Notes
ForecastForGridPoint		[redacted]	Part of the forecast for a single grid.
	Attribute Name	Type	Notes
	gridPointCoordinates		Coordinates (two dimensional) of the grid point. Point located at the intersection of two or more curves in a grid.
	Tagged Value Name	Value	
	CLDMSemanticTrace	urn:x-ses:sesarju:airm:v410:ConsolidatedLogicalDataModel:Abstract:GeoEnabledEntity@position	
Element Name		Author	Notes
GetCoverageException		[redacted]	Error messages
	Attribute Name	Type	Notes
	getCoverageException	GetCoverageExceptionOptions	error message
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	
Element Name		Author	Notes
GetCoverageExceptionOptions		[redacted]	GetCoverageExceptions
	Attribute Name	Type	Notes
	INVALID_AXIS_LABEL		The dimension subsetting operation specified an axis label that does not exist in the Envelope or has been used more than once in the *GetCoverage* request
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM out of scope	
	Attribute Name	Type	Notes
	INVALID_SUBSETTING		Operation request contains an invalid subsetting value; either a trim or slice parameter value is outside the extent of the coverage or, in a trim operation, a lower bound is above the upper bound
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM out of scope	
	Attribute Name	Type	Notes
	NO_SUCH_COVERAGE		The identifier passed does not match with any of the coverages offered by this server
	Tagged Value Name	Value	
	CLDMSemanticTrace	CLDM_out_of_scope	
Element Name		Author	Notes
GML::GridCoverage		[redacted]	A GridCoverage is a discrete point coverage in which the domain is a

		geometric grid of points encoded using gml:Grid (not its subtypes gml:RectifiedGrid or a subtype of AbstractReferenceableGrid). Note that this is similar to the MultiPointCoverage except that a gml:Grid shall be used to describe the domain.

Table 8: Output parameters for the getCoverage operation

5.2 Service Interface MgfSubscriberInterface

5.2.1 Service Interface Definition METGriddedForecastPublisher

This interface definition consists of a total of two operations and represents a standard publish/subscribe (push) message exchange pattern. It is the Interface provided by the service provider.

5.2.1.1 Operation subscribeToForecast

This operation enables a consumer to subscribe to a specific coverage provided by a MET server.

5.2.1.1.1 Operation Parameters

The payload (“CoverageRequest”) is the same as used by the getMETGriddedForecast request of the request/reply interface of the service.

5.2.1.2 Operation unsubscribeToForecast

This operation enables a consumer to unsubscribe to a specific coverage provided by a MET server.

5.2.1.2.1 Operation Parameters

The payload (“CoverageRequest”) is the same as used by the getMETGriddedForecast request of the request/reply interface of the service.

5.2.2 Service Interface Definition METGriddedForecastSubscriber

This interface definition consists of one operation and represents a standard publish/subscribe message exchange pattern. It is the Interface transmitting the MET forecast and provided by the service consumer.

5.2.2.1 Operation publishMETGriddedForecast

This operation enables a server to publish a forecast in gridded format for an area defined by the coverage specification. A standard publish/subscribe (push) pattern is used.

5.2.2.1.1 Operation Parameters

The payload (“Coverage”) is the same as used by the getMETGriddedForecast request of the request/reply interface of the service.

6 Service dynamic behaviour

This chapter is used to describe the interactive behaviour between Services (orchestration) or Service Interfaces (interaction specification). Architectural elements applicable for this description are:

- Service Interaction Specifications
- Service State machines
- Service orchestration

6.1 Service Interface MgFSubscriberInterface

The service interface operates in usual publish/subscribe message exchange pattern. This is represented in the diagram shown in the next figure.

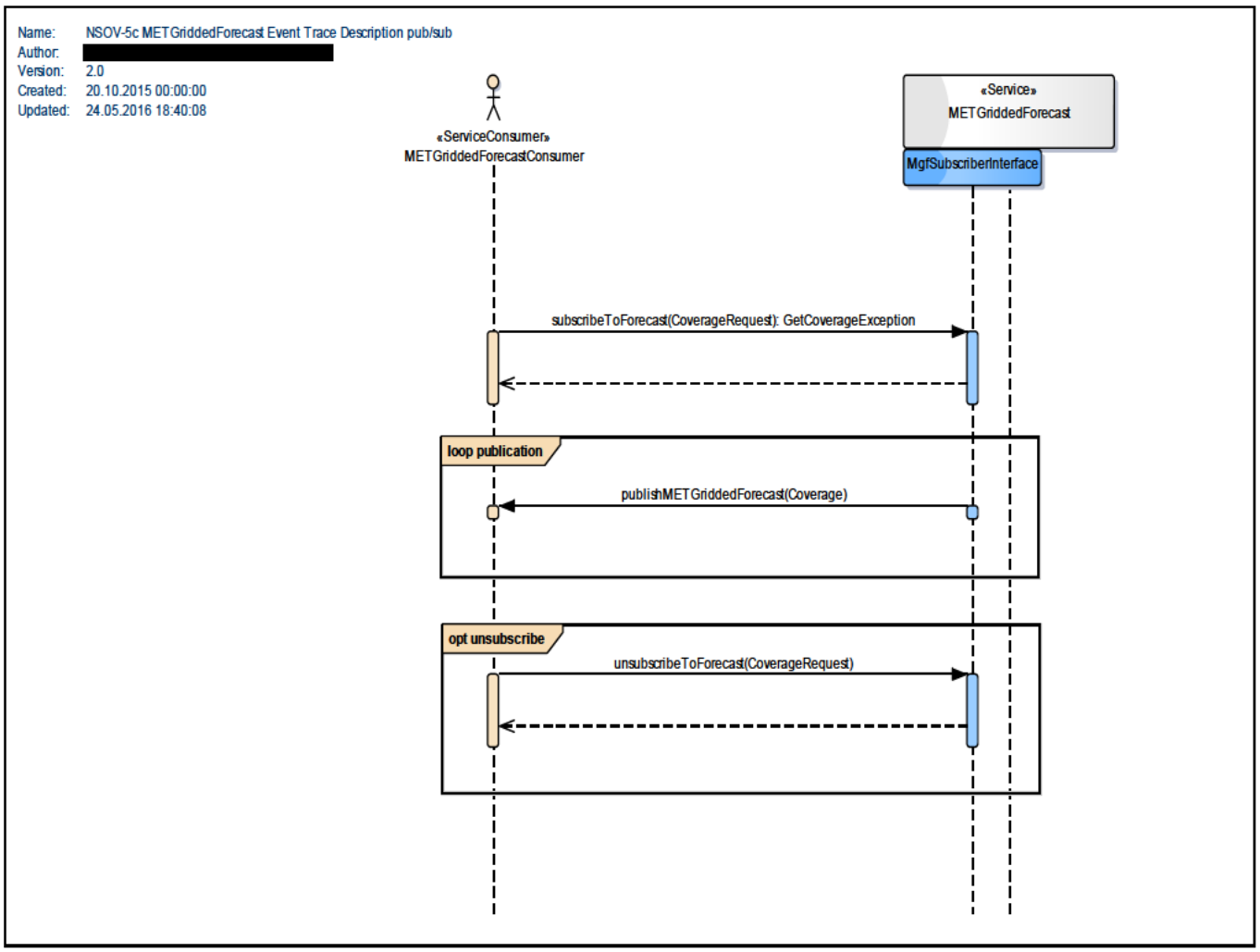

Figure 10: NSOV-5c METGriddedForecast Event Trace Description for MgFSubscriberInterface

6.2 Service Interface MgFRequesterInterface

The service interface operates in usual request/reply message exchange pattern. This is represented in the diagram shown in Figure 11.

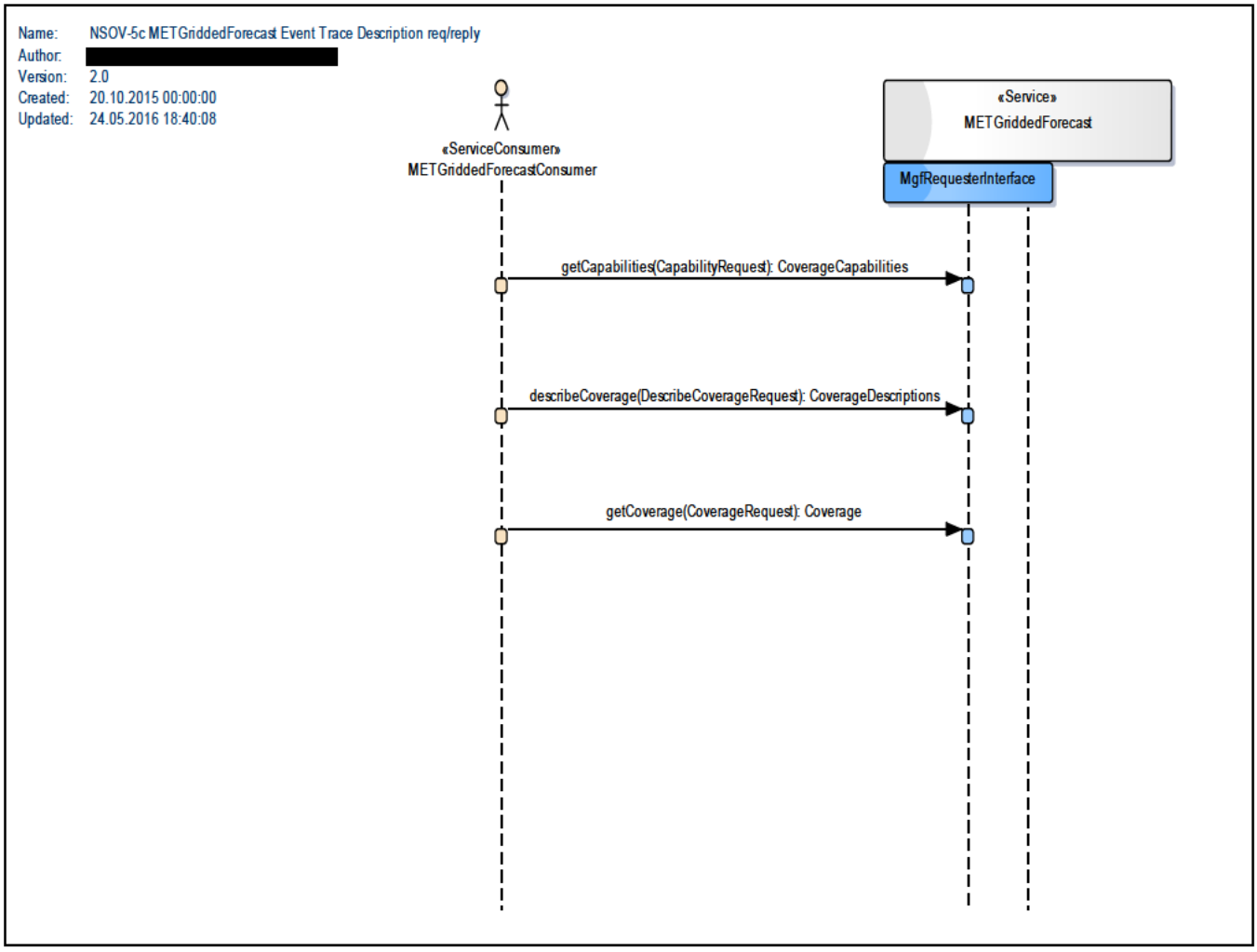

Figure 11: NSOV-5c METGriddedForecast Event Trace Description for MgFRequesterInterface

7 Service provisioning (optional)

N.A.

8 Validation and Verification

8.1 Verification

Verification was performed relying on the ISRM foundation version 00.07.00.

8.1.1 Verification Results

Verification report (excerpt):

Service name:	Designed Services - METGriddedForecastService	Date of Service Creation:	20140212-09:37:57
Service version:	2.0	Version of Verification Rules:	00.07.00
Phase:	2.0	Date of Verification:	20160525-03:51:45
Owner of service:	[redacted]	Passes:	436
Name of verifier:		Failures:	
Overall comments:		Manual:	164
MDG Library Functions version:	29915	MDG ISRM Verification version	29993

Figure 12: Verification results

The verification was performed via manual inspection and assisted by a script. The verification outcome is completely out of errors.

Verification report is this file [18]:

- Designed_Services_-_METGriddedForecastService.xls

8.2 Validation

The service is planned to be validated by a prototype implementation as part of IOP VLD.

9 References

Name	Version	Document ID / Location
[1] FAA Web Service Description Document	2008-16-10	http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/atc_comms_services/swim/documentation/media/briefings/WSDD%20FPS%20EXAMPLE%2008-16-10.pdf
[2] NATO Architecture Framework	v3.0 & 3.1	http://www.nhqc3s.nato.int/
[3] SoaML	1.0 Beta 09-04-01	http://www.omg.org/spec/SoaML/
[4] Project deliverables template	03.00.00	SJU templates & guidelines package, Project deliverables template
[5] SESAR Operational Service and Environment Definition	03.00.00	SJU templates & guidelines package, OSED template
[6] SESAR Safety and Performance Requirements	03.00.00	SJU templates & guidelines package, SPR template
[7] ISRM Tooling Guidelines	00.07.00	08.03.10 D44
[8] ISRM Modelling Guidelines	00.07.00	08.03.10 D44
[9] ISRM Foundation Rulebook	00.07.00	08.03.10 D44
[10] ISRM Verification Guidelines	00.07.00	08.03.10 D44
[11] ISRM Service Portfolio	00.08.01	08.03.10 D65
[12] WMO Grib 2 format specification	June 2003	https://www.wmo.int/pages/prog/www/WMOCodes/Guides/GRIB/Introduction_GRIB1-GRIB2.pdf
[13] MET OSED parts A,B,C update	00.01.01	11.02.01 D23
[14] Collaborative NOP final OSED Step 1	00.02.00	07.06.01 D39
[15] OGC WCS Core	2.0.1	OGC® WCS 2.0 Interface Standard - Core, version 2.0.1
[16] ICAO Annex 3 (MET)	Ed. 16	http://www.google.de/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CCMQFjAAahUKEwi6tZi_5efIAhVGBBoKHfYuD8Q&url=http%3A%2F%2Fwww.wmo.int%2Fpages%2Fprog%2Fwww%2FISS%2FMeetings%2FCT-MTDCF-ET-DRC_Geneva2008%2FAnnex3_16ed.pdf&usg=AFQjCNHnrOMIHoTLAy4S7McfgUjaV

Name	Version	Document ID / Location
		T79TQ&sig2=I-Qhh0cbELaOrsRHIL5WxQ
[17] OFA 05.01.01 Consolidated OSED edition 3 document	00.03.01	06.05.04 D16
[18] Verification reports for the service	N/A	08.03.10 D65 Verification reports
[19] SCG24 Meeting minutes		B.04.03

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