Final Verification Report: 4DWxCube - MET GATE

Document information	
Project Title	MET Information System Development, Verification and Validation
Project Number	11.02.02
Project Manager	Météo-France
Deliverable Name	Initial Verification Report: 4DWxCube - MET GATE
Deliverable ID	11.02.02-D30
Edition	00.02.00
Template Version	03.00.00
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Abstract

This document describes the verification exercises conducted on the 4DWxCube – MET-GATE Prototype of the MET Domain System "4DWxCube" according to the technical architecture description 11.02.01-D31 and its results. It is based on the planned verification exercises described in the Verification Plan 11.02.02-D29 and is based on the preliminary requirements formulated in 11.02.02.D27 (Technical Specification) and 11.02.02.D28 (Interface Requirements Specification). This document is the update of the Initial Verification Report and is final version of verification results for 4DWxCube – MET-GATE prototypes developed in SESAR 1 project.

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*Initial version had been send to the reviewers and no comments had been made. As this final report does not include any changes to the content, it has not been distributed for external review once more.

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Rational for rejection
None.

Document History

Edition	Date	Status	Author	Justification
00.00.01	11/01/2016	New document	[redacted]	D30 updates D25 in minor parts (e.g. REQs)
00.01.00	29/02/2016	Revised draft		Updated document following review
00.02.00	28/04/2016	Revised draft		Updated following SJU assessment report

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This deliverable consists of SJU foreground and EUMETNET Consortium background. The NWP models and used to support the described prototypes, belong to the respective National Meteorological Service.

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Executive summary

This document describes the verification exercises conducted on the 4DWxCube – MET-GATE Prototype of the MET Domain System “4DWxCube – MET-GATE” (technical architecture description 11.02.01-D31) and its results. It is based on the planned verification exercises described in the Verification Plan 11.02.02-D29 and is based on the preliminary requirements formulated in 11.02.02.D27 (Technical Specification) and 11.02.02.D28 (Interface Requirements Specification).

Due to the diversity of the different formulated requirement types in fact it would have been also justified to use all verification methods consisting of *inspection, analysis, design review* (static verification methods) as well as *test* (dynamic verification method).

However it was at the same time also the intention to introduce the concept of test automation in the context of verification exercises. As a consequence mostly the verification method *test* was applied in the context of **functional** requirements representing here at the same time the by far greatest part of the verification exercises

A minor part verification exercises corresponded to the verification of **non-functional** requirements for which the static verification methods were estimated to be more suitable.

As far as the verification method *test* was concerned the development and implementation of programmatic test scripts based on the Java language and its execution in a preconfigured MET-GATE test runtime environment were realized.

The evaluation of the results of the verification exercises was summarized for a final conclusion and assessment of the verified MET-GATE Prototype system.

This final report is an editorial update on requirements and references. The delay of the initial verification report enabled to perform all verification tests possible on the available MET-GATE prototype version beforehand and report them in the initial version. The requirement on the provision of consistent was out of scope of the MET-GATE verification process and has been verified by the local, sub-regional and network MET verification exercises. These results are the only new addition in respect of content to the verification report.

The further development work was prioritized by the validation exercises to fulfil their specific requirements on e.g. product formats and services. Therefore no new verification exercises of technical aspects were performed. However, the verification results have been analysed completely during the review process of the initial verification report and are confirmed by this final report.

1 Introduction

1.1 Purpose of the document

This document describes the verification exercises conducted on the 4DWxCube – MET-GATE Prototype of the MET Domain System “4DWxCube” according to the technical architecture description in 11.02.01-D31 and presents its results.

The 4DWxCube – MET-GATE Prototype represents the reference software system against the formulated technical requirements, described in 11.02.02.D27 (Technical Specification) and 11.02.02.D28 (Interface Requirements Specification) was to be proved.

This verification report is based on the planned verification exercises described in the Verification Plan 11.02.02-D29.

Based on the attained verification results this verification report intends to provide the necessary facts to be able to formulate a final conclusion concerning the conformance of the current MET-GATE prototype system with regards to the formulated technical requirements.

1.2 Intended readership

This document is mainly intended for project partners and related projects who need MET Information in support of their conceptual and operational activities.

Operation work packages (OPS WPs) and technical projects that might be interested in the results are primarily the project partners in P11.02.01 and P11.02.02, further on also WP 5 TMA Operation sub-work-packages, WP 6 Airport sub-work-packages, WP 8 Information Management sub-work-packages and WP 14 Technical Architecture SWIM sub-work-packages.

1.3 Structure of the document

This report is structured as follows:

Chapter 1: Common introduction of the subject, including the purpose, the targeted audience and used terminology

Chapter 2: Declaration of the scope of the verification activities overviewing the verification exercises and the applied verification techniques

Chapter 3: Preparation and execution of planned verification exercises

Chapter 4: Presentation of verification exercise results and evaluation

Chapter 5: Conclusions and recommendations

Chapter 6: Following-up the information originated from chapter 3 and chapter 4 the presentation of verification exercise reports in a more detailed form

1.4 Glossary of terms

Term	Definition	Source
4DWxCube	The 4DWxCube is a (virtual) repository of shared consistent and translated meteorological information, produced by multiple METSPs and made available to ATM stakeholders via its SWIM compliant "MET-GATE".	Proposed by WP11.02, 11.02.01 D31 TAD
Black-box-testing	Test technique. Principal input for a software test is based on a specification without any knowledge about the implementation details of a software system under test.	ISO 29119
MET Information	Generic term for any meteorological data, service or information, regardless of format or use.	Proposed by WP11.02
MET-GATE	The MET-GATE is a SWIM node enabling the discovery, access and retrieval of consistent and translated MET information, tailored to the ATM stakeholders' needs, from the 4DWxCube via SWIM compliant web services.	Proposed by WP11.02, 11.02.01 D31 TAD
MET product	MET Information provided to the 4DWxCube which is specified by its metadata; therefore it contains metadata and data items.	Proposed by P11.02.02
Test Case	Set of preconditions, inputs, actions and expected results developed to run a test to prove verification objectives	ISO 29119
Test Script	In software development the executable implementation of a Test Case	ISO 29119
Test Class	Established but still not standardized term in software development usually used as synonym for a category of Test Scripts belonging together	Software Development
Test Suite	Established but still not standardized term in software development aggregating a set of Test Classes into a library	Software Development

Table 1: Glossary of terms

1.5 Acronyms and Terminology

Term	Definition
AIRM	Aeronautical Information Reference Model
ATM	Air Traffic Management
IRS	Interface Requirements Specification
ISRM	Information Service Reference Model
JRE	Java Runtime Environment
Lat / Long	Latitude / Longitude
MET-GATE	METerological information services – Generation, ATM Tailoring and Exchange
OFA	Operational Focus Area
OGC	Open Geospatial Consortium
OGC WCS	OGC Web Coverage Service
OGC WFS	OGC Web Feature Service
OP WP	Operational Work Package
SESAR	Single European Sky ATM Research Programme
SJU	SESAR Joint Undertaking (Agency of the European Commission)
SUT	System Under Test
SWIM	System Wide Information Management
TAD	Technical Architecture Description
TS	Technical Specification
VP	Verification Plan
VR	Verification Report
WCS	Web Coverage Service
WFS	Web Feature Service
WMS	Web Mapping Service

Table 2: Acronyms and Terminology

2 Context of the Verification

This verification report is targeted to the 4DWxCube – MET-GATE Prototype as developed in the SWP 11.02.02.02 and is based on the planned verification exercises described in the Verification Plan 11.02.02-D29 as well as on the preliminary requirements formulated in 11.02.02.D27 (Technical Specification) and 11.02.02.D28 (Interface Requirements Specification).

2.1 System Overview

The 4DWxCube – MET-GATE Prototype represents the addressed system to be verified by this report. According to the Verification Plan 11.02.02-D29 a requirement-based verification procedure is established.

The verification exercises were conducted on the 4DWxCube – MET-GATE release version **v1.0-rc1**. The related software modules of the 4DWxCube – MET-GATE Prototype under test are backed up in the SWP 11.02.02.02 source control and versioning system.

The following tables overviews the planned verification exercises and their relationship to verification objectives. The information presented is perfectly in accordance with the Verification Plan 11.02.02-D29.

Verification Exercise ID and Title	**EXE-11.02.02-VP-4DWC.0001**
Leading organization	EUMETNET EIG
Verification exercise objectives	OBJ-11.02.02-VP-4DWC. 0001 OBJ-11.02.02-VP-4DWC. 0002 OBJ-11.02.02-VP-4DWC. 0003 OBJ-11.02.02-VP-4DWC. 0004 OBJ-11.02.02-VP-4DWC. 0005 OBJ-11.02.02-VP-4DWC. 0006 OBJ-11.02.02-VP-4DWC. 0007 OBJ-11.02.02-VP-4DWC. 0008 OBJ-11.02.02-VP-4DWC. 0009 OBJ-11.02.02-VP-4DWC. 0010 OBJ-11.02.02-VP-4DWC. 0011 OBJ-11.02.02-VP-4DWC. 0012 OBJ-11.02.02-VP-4DWC. 0013 OBJ-11.02.02-VP-4DWC. 0014 OBJ-11.02.02-VP-4DWC. 0015 OBJ-11.02.02-VP-4DWC. 0016 OBJ-11.02.02-VP-4DWC. 0017 OBJ-11.02.02-VP-4DWC. 0018

Rationale	The purpose of this exercise is to verify that the MET-GATE Prototype provides subscription and publishing of MET information according to TS and IRS requirements
Verification Technique	Multi-valued combination consisting of test, inspection and design review
Dependent Verification Exercises	N/A

Table 3: Exercise EXE-11.02.02-VP-4DWC.0001 and related verification objectives

Verification Exercise ID and Title	**EXE-11.02.02-VP-4DWC.0002**
Leading organization	EUMETNET EIG
Verification exercise objectives	OBJ-11.02.02-VP-4DWC.0500 OBJ-11.02.02-VP-4DWC.0501 OBJ-11.02.02-VP-4DWC.0502 OBJ-11.02.02-VP-4DWC.0503 OBJ-11.02.02-VP-4DWC.0504 OBJ-11.02.02-VP-4DWC.0505 OBJ-11.02.02-VP-4DWC.0506 OBJ-11.02.02-VP-4DWC.0507 OBJ-11.02.02-VP-4DWC.0508 OBJ-11.02.02-VP-4DWC.0509 OBJ-11.02.02-VP-4DWC.0510 OBJ-11.02.02-VP-4DWC.0511 OBJ-11.02.02-VP-4DWC.0512 OBJ-11.02.02-VP-4DWC.0513 OBJ-11.02.02-VP-4DWC.0514
Rationale	The purpose of this exercise is to verify that the MET-GATE Prototype provides a request/reply mechanism according to TS and IRS requirements
Verification Technique	Test
Dependent Verification Exercises	N/A

Table 4: Exercise EXE-11.02.02-VP-4DWC.0002 and related verification objectives

Verification Exercise ID and Title	EXE-11.02.02-VP-4DWC.0003
Leading organization	EUMETNET EIG
Verification exercise objectives	OBJ-11.02.02-VP-4DWC.1000 OBJ-11.02.02-VP-4DWC.1001 OBJ-11.02.02-VP-4DWC.1002 OBJ-11.02.02-VP-4DWC.1003 OBJ-11.02.02-VP-4DWC.1004
Rationale	The purpose of this exercise is to verify that the MET-GATE Prototype provides discovery functionality to ATM clients according to TS and IRS requirements
Verification Technique	Multi-valued combination consisting of test and inspection
Dependent Verification Exercises	N/A

Table 5: Exercise EXE-11.02.02-VP-4DWC.0003 and related verification objectives

Verification Exercise ID and Title	EXE-11.02.02-VP-4DWC.0004
Leading organization	EUMETNET EIG
Verification exercise objectives	OBJ-11.02.02-VP-4DWC.1500 OBJ-11.02.02-VP-4DWC.1501 OBJ-11.02.02-VP-4DWC.1502 OBJ-11.02.02-VP-4DWC.1503 OBJ-11.02.02-VP-4DWC.1504 OBJ-11.02.02-VP-4DWC.1505 OBJ-11.02.02-VP-4DWC.1506 OBJ-11.02.02-VP-4DWC.1507 OBJ-11.02.02-VP-4DWC.1508 OBJ-11.02.02-VP-4DWC.1509 OBJ-11.02.02-VP-4DWC.1510 OBJ-11.02.02-VP-4DWC.1511 OBJ-11.02.02-VP-4DWC.1512 OBJ-11.02.02-VP-4DWC.1513 OBJ-11.02.02-VP-4DWC.1514 OBJ-11.02.02-VP-4DWC.1515

Verification Exercise ID and Title	EXE-11.02.02-VP-4DWC.0004
	OBJ-11.02.02-VP-4DWC.1516
Rationale	The purpose of this exercise is to verify that the MET-GATE Prototype provides data management capabilities according to TS and IRS requirements
Verification Technique	Multi-valued combination consisting of test, inspection and design review
Dependent Verification Exercises	N/A

Table 6: Exercise EXE-11.02.02-VP-4DWC.0004 and related verification objectives

Verification Exercise ID and Title	EXE-11.02.02-VP-4DWC.0005
Leading organization	EUMETNET EIG
Verification exercise objectives	OBJ-11.02.02-VP-4DWC.2000 OBJ-11.02.02-VP-4DWC.2001 OBJ-11.02.02-VP-4DWC.2002 OBJ-11.02.02-VP-4DWC.2003 OBJ-11.02.02-VP-4DWC.2004 OBJ-11.02.02-VP-4DWC.2005 OBJ-11.02.02-VP-4DWC.2006 OBJ-11.02.02-VP-4DWC.2007 OBJ-11.02.02-VP-4DWC.2008 OBJ-11.02.02-VP-4DWC.2009 OBJ-11.02.02-VP-4DWC.2010 OBJ-11.02.02-VP-4DWC.2011 OBJ-11.02.02-VP-4DWC.2012 OBJ-11.02.02-VP-4DWC.2013 OBJ-11.02.02-VP-4DWC.2014 OBJ-11.02.02-VP-4DWC.2015 OBJ-11.02.02-VP-4DWC.2016 OBJ-11.02.02-VP-4DWC.2017 OBJ-11.02.02-VP-4DWC.2018 OBJ-11.02.02-VP-4DWC.2019 OBJ-11.02.02-VP-4DWC.2020 OBJ-11.02.02-VP-4DWC.2021

Verification Exercise ID and Title	EXE-11.02.02-VP-4DWC.0005
	OBJ-11.02.02-VP-4DWC.2022 OBJ-11.02.02-VP-4DWC.2023 OBJ-11.02.02-VP-4DWC.2024 OBJ-11.02.02-VP-4DWC.2025 OBJ-11.02.02-VP-4DWC.2026 OBJ-11.02.02-VP-4DWC.2027 OBJ-11.02.02-VP-4DWC.2028
Rationale	The purpose of this exercise is to verify that the MET-GATE Prototype provides monitoring and control capabilities to fulfil the TS and IRS requirements
Verification Technique	Multi-valued combination consisting of test, inspection and design review
Dependent Verification Exercises	N/A

Table 7: Exercise EXE-11.02.02-VP-4DWC.0005 and related verification objectives

Verification Exercise ID and Title	EXE-11.02.02-VP-4DWC.0006
Leading organization	EUMETNET EIG
Verification exercise objectives	OBJ-11.02.02-VP-4DWC.2500
Rationale	The purpose of this exercise is to verify that the MET-GATE Prototype provides the MET information types (functional) according to the TS and IRS requirements
Verification Technique	Inspection method
Dependent Verification Exercises	N/A

Table 8: Exercise EXE-11.02.02-VP-4DWC.0006 and related verification objectives

Verification Exercise ID and Title	EXE-11.02.02-VP-4DWC.0007
Leading organization	EUMETNET EIG
Verification exercise	OBJ-11.02.02-VP-4DWC.2500

Verification Exercise ID and Title	EXE-11.02.02-VP-4DWC.0007
objectives	
Rationale	The purpose of this exercise is to verify that the MET-GATE Prototype provides the non-functional capabilities according to the TS and IRS requirements
Verification Technique	Multi-valued combination consisting of test, inspection and design review
Dependent Verification Exercises	EXE-11.02.02-VP-LOC1.0007 EXE-11.02.02-VP-TER1.0007 EXE-11.02.02-VP-NET1.0007

Table 9: Exercise EXE-11.02.02-VP-4DWC.0007 and related verification objectives

2.2 Summary of Verification Exercises

2.2.1 Summary of Verification Objectives and Success Criteria

The verification objectives and the related success criteria addressed by the verification exercises are completely in accordance with those expressed in the Verification Plan 11.02.02-D29.

2.2.2 Choice of methods and techniques

Only the black-box-test method is applied in verification exercises based on the verification method *test*. This means that the test procedures developed have no knowledge about of how the MET-GATE Prototype software modules are implemented and which use only standard network protocols for accessing and communication with the MET-GATE Prototype software.

Furthermore test automation is implemented for nearly all test cases. This allows for an execution of verification exercises in a comfortable programmatic and easy reproducible way. The test cases are combined into a test suite which can be run optionally on a scheduled basis.

The Verification Plan 11.02.02-D29 introduces in Appendix H a suitable tool concept which now can be formulated more precise in the context of this verification report.

Table 10 overviews the tool components which were used for the purpose of test case design and test case implementation to provide runnable test code, as well as for the integration of suitable test drivers to manage and control the test execution in a programmatic runtime environment.

The code basis for test implementation is founded on Java 7. Additionally SQL is used in the context of test data creation procedures with regards to an initial test data setup in the MET-GATE database.

Platform / Tool	Function, Method or Technique
MET-GATE Test-Tool Suite	Library of test utilities used by MET-GATE test scripts and for test data set up
“LocalProductFeedManager”	Specific Java based self-developed software utility contained in the MET-GATE Test-Tool Suite to supply MET information to a

Platform / Tool	Function, Method or Technique
	running MET-GATE Prototype instance and using the same transfer procedure as expected to be used by MET provider systems
Build and Deployment of test classes	Project Management Tool *Maven 3*
Test driver and Test automation	• Project Management Tool: *Maven 3* Open Source package • Assertion based test framework: *TestNG* Open Source package • Continuous Integration Management: *Jenkins Server* Open Source package
Query Tool for OGC WFS	• Monitoring and control of network communication: Apache Http Client 4 Open Source package • Binding of XML formats to Java object models: JAXB
Query Tool for OGC WCS	• Transformation of XML formats to Java object models: SAX-Parser • Reader for binary NetCDF4 file format: NETCDF4 Open Source Java package
Query Tool for ATM client Subscription management	Monitoring and Control of web services based on the REST protocol: Jersey Client 2 Open Source package

Table 10: Integrated and applied Tests Tools in the MET-GATE test runtime environment

2.2.3 Verification Exercises List and Dependencies

N/A

3 Conduct of Verification Exercises

3.1 Verification Exercises Preparation

Due to the diversity of the many requirements to verify, as static (inspection, analysis, design review) as dynamic (test) verification methods were applied in the verification exercises.

As far as the verification method *test* was involved, the conductance of the verification exercises were performed in a Java based runtime environment.

Network communication to the involved external parties (MET provider systems, SWIM connectivity to ATM users) as demanded by the technical requirements was realized by using a simple SWIM-compliant communication model which fulfilled already the basic required network communication characteristics and ran on top of TCP/IP and HTTP internet protocols.

Furthermore test automation was introduced for the conductance of executable tests when a programmatic test implementation was feasible. Time consuming manual test activities could be reduced by this procedure to a minimum or could be avoided completely.

The programmatic implementation of test cases led to related Java test classes which were tied together to form a MET-GATE Test Case Suite (Figure 1). Generic and common code modules independent of concrete test case logic were bound together to build the MET-GATE Test-Tool Library. The MET-GATE Test-Tool Library represents a programmatic abstraction layer which hides away the complexities of the underlying integrated external standard JAVA APIs from the test case implementation work (Figure 2). It was designed and implemented parallel to the test case design phase. The MET-GATE Test Suite and the MET-GATE Test Tool Library form together the MET-GATE Test Suite.

The test preparation and execution evolves in a programmatic test runtime environment (Figure 3) where

1. test data is initially loaded into the database
2. the MET-GATE Test Case Suite is executed against a running MET-GATE Prototype instance

This verification report is based on the MET-GATE Test Suite release **vp1.0-rc1.0.2**. The software modules of the MET-GATE Test Suite are backed up in the same source control and versioning system as is used by the P11.02.02.02 project for the MET-GATE Prototype software modules.

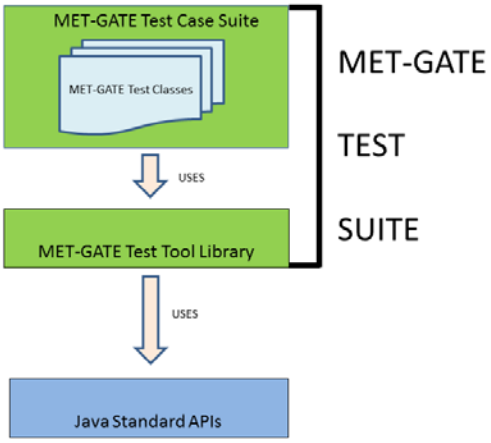

Figure 1 : Software modules of the MET-GATE Test Suite

It is composed of the MET-GATE Test Tool Library on which the MET-GATE Test Classes are founded and the MET-GATE Test Classes itself which are logically bound together to form the MET-GATE Test Suite. The MET-GATE-Test Tool Library integrates and provides needed functionalities by the use of Standard Java APIs and related Java frameworks.

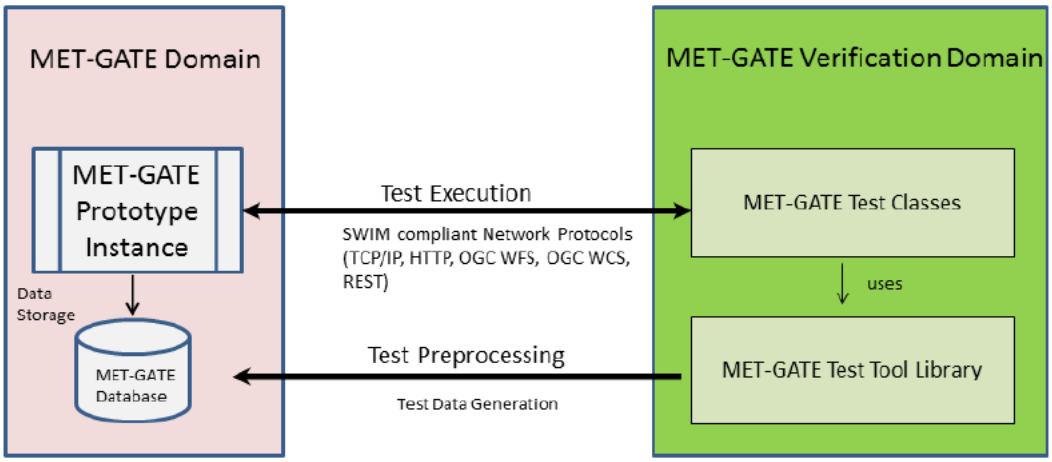

Figure 3 : MET-GATE Test Tool Library and its platform dependencies.

The MET-GATE Test Tool Library is built on top of a multi-tier software layer model based on a Linux Operating System and the Java Runtime Environment (JRE) in which test drivers run. The TestNG software package is used to implement test cases with an assertion based verification technique. Build and configuration of test code is managed by the Maven 3 software package. The Jenkins Server software package is additionally integrated for a centralized set up, scheduling and execution of runnable test code but represents in this release only an optional component.

To minimize self-implementation of test code a set of Standard Java APIs is integrated into the MET-GATE Test Tool Library.

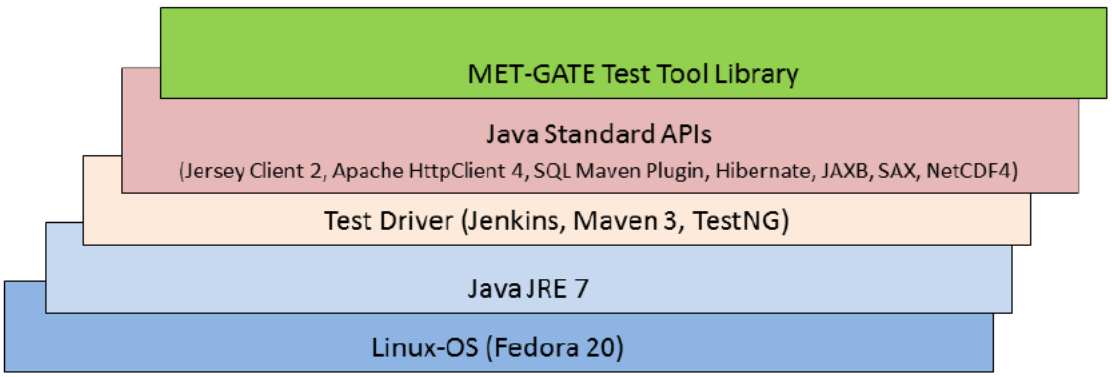

Figure 2 : Test Execution in the MET-GATE Test Runtime Environment

The MET-GATE test runtime environment contains the MET-GATE Verification Domain and the MET-GATE Prototype Domain to which MET-GATE Prototype system belongs to. Prior to a test execution, data is loaded to the MET-GATE Prototype database using the tools in the MET-GATE Verification Domain. Afterwards the MET-GATE Test Suite consisting of a set of runnable test modules/classes is executed against the running MET-GATE Prototype instance in the MET-GATE Domain.

3.2 Verification Exercises Execution

The verification exercises were conducted using the 4DWxCube – MET-GATE Prototype release version **v1.0-rc1** in the period February-April 2015. The related software modules of the 4DWxCube – MET-GATE Prototype software are backed up in the SWP 11.02.02.02 source control and versioning system.

The subsequent table overviews the scheduling aspects associated with the performed verification exercise executions.

Exercise ID	Exercise Title	Actual Exercise execution start date	Actual Exercise execution end date	Actual Exercise start analysis date	Actual Exercise end date
EXE-11.02.02-VP-4DWC.0001	Verification of subscription and publication capabilities	01/12/2014	30/04/2015	15/02/2015	30/04/2015
EXE-11.02.02-VP-4DWC.0002	Verification of request and reply capabilities	01/12/2014	30/04/2015	15/02/2015	30/04/2015
EXE-11.02.02-VP-4DWC.0003	Verification of discovery capabilities	Not Available	Not Available	Not Available	Not Available
EXE-11.02.02-VP-4DWC.0004	Verification of data management capabilities	01/12/2014	30/04/2015	15/02/2015	30/04/2015
EXE-11.02.02-VP-4DWC.0005	Verification of monitoring and control capabilities	01/12/2014	30/04/2015	15/02/2015	30/04/2015
EXE-11.02.02-VP-4DWC.0006	Inspection of available MET information types	01/12/2014	30/04/2015	15/02/2015	30/04/2015
EXE-11.02.02-VP-4DWC.0007	Verification of non-functional aspects	01/12/2014	30/04/2015	15/02/2015	31/05/2015

Table 11: Verification Exercise executions and related analysis dates

3.3 Deviations from the Planned Activities

3.3.1 Deviations with Respect to the Verification Strategy

N/A

3.3.2 Deviations with Respect to the Verification Plan

3.3.2.1 Deviations due to unnoticed verification opportunities

The verification objective OBJ-11.02.02-VP-4DWC.5501 [6] to verify the requirement REQ-11.02.02-TS-4DWC-0012 [4] has been verified in the Met prototypes verification exercises EXE-11.02.02-VP-LOC1.0001, EXE-11.02.02-VP-TER1.0001 and EXE-11.02.02-VP-NET1.0001 described in the respective verification plans [9].

The success criterion has been changed slightly to the verification objective to provide consistent MET information independent of the respective operational user environment of the ATM system:

CRT-11.02.02-VP-4DWC.5501: When users of different ATM systems request the MET-GATE for MET information they will receive consistent MET information independent of the ATM system operational environment.

The results of the verification exercises to verify the consistency of provided MET information are described in detail in the MET prototypes verification reports [10].

3.3.2.2 Deviation due to Restricted Functionalities

Due to time restrictions the used MET-GATE Prototype release available for this verification report covered only a fraction of the whole set of requirements specified in the related technical specification documents. The scope of verification activities was therefore **a priori** limited to a reduced set of the overall set of verification objectives described in the MET-GATE Verification Plan.

As a consequence the execution of the verification exercise EXE-11.02.02-VP-4DWC.0003 was skipped, because the MET-GATE Prototype version under test did not support any related discovery capabilities yet and this functionality is not prioritized to be implemented as it is not necessary for the validation exercises. The users in the validation exercises have specified their required MET information prior to the validation exercise.

Nevertheless the MET-GATE Prototype release under test could provide already *core parts* of the overall set of expected capabilities as demanded by the related technical requirements.

Core parts include among others especially capabilities that allow the MET-GATE Prototype to act as a data provider for MET information in relation to ATM systems connected by a SWIM network. In summary the following aspects were declared to be verifiable:

Support for ad hoc requests performed by ATM users and based on the OGC WFS and WCS specifications;

Subscription support for ATM users who want to register and get automatically delivered with MET information;

Ingestion of incoming MET information originated from MET information providers;

Management and administration of MET information in a persistent storage medium;

Supply of MET information to ATM users originated from ad hoc requests as well as a result of the subscription mechanism.

3.3.2.3 Deviation due to Optimization of Test Design

A further difference to the MET-GATE Verification Plan consisted in the migration to an optimized and at the same time simplified verification procedure. While the preliminary Verification Plan introduced a two-stage verification strategy distinguishing a “Local” and an “End-to-End-user” verification procedure, this separation was no longer needed due to an implementation of a more generic and adaptable model of the test environment and the involved test procedures.

The test environment characteristics now does not depend on specific and proprietary details as originally assumed for the local or end-to-end-user environment. This simplification was also enabled by the fact that only the black-box test technique was applied and only standard internet communication protocols were used.

As a consequence the worked out verification procedures were applicable as to a local as to an end-to-end user environment without the need to rewrite any test scripts. Only the test parametrization had to be adapted to the concrete verification environment details.

Test parametrization means mainly the identification and address details of involved application servers in a computer network and the connection parameters to involved databases. It was assumed that the needed network connectivity to related servers and its services is technically feasible without problem for a specific MET-GATE verification environment layout as only standard communication protocols are used.

4 Verification Exercises Results

4.1 Summary of Verification Exercises Results

The subsequent table summarizes the results of the different Verification Exercises as compared to the success criteria identified within the Verification Plan per verification objectives. It covers all the Verification Objectives as specified in the MET-GATE Verification Plan.

For a better visualization of the results a specific colouring was used in order to distinguish more easily between successful and unsuccessful result states.

Verification Exercise ID	Verification Objective ID	Verification Objective Title	Success Criterion ID	Success Criterion	Exercise Results	Verification Objective Analysis Status
EXE-11.02.02-VP-4DWC.0001	OBJ-11.02.02-VP-4DWC.0001	Individual subscription configuration Individual subscription configuration	CRT-11.02.02-VP-4DWC.0001	The configuration of an arbitrary subscription (parameters, thresholds, area of interest, time horizon) is supported.	The configuration of an arbitrary subscription can be created.	OK
EXE-11.02.02-VP-4DWC.0001	OBJ-11.02.02-VP-4DWC.0002	Subscription processing modes Subscription processing modes	CRT-11.02.02-VP-4DWC.0002	The MET-GATE processes a subscription periodically and delivers MET product data to ATM clients in accordance to the subscription profile. The same holds for another subscription which is processed on event.	The conduction of the subscription performed well.	OK
EXE-11.02.02-VP-4DWC.0001	OBJ-11.02.02-VP-4DWC.0003	Subscription configuration modes Subscription configuration modes	CRT-11.02.02-VP-4DWC.0003	A subscription is available which is configured as periodical request in accordance with the related MET information. A different subscription is available which is configured event triggered due to its related MET information.	Not Available (not tested)	NOK

Verification Exercise ID	Verification Objective ID	Verification Objective Title	Success Criterion ID	Success Criterion	Exercise Results	Verification Objective Analysis Status
EXE-11.02.02-VP-4DWC.0001	OBJ-11.02.02-VP-4DWC.0004	Subscription processing after MET product supply Subscription processing after MET product supply	CRT-11.02.02-VP-4DWC.0004	After supply of MET information to the MET-GATE, the MET-GATE detects and processes any subscription related to the new MET information by publishing the involved information.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0001	OBJ-11.02.02-VP-4DWC.0005	User-based subscription maintenance User-based subscription maintenance	CRT-11.02.02-VP-4DWC.0005	An ATM user has a subscription assigned to. Afterwards he is able to modify subscription details, to pause the subscription processing, to resume the subscription processing and to delete the subscription.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0001	OBJ-11.02.02-VP-4DWC.0006	Subscription processing Subscription processing	CRT-11.02.02-VP-4DWC.0006	An ATM client is automatically served with data items from MET information available through the MET-GATE, according to his subscription profile.	The subscription processed successfully	OK

Verification Exercise ID	Verification Objective ID	Verification Objective Title	Success Criterion ID	Success Criterion	Exercise Results	Verification Objective Analysis Status
EXE-11.02.02-VP-4DWC.0001	OBJ-11.02.02-VP-4DWC.0007	Subscription processing by APISubscription processing by API	CRT-11.02.02-VP-4DWC.0007	ATM clients have an API available which enables them to define the profile of a subscription containing - a start date and an end date of the subscription, expressed in UTC - publication mode, either automated polling by the client or notification by the MET-GATE - subscr bers unique identifier - all optional MET information metadata, if any applicable - all mandatory MET information metadata	Partially	OK
EXE-11.02.02-VP-4DWC.0001	OBJ-11.02.02-VP-4DWC.0008	Subscription API for user-based subscription maintenance Subscription API for user-based subscription maintenance	CRT-11.02.02-VP-4DWC.0008	An ATM client is able to retrieve, configure and delete his subscriptions.	Passed	OK
EXE-11.02.02-VP-4DWC.0001	OBJ-11.02.02-VP-4DWC.0009	Subscription API for Discovery Subscription API for Discovery	CRT-11.02.02-VP-4DWC.0009	An ATM client uses an API provided by the MET Subscription service to specify a repetitive request of MET information found in the MET Discovery service.	Not Available (not tested)	NOK

Verification Exercise ID	Verification Objective ID	Verification Objective Title	Success Criterion ID	Success Criterion	Exercise Results	Verification Objective Analysis Status
EXE-11.02.02-VP-4DWC.0001	OBJ-11.02.02-VP-4DWC.0010	Subscription API for Request / Reply Subscription API for Request/Reply	CRT-11.02.02-VP-4DWC.0010	An ATM client is able to define a subscription using the API of the MET Subscription by using subscription metadata and their possible range for the considered MET information which has already been specified by the MET Request/Reply Service.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0001	OBJ-11.02.02-VP-4DWC.0011	Subscription API using Request / Reply API Subscription API using Request/Reply API	CRT-11.02.02-VP-4DWC.0011	An ATM client is able to define a subscription by using the MET Subscription service API to choose a request specification found by using the API of the MET Request/Reply Service.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0001	OBJ-11.02.02-VP-4DWC.0012	Subscription with thresholds Subscription with thresholds	CRT-11.02.02-VP-4DWC.0012	A MET Subscription service API is available to enable the selection of threshold criteria if relevant. Four different categories of thresholds are available.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0001	OBJ-11.02.02-VP-4DWC.0013	Subscription Processing without MET product Subscription Processing without MET product	CRT-11.02.02-VP-4DWC.0013	A valid subscription for which the related MET information is not available is considered. After processing the subscription the corresponding data items are filled-in with an error field.	Not Available (not tested)	NOK

Verification Exercise ID	Verification Objective ID	Verification Objective Title	Success Criterion ID	Success Criterion	Exercise Results	Verification Objective Analysis Status
EXE-11.02.02-VP-4DWC.0001	OBJ-11.02.02-VP-4DWC.0014	Subscription notification MET product change Subscription notification MET product change	CRT-11.02.02-VP-4DWC.0014	A subscriber is notified due to MET information description changes.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0001	OBJ-11.02.02-VP-4DWC.0015	Subscription notification no MET product availability Subscription notification no MET product availability	CRT-11.02.02-VP-4DWC.0015	A subscriber is notified due to the fact that the related MET information is no longer available.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0001	OBJ-11.02.02-VP-4DWC.0016	Valid Subscription Processing status message Valid Subscription Processing status message	CRT-11.02.02-VP-4DWC.0016	After requesting a valid Subscription an ATM client receives an acknowledgement indicating that the subscription will be operated from its start date.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0001	OBJ-11.02.02-VP-4DWC.0017	Invalid Subscription Processing status message Invalid Subscription Processing status message	CRT-11.02.02-VP-4DWC.0017	After requesting an invalid subscription an ATM client receives an indication informing that the subscription is not valid and will not be operated.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0001	OBJ-11.02.02-VP-4DWC.0018	Valid Subscription with missing MET products Valid Subscription with missing MET products	CRT-11.02.02-VP-4DWC.0018	The MET-GATE delivers a warning message for a valid subscription for which related MET information is not available.	Not Available (not tested)	NOK

Verification Exercise ID	Verification Objective ID	Verification Objective Title	Success Criterion ID	Success Criterion	Exercise Results	Verification Objective Analysis Status
EXE-11.02.02-VP-4DWC.0002	OBJ-11.02.02-VP-4DWC.0500	Interactive request processing Interactive request processing	CRT-11.02.02-VP-4DWC.0500	The MET-GATE processes interactively request and response data is received by the requestor without any error state.	Successful interactive request processing	OK
EXE-11.02.02-VP-4DWC.0002	OBJ-11.02.02-VP-4DWC.0501	Request processing with data parameters Request processing with data parameters	CRT-11.02.02-VP-4DWC.0501	MET product data is provided due to a request based on data parameters	Successful request processing with data parameters	OK
EXE-11.02.02-VP-4DWC.0002	OBJ-11.02.02-VP-4DWC.0502	Sub-setting and sub-gridding Sub-setting and sub-gridding	CRT-11.02.02-VP-4DWC.0502	After sub-setting and sub-gridding the data of a MET product the MET-GATE generates the result data related to the time or geographical criteria.	Sub-setting and sub-gridding performs successfully.	OK
EXE-11.02.02-VP-4DWC.0002	OBJ-11.02.02-VP-4DWC.0503	Request Processing Request Processing	CRT-11.02.02-VP-4DWC.0503	The "MET Request/Reply" service responses the indication that no MET product matches with the request as no MET data is found which is compliant with the requested criteria.	The MET Request/Reply Service processes successfully	OK
EXE-11.02.02-VP-4DWC.0002	OBJ-11.02.02-VP-4DWC.0504	Request by Discovery Request by Discovery	CRT-11.02.02-VP-4DWC.0504	An ATM client sends a request to the MET Request Service based on MET products found in the MET Discovery service. After this he receives a response containing the requested MET product data.	Not Available (not tested)	NOK

Verification Exercise ID	Verification Objective ID	Verification Objective Title	Success Criterion ID	Success Criterion	Exercise Results	Verification Objective Analysis Status
EXE-11.02.02-VP-4DWC.0002	OBJ-11.02.02-VP-4DWC.0505	API-based Request using Discovery Service API-based Request using Discovery Service	CRT-11.02.02-VP-4DWC.0505	An ATM client uses the MET Request service by indicating the MET product description with the poss ble range for the considered MET product which is identified by the MET product unique identifier received from the MET Discovery Service. After this he receives a response from the MET-GATE with the requested MET product data.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0002	OBJ-11.02.02-VP-4DWC.0506	Request by point Request by point	CRT-11.02.02-VP-4DWC.0506	An ATM client is able to request a MET product by the selection of a geographical area determined by a point (Lat./Long). After this he receives a response from the MET-GATE with the requested MET product data.	Geographical point selection verified successful.	OK
EXE-11.02.02-VP-4DWC.0002	OBJ-11.02.02-VP-4DWC.0507	Request by polygon Request by polygon	CRT-11.02.02-VP-4DWC.0507	An ATM client is able to request a MET product by the selection of a geographical area determined by a Lat./Long polygon. After this he receives a response from the MET-GATE with the requested MET product data.	Polygon selection verified successful	OK

Verification Exercise ID	Verification Objective ID	Verification Objective Title	Success Criterion ID	Success Criterion	Exercise Results	Verification Objective Analysis Status
EXE-11.02.02-VP-4DWC.0002	OBJ-11.02.02-VP-4DWC.0508	Request by Lat./Long/ FL_{min} - FL_{max} volume Request by Lat/Long/ FLMin-FLMax volume	CRT-11.02.02-VP-4DWC.0508	An ATM client is able to request a MET product by the selection of a geographical area determined by a Lat./Long/ FL_{min}-FL_{max} volume. After this he receives a response from the MET-GATE with the requested MET product data.	Lat/long/Level selection verified successful	OK
EXE-11.02.02-VP-4DWC.0002	OBJ-11.02.02-VP-4DWC.0509	Request by a 4D-Trajectory corridor Request by a 4D-Trajectory corridor	CRT-11.02.02-VP-4DWC.0509	An ATM client is able to request MET products by the selection of a geographical area determined by a 4D-Trajectory corridor. After this he receives a response from the MET-GATE with the requested MET product data.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0002	OBJ-11.02.02-VP-4DWC.0510	Request by time horizon Request by time horizon	CRT-11.02.02-VP-4DWC.0510	An ATM client is able to request MET products by the selection of a time horizon determined by a T_{min} and T_{max}. After this he receives a response from the MET-GATE with the requested MET product data.	Not Available (not tested)	NOK

Verification Exercise ID	Verification Objective ID	Verification Objective Title	Success Criterion ID	Success Criterion	Exercise Results	Verification Objective Analysis Status
EXE-11.02.02-VP-4DWC.0002	OBJ-11.02.02-VP-4DWC.0511	Request by MET elements Request by MET elements	CRT-11.02.02-VP-4DWC.0511	An ATM client is able to request MET products by the selection of one or several MET elements among the list of available MET elements of the considered MET product. After this he receives a response from the MET-GATE with the requested MET product data.	MET elements selection verified successful	OK
EXE-11.02.02-VP-4DWC.0002	OBJ-11.02.02-VP-4DWC.0512	Request by QoS Request by QoS	CRT-11.02.02-VP-4DWC.0512	An ATM client is able to request MET products by the selection of a given QoS among the available QoS for the considered MET-ATM product. After this he receives a response from the MET-GATE with the requested MET product data.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0002	OBJ-11.02.02-VP-4DWC.0513	Request by format Request by format	CRT-11.02.02-VP-4DWC.0513	An ATM client is able to request MET products by the selection of a given format among the available formats for the considered MET product. After this he receives a response from the MET-GATE with the requested MET product data.	Format selection verified successful	OK

Verification Exercise ID	Verification Objective ID	Verification Objective Title	Success Criterion ID	Success Criterion	Exercise Results	Verification Objective Analysis Status
EXE-11.02.02-VP-4DWC.0002	OBJ-11.02.02-VP-4DWC.0514	Request Processing Request Processing	CRT-11.02.02-VP-4DWC.0514	The query responses received by an ATM client contain all data items of each requested MET product in a message immediately after the MET-GATE has collected and compiled the data	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0003	OBJ-11.02.02-VP-4DWC.1000	MET product description inspection MET product description inspection	CRT-11.02.02-VP-4DWC.1000	It is possible to inspect MET product descriptions	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0003	OBJ-11.02.02-VP-4DWC.1001	Discovery Request Discovery Request	CRT-11.02.02-VP-4DWC.1001	MET product descriptions are filtered according to different criteria categories	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0003	OBJ-11.02.02-VP-4DWC.1002	Discovery Response Discovery Response	CRT-11.02.02-VP-4DWC.1002	The response to a MET Discovery service query contains the list of available MET-ATM products compliant with the requested criteria, associated with their MET product descriptions, including the available QoS and formats.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0003	OBJ-11.02.02-VP-4DWC.1003	Empty Discovery Response Empty Discovery Response	CRT-11.02.02-VP-4DWC.1003	The requested criteria are chosen such that there is no product which fulfils them. On requesting the "MET Discovery" service by these criteria the indication is received that no MET product matches with the request.	Not Available (not tested)	NOK

Verification Exercise ID	Verification Objective ID	Verification Objective Title	Success Criterion ID	Success Criterion	Exercise Results	Verification Objective Analysis Status
EXE-11.02.02-VP-4DWC.0003	OBJ-11.02.02-VP-4DWC.1004	Discovery Request by criteria Discovery Request by criteria	CRT-11.02.02-VP-4DWC.1004	Data is read and formatted in accordance to the applied criteria types.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0004	OBJ-11.02.02-VP-4DWC.1500	MET product availability MET product availability	CRT-11.02.02-VP-4DWC.1500	A product for which the related time is elapsed is removed by the MET-GATE	Outdated MET products are non-available.	OK
EXE-11.02.02-VP-4DWC.0004	OBJ-11.02.02-VP-4DWC.1501	MET product description management MET product description management	CRT-11.02.02-VP-4DWC.1501	An administrator is able to list, create, edit and delete MET product descriptions in the Administration portal.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0004	OBJ-11.02.02-VP-4DWC.1502	Cached MET product management Cached MET product management	CRT-11.02.02-VP-4DWC.1502	In the Administration portal an Administrator is able to list and delete MET products in the cache.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0004	OBJ-11.02.02-VP-4DWC.1503	Subscription management Subscription management	CRT-11.02.02-VP-4DWC.1503	An Administrator is able to list, edit, suspend, resume and discard subscriptions in the Administration portal.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0004	OBJ-11.02.02-VP-4DWC.1504	Application user management Application user management	CRT-11.02.02-VP-4DWC.1504	An Administrator is able to list, create, edit and delete user information in the Administration portal.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0004	OBJ-11.02.02-VP-4DWC.1505	Deletion of MET product dataDeletion of MET product data	CRT-11.02.02-VP-4DWC.1505	A MET product was recently deleted. The associated metadata cannot be found.	Status of MET product and metadata are close connected	OK

Verification Exercise ID	Verification Objective ID	Verification Objective Title	Success Criterion ID	Success Criterion	Exercise Results	Verification Objective Analysis Status
EXE-11.02.02-VP-4DWC.0004	OBJ-11.02.02-VP-4DWC.1506	MET product time window MET product time window	CRT-11.02.02-VP-4DWC.1506	After elapsing the determined time (at least 24 hours) a MET product is no longer accessible.	Valid time windows are verified successfully.	OK
EXE-11.02.02-VP-4DWC.0004	OBJ-11.02.02-VP-4DWC.1507	MET product sizeMET product size	CRT-11.02.02-VP-4DWC.1507	Only MET products in the range between 10 bytes and 1 GB are available in the store	Minimum and maximum size are verified successfully	OK
EXE-11.02.02-VP-4DWC.0004	OBJ-11.02.02-VP-4DWC.1508	MET provider registration MET provider registration	CRT-11.02.02-VP-4DWC.1508	A Met provider registers to the MET-GATE and is afterwards found in the list of registered MET providers in the MET-GATE. Afterwards he deregisters. Now he is missing in the list of registered MET providers in the MET-GATE.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0004	OBJ-11.02.02-VP-4DWC.1509	MET product registration MET product registration	CRT-11.02.02-VP-4DWC.1509	The MET provider registers a MET product description. The MET product description can now be found in the MET-GATE database. Afterwards he deregisters this MET product. Now the MET production description is missing in the MET-GATE database.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0004	OBJ-11.02.02-VP-4DWC.1510	MET product definition MET product definition	CRT-11.02.02-VP-4DWC.1510	When inspecting the data content of MET products, the MET product definition and data items are found.	Not Available (not tested)	NOK

Verification Exercise ID	Verification Objective ID	Verification Objective Title	Success Criterion ID	Success Criterion	Exercise Results	Verification Objective Analysis Status
EXE-11.02.02-VP-4DWC.0004	OBJ-11.02.02-VP-4DWC.1511	MET Product description definition MET product description definition	CRT-11.02.02-VP-4DWC.1511	When inspecting the data content of MET product definition it contains a predefined set of parameters.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0004	OBJ-11.02.02-VP-4DWC.1512	Data item integrity Data item integrity	CRT-11.02.02-VP-4DWC.1512	After a design review it is confirmed that the MET-GATE verifies a data item's integrity using MET product definition	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0004	OBJ-11.02.02-VP-4DWC.1513	MET product publication MET product publication	CRT-11.02.02-VP-4DWC.1513	A MET provider is able to publish a MET product. Afterwards the MET product is served to a ATM system client who requests the MET product data.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0004	OBJ-11.02.02-VP-4DWC.1514	MET product recall MET product recall	CRT-11.02.02-VP-4DWC.1514	A MET provider is able to recall a MET product. Afterwards an ATM client request to this MET product data fails.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0004	OBJ-11.02.02-VP-4DWC.1515	Active Subscriptions Active Subscriptions	CRT-11.02.02-VP-4DWC.1515	A MET provider is able to query active subscriptions for a MET product description. After the query he receives a response containing the requested subscription data.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0004	OBJ-11.02.02-VP-4DWC.1516	Retrieval Statistics Retrieval Statistics	CRT-11.02.02-VP-4DWC.1516	A MET provider is able to query retrieval statistics for a MET product description. Afterwards he receives a response containing retrieval statistics.	Not Available (not tested)	NOK

Verification Exercise ID	Verification Objective ID	Verification Objective Title	Success Criterion ID	Success Criterion	Exercise Results	Verification Objective Analysis Status
EXE-11.02.02-VP-4DWC.0004	OBJ-11.02.02-VP-4DWC.1517	User registration User registration	CRT-11.02.02-VP-4DWC.1517	An arbitrary user applies for registration. Afterwards he gets registered meaning that the MET-GATE creates and saves registration data.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2000	Administration Portal Administration Portal	CRT-11.02.02-VP-4DWC.2000	The Administrator can configure and monitor the system through the Administration portal.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2001	Admin time window Admin time window	CRT-11.02.02-VP-4DWC.2001	The administrator configures the time window of cache (24 hours) in the Administration portal. Afterwards data is cached according to the specified time window period.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2002	Admin alarms Admin alarms	CRT-11.02.02-VP-4DWC.2002	The administrator configures an alarm to produce warning messages. After the related threshold is exceeded a warning message is produced.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2003	Admin distributed components Admin distributed components	CRT-11.02.02-VP-4DWC.2003	The Administrator is able to monitor functions of distr buted components by using the integrated user interface.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2004	Severity levels Severity levels	CRT-11.02.02-VP-4DWC.2004	Different levels of severity of event, such as Information, Warning, and Critical are observed in the MET-GATE	Categories of events verified successfully	OK

Verification Exercise ID	Verification Objective ID	Verification Objective Title	Success Criterion ID	Success Criterion	Exercise Results	Verification Objective Analysis Status
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2005	Configurable alarms Configurable alarms	CRT-11.02.02-VP-4DWC.2005	After a pre-defined threshold is exceeded or a defined event occurs a warning message is produced by a configurable alarm function.	Alarms can be configured	OK
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2006	Event-based warnings Event-based warnings	CRT-11.02.02-VP-4DWC.2006	The triggering of the events in question produces related warning messages.	A few possible event have been tested, but a few scenarios are not tested yet.	OK
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2007	Alarm logging Alarm logging	CRT-11.02.02-VP-4DWC.2007	When inspecting the alarm log file it has the predefined common format and contains alarm information.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2008	Action-based logging Action-based logging	CRT-11.02.02-VP-4DWC.2008	The database content is modified or configuration parameters are modified or the content of the Cache is modified or an arbitrary action inducing persistent changes is executed. According to a configurable time window the MET-GATE logs the related transaction details.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2009	Log file archives Log file archives	CRT-11.02.02-VP-4DWC.2009	Logs are archived according to a configurable time window.	Not Available (not tested)	NOK

Verification Exercise ID	Verification Objective ID	Verification Objective Title	Success Criterion ID	Success Criterion	Exercise Results	Verification Objective Analysis Status
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2010	Log trigger Log trigger	CRT-11.02.02-VP-4DWC.2010	Log information is produced triggered by any exchange with an ATM system containing the information about what was requested, about the identity of the requestor, about the time of the request, about whether the request was fulfilled or not, about the time that the request was fulfilled and about the response.	Partially	OK
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2011	Error logs Error logs	CRT-11.02.02-VP-4DWC.2011	Log information is produced originating from errors. In detail the following information is provided : the MET-GATE component that had the error, the type of error, the level of error (critical, non-critical, etc...), the time that the error occurred, any alerts that were generated as a result of the error, and any actions that were taken to isolate or correct the error.	Partially	OK
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2012	Log rolling files Log rolling files	CRT-11.02.02-VP-4DWC.2012	The log file represent rolling files with a backup number of days and a filename pattern including the date	Not Available (not tested)	NOK

Verification Exercise ID	Verification Objective ID	Verification Objective Title	Success Criterion ID	Success Criterion	Exercise Results	Verification Objective Analysis Status
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2013	Report on activities Report on activities	CRT-11.02.02-VP-4DWC.2013	The MET-GATE produces a report about the overall activity per day of request and subscriptions.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2014	Missing product error message Missing product error message	CRT-11.02.02-VP-4DWC.2014	An ATM client sends a request for a product which is not found. An error message is sent to the ATM client.	Error message verified successfully	OK
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2015	Registration page Registration page	CRT-11.02.02-VP-4DWC.2015	The administrator is able to connect to the registration page. He is able to list, accept and discard requests for registration from ATM systems.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2016	User page User page	CRT-11.02.02-VP-4DWC.2016	The Administration portal provides a User page. The administrator is able to list, create, edit and delete access rights for each user.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2017	Statistics page Statistics page	CRT-11.02.02-VP-4DWC.2017	The MET-GATE administrator is able to access a Statistic web page. It provides statistics about requests and subscriptions	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2018	Log web page Log web page	CRT-11.02.02-VP-4DWC.2018	The MET-GATE administrator is able to access a Log web page. It provides log information.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2019	Alarm logs view Alarm logs view	CRT-11.02.02-VP-4DWC.2019	A web page contains a table showing alarm log events.	Not Available (not tested)	NOK

Verification Exercise ID	Verification Objective ID	Verification Objective Title	Success Criterion ID	Success Criterion	Exercise Results	Verification Objective Analysis Status
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2020	Function control view Function control view	CRT-11.02.02-VP-4DWC.2020	The Administrator is able to control the functions of the system.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2021	MET-GATE services page MET-GATE services page	CRT-11.02.02-VP-4DWC.2021	The Administrator is able to connect to a web page related to MET-GATE services. From here he is able to stop and start all the MET-GATE services	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2022	Reports from log files Reports from log files	CRT-11.02.02-VP-4DWC.2022	Reports are produced related to logs and events contained in available log files or database. The administrator accesses them by using the Administration Portal. He is able to export the reports in XML and he is able to specify parameters which he uses to filter the reports. Report contents are kept for five years.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2023	Report of availability Report about availability	CRT-11.02.02-VP-4DWC.2023	A Report is produced containing information about the overall availability (daily percentage of availability) for a given period (day, week, month, year).	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2024	Report of volume Report about volume	CRT-11.02.02-VP-4DWC.2024	A report is produced containing information about the overall volume of collected and transferred data.	Not Available (not tested)	NOK

Verification Exercise ID	Verification Objective ID	Verification Objective Title	Success Criterion ID	Success Criterion	Exercise Results	Verification Objective Analysis Status
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2025	Status monitoring Status monitoring	CRT-11.02.02-VP-4DWC.2025	The status of the MET information which is needed by a related MET information service is monitored.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2026	MET information alert MET information alert	CRT-11.02.02-VP-4DWC.2026	Only partly or all of the MET Information of a MET Information service is not available, out of date or cannot be generated. An alert is triggered by the MET-GATE.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2027	Resume of information Resume of information	CRT-11.02.02-VP-4DWC.2027	The MET-GATE is able to resume information about operations and configurations.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2028	Restricted number of registered users Restricted number of registered users	CRT-11.02.02-VP-4DWC.2028	It is not poss ble to register more users than the predefined threshold value	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0006	OBJ-11.02.02-VP-4DWC.2500	MET Product capabilities MET Product capabilities	CRT-11.02.02-VP-4DWC.2500	Consolidated and translated MET products for local, sub-regional and network client systems are provided.	Partially	OK
EXE-11.02.02-VP-4DWC.0007	OBJ-11.02.02-VP-4DWC.5000	Component Performance EfficiencyComponent Performance Efficiency	CRT-11.02.02-VP-4DWC.5000	The performance requirements originated from TS and IRS are satisfied by the MET-GATE.	Partially	OK

Verification Exercise ID	Verification Objective ID	Verification Objective Title	Success Criterion ID	Success Criterion	Exercise Results	Verification Objective Analysis Status
EXE-11.02.02-VP-4DWC.0007	OBJ-11.02.02-VP-4DWC.5500	SWIM compatibility SWIM compatibility	CRT-11.02.02-VP-4DWC.5500	An assessment concerning the SWIM compliancy confirms the compat bility with a SWIM Technical Infrastructure Profile and with the ISRM and AIRM guidelines	Not Available (not tested)	NOK
EXE-11.02.02-VP-LOC1.0001	OBJ-11.02.02-VP-4DWC.5501	Consistency of MET information	CRT-11.02.02-VP-4DWC.5501	When users of different ATM systems request the MET-GATE for MET information they will receive consistent MET information independent of the ATM system operational environment.	It is verified that Network MET prototypes provide consistent MET information in a specific geographic domain depending on the kind of MET information.	OK
EXE-11.02.02-VP-TER1.0001	OBJ-11.02.02-VP-4DWC.5501	Consistency of MET information	CRT-11.02.02-VP-4DWC.5501	When users of different ATM systems request the MET-GATE for MET information they will receive consistent MET information independent of the ATM system operational environment.	It is verified that Network MET prototypes provide consistent MET information in a specific geographic domain depending on the kind of MET information.	OK
EXE-11.02.02-VP-NET1.0001	OBJ-11.02.02-VP-4DWC.5501	Consistency of MET information	CRT-11.02.02-VP-4DWC.5501	When users of different ATM systems request the MET-GATE for MET information they will receive consistent MET information independent of the ATM system operational environment.	It is verified that Network MET prototypes provide consistent MET information in a specific geographic domain depending on the kind of MET information.	OK
EXE-11.02.02-VP-4DWC.0007	OBJ-11.02.02-VP-4DWC.6500	Component Reliability Component Reliability	CRT-11.02.02-VP-4DWC.6500	The reliability requirements originated from TS and IRS are satisfied by the MET-GATE.	Partially	OK

Verification Exercise ID	Verification Objective ID	Verification Objective Title	Success Criterion ID	Success Criterion	Exercise Results	Verification Objective Analysis Status
EXE-11.02.02-VP-4DWC.0007	OBJ-11.02.02-VP-4DWC.7000	Component security policies Component security policies	CRT-11.02.02-VP-4DWC.7000	The security requirements originated from TS and IRS are satisfied by the MET-GATE.	Not Available (not tested)	NOK
EXE-11.02.02-VP-4DWC.0007	OBJ-11.02.02-VP-4DWC.7500	Component maintenance Component maintenance	CRT-11.02.02-VP-4DWC.7500	The maintainability requirements originated from TS and IRS are satisfied by the MET-GATE.	Not Available (not tested)	NOK

Table 12: Summary of Verification Exercises Results

4.2 Analysis of Verification Exercises Results

4.2.1 Unexpected Behaviours/Results

Besides the group of verification objectives which are labelled as '*Not Available (not tested)*' and which are traced back to a limited release of the MET-GATE Prototype, there are furthermore some entries in Table 12 marked as '*Partially*' with a final analysis status of 'OK'.

This latter group aggregates cases where the related technical requirements referenced by the associated verification objectives could not be satisfied completely by the MET-GATE Prototype due to their complexity, range or scope but could be accepted taken into account that the Prototype had a priori only a limited ability for this issue. The analysis status was in those cases set to 'OK' when the verification objective was adaptable and successfully verified for this limited version.

The following table summarizes these '*Partially*' labelled cases, giving also the justification for the final acceptance.

Verification Exercise ID	Verification Objective ID	Problem	Justification
EXE-11.02.02-VP-4DWC.0001	OBJ-11.02.02-VP-4DWC. 0007	Automated polling not available as publication mode in the context of subscription managementSubscription processing by API	The alternative publication mode 'Notification' could be verified successfully.
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2006	Only one event type from the set of event types was available for the generation of warning messagesEvent-based warnings	The verification exercise for the supported event type passes successfully demonstrating the correctness of the mechanism.
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2010	Log information is produced only for a subset of the expected application casesLog trigger	A log mechanism is available and could be verified for a representative subset of the expected application cases.
EXE-11.02.02-VP-4DWC.0005	OBJ-11.02.02-VP-4DWC.2011	Log information is produced only for a subset of the expected information parts. Log trigger	A log mechanism is available and could be verified for a representative subset of the expected information details.
EXE-11.02.02-VP-4DWC.0006	OBJ-11.02.02-VP-4DWC.2500	Only a subset of the expected MET information types is availableMET Product capabilities	Test cases for the available subset of MET information types run successfully.
EXE-11.02.02-VP-4DWC.0007	OBJ-11.02.02-VP-4DWC.5000	Only the indexing aspect was available in the set of expected capabilities related to performance Component Performance Efficiencyrequirements.	The indexing mechanism for MET information was functionally verified successfully but bulk tests to test the effectiveness of the mechanism were not implemented in this release.
EXE-11.02.02-VP-4DWC.0007	OBJ-11.02.02-VP-4DWC.6500	Only the aspect of the immediate availability of incoming data could be verified in this group related to reliabComponent Reliabilityility requirements.	It could be verified successfully that incoming data is made available to requesting HTTP clients by the MET-GATE Prototype instance shortly afterwards (delay of few seconds due to internal processing).

Table 13: Justification of passed verification objectives related to Prototype limitations

5 Conclusions and recommendations

5.1 Conclusions

The MET-GATE Prototype release under test covered a subset of the overall set of demanded technical requirements.

Nevertheless the successfully verified capabilities demonstrated quite well the basic suitability of the MET-GATE Prototype system to act as an intermediate broker of MET information coming from MET provider systems and supplying this information to interested ATM users in an enabled SWIM network.

The MET-GATE Prototype system could demonstrate its ability as broker of MET information by providing the following capabilities:

- ATM users are able to request for MET information based on the OGC standards WFS and WCS
- A Subscription mechanism is available to automatically serve ATM users with MET information
- The ingestion procedure enables a time-efficient supply of up-to-date MET information to ad hoc or registered ATM users
- Reliable data management and administration procedures were implemented using a persistent storage medium that guarantees a consistent basis to supply ATM users with MET information.
- Basic monitoring and logging features were realized to support the visualization of internal server processes in a running MET-GATE Prototype instance.
- An initial set of supported MET information types is made available for interested ATM users consisting of the following alternatives:
    - ASPOC (Convection data)
    - SIGMET (IWXXM format)
    - METAR/TREND
    - TAF
    - AROME Temperature (4-dimensional temperature field, NetCDF4 format)
    - AROME Pressure (4-dimensional pressure field, NetCDF4 format)

5.2 Recommendations

The future development is focussed on the needs to support the validation exercises to ensure a successful provision of MET-GATE services to be validated by the operational work packages.

6 Verification Exercises reports

6.1 Verification EXE-11.02.02-VP-4DWC.0001 Report

6.1.1 Verification Exercise Scope

This exercise is at function level. It intends to verify that the MET-GATE Prototype supports subscription and publishing of MET information and satisfies the related verification objectives specified in the Verification Plan 11.02.02-D29 and also listed in Table 12.

6.1.2 Conduct of Verification Exercise

6.1.2.1 Verification Exercise Preparation

(1) Installation and start of a MET-GATE Prototype instance an accessible network node

(2) Installation and configuration of the MET-GATE Test Library on a test machine

(3) Parametrization of the MET-GATE Test Suite with respect to service connection parameters

(4) Initial load of MET information to be referenced by subscriptions

6.1.3 Verification Exercise execution

Execution of test suite tests related to the subscription context in a Java Runtime by using Maven 3 and TestNG as test driver. Communication with a MET-GATE Prototype instance occurs through the HTTP protocol.

6.1.4 Deviation from the planned activities

N/A

6.1.5 Verification exercise Results

6.1.5.1 Summary of Verification exercise Results

Only a fraction of the overall defined verification objectives in this exercise were verifiable due to a limited MET-GATE Prototype release as noted in 3.3.2.

The fraction which was not available to get verified was labelled ‘Not Available (not tested)’ in the column ‘Exercise Results’ in Table 12.

6.1.5.2 Analysis of Verification Exercise Results

Life-Cycle-Management operations like create, read, update, delete operations on subscriptions could be verified and equally the delivery of MET information to registered subscription users.

6.1.5.3 Unexpected Behaviours/Results

N/A

6.1.6 Conclusions and recommendations

6.1.6.1 Conclusions

The verification exercise was successful for the a priori verifiable features. Herein included is the support for subscription management by a registered user and the internal process workflow running in the MET-GATE server instance to supply MET information to registered users.

6.1.6.2 Recommendations

- Introduction of a user concept in the MET-GATE domain
- Export of the subscription service as SWIM compliant network service in accordance to the ISRM specification

6.2 Verification EXE-11.02.02-VP-4DWC.0002 Report

6.2.1 Verification Exercise Scope

This exercise is at function level. It intends to verify that the MET-GATE Prototype provides a request/reply mechanism for MET information to satisfy the related verification objectives specified in the Verification Plan 11.02.02-D29 and presented in Table 12.

6.2.2 Conduct of Verification Exercise

6.2.2.1 Verification Exercise Preparation

(1) Installation and start of a MET-GATE Prototype instance an accessible network node

(2) Availability of HTTP connection to the running MET-GATE Prototype instance from the test machine

(3) Installation and setup of the MET-GATE Test Library on the test machine

(4) Configuration of the MET-GATE Test Suite with respect to service connection parameters

(5) Initial load of MET information to be available for subsequent test queries

(6) Test classes executed only queries compliant with the OGC WFS and OGC WCS specification

6.2.2.2 Verification Exercise execution

Execution of test suite tests related to the request/reply aspect in a Java Runtime environment and using Maven3 and TestNG as test driver. Communication is based on the HTTP protocol.

6.2.2.3 Deviation from the planned activities

N/A

6.2.3 Verification exercise Results

6.2.3.1 Summary of Verification exercise Results

Only a fraction of the overall defined verification objectives in this exercise were verifiable due to a limited MET-GATE Prototype release as noted in 3.3.2.

The fraction which was not available to get verified was labelled ‘Not Available (not tested)’ in the column ‘Exercise Results’ in Table 12.

6.2.3.2 Analysis of Verification Exercise Results

MET information for the supported MET information types could be provided to the HTTP requestor restricting to the OGSC WFS and OGC WCS specifications. Sub-setting and sub-gridding operations were supported for geographical as well as for time based data. Sub-gridding relates only to the OGC WCS specification. An overview about the verified alternatives is presented in Table 14.

OGC Service	Request Type	Feature	ASPOC	SIGMET	METAR	TAF	AROME 4-dimens. Temperature Field	AROME 4-dimens. Pressure Field
WFS	GetCapabilities		Y	Y	Y	Y		
WFS	DescribeFeature		Y	Y	Y	Y		
WFS	GetFeature	DATA	Y	Y	Y	Y		
WFS	GetFeature	MWOCREATIONDATE	Y	Y	Y	Y		
WFS	GetFeature	MWONAME	Y	Y	Y	Y		
WFS	GetFeature	BASEFL	N					
WFS	GetFeature	TOPFL	N					
WFS	GetFeature	ATSUCODE		Y				
WFS	GetFeature	MWOLOCATION	Y	Y	Y	Y		
WFS	GetFeature	OBSERVEDAREA	Y	Y				
WFS	GetFeature	[combination]	Y	Y	Y	Y		
WCS	GetCapabilities						Y	Y
WCS	DescribeCoverage						Y	Y
WCS	GetCoverage	COVERAGE ID					Y	Y
WCS	GetCoverage	LATITUDE					N	N
WCS	GetCoverage	LONGITUDE					N	N
WCS	GetCoverage	TIME					N	N
WCS	GetCoverage	[combination]					N	N

Table 14: Supported OGC Request Matrix

The MET-GATE Prototype release under test supported requests compliant with the OGC WFS and OGC WCS specification. For each specification type a specific group of features were available to be used in requests. The white cells labelled 'Y' indicate a request alternative for which an executable test was implemented. The white cells labelled 'N' mark supported options, but for which a test was not available yet. The black cells represent options which are not realizable at all.

6.2.3.2.1 Unexpected Behaviours/Results

N/A

6.2.4 Conclusions and recommendations

6.2.4.1 Conclusions

The verification exercise was successful for the MET information types which were a priori supported at all by the MET-GATE Prototype system.

6.2.4.2 Recommendations

N/A

6.3 Verification EXE-11.02.02-VP-4DWC.0003 Report

6.3.1 Verification Exercise Scope

This exercise is at function level. It intends to verify that the MET-GATE Prototype provides a discovery mechanism to requesting users and satisfies the related verification objectives specified in the Verification Plan 11.02.02-D29 and listed also in Table 12.

6.3.2 Conduct of Verification Exercise

6.3.2.1 Verification Exercise Preparation

N/A

6.3.2.2 Verification Exercise execution

This exercise could not be performed, because the MET-GATE Prototype did not support **a priori** any of the formulated verification objectives related to the discovery mechanism projected.

6.3.2.3 Deviation from the planned activities

N/A

6.3.3 Verification exercise Results

6.3.3.1 Summary of Verification exercise Results

N/A

6.3.3.2 Analysis of Verification Exercise Results

N/A

6.3.3.3 Unexpected Behaviours/Results

N/A

6.3.4 Conclusions and recommendations

6.3.4.1 Conclusions

N/A

6.3.4.2 Recommendations

N/A

6.4 Verification EXE-11.02.02-VP-4DWC.0004 Report

6.4.1 Verification Exercise Scope

This exercise is at function level. It intends to verify that the MET-GATE Prototype provides data management capabilities to satisfy the related verification objectives specified in the Verification Plan 11.02.02-D29 and listed also in Table 12.

6.4.2 Conduct of Verification Exercise

6.4.2.1 Verification Exercise Preparation

(1) Installation and start of a MET-GATE Prototype instance on an accessible network node

(2) Installation and setup of the MET-GATE Test Library on the test machine

(3) Configuration of the MET-GATE Test Suite with respect to service connection parameters

(4) Initial load of MET information into the MET-GATE Prototype database

6.4.2.2 Verification Exercise execution

Feed of MET-GATE Prototype instance using MET information files with forbidden file size to verify the error handling

Inspection of generated error messages coming from the MET-GATE Prototype instance

Inspection of available MET information located in the MET-GATE database

6.4.2.3 Deviation from the planned activities

N/A

6.4.3 Verification exercise Results

6.4.3.1 Summary of Verification exercise Results

Only a small fraction of the overall defined verification objectives in this exercise were available to be verified due to a limited MET-GATE Prototype release as noted in 3.3.2.

The fraction which was not available to get verified was labelled ‘Not Available (not tested)’ in the column ‘Exercise Results’ in Table 12.

6.4.3.2 Analysis of Verification Exercise Results

Only two capabilities of the MET-GATE Prototype were verifiable:

(1) The application of a predefined time window controlling the availability of MET information against user requests

(2) The application of a file size related filter rule for incoming MET information (from the MET provider side)

6.4.3.2.1 Unexpected Behaviours/Results

N/A

6.4.4 Conclusions and recommendations

6.4.4.1 Conclusions

The verification exercise was successful for the verification objectives which a priori could be verify at all. None of the verifiable aspects failed.

6.4.4.2 Recommendations

N/A

6.5 Verification EXE-11.02.02-VP-4DWC.0005 Report

6.5.1 Verification Exercise Scope

This exercise is at function level. It intends to verify that the MET-GATE Prototype provides monitoring and control capabilities to satisfy the related verification objectives specified in the Verification Plan 11.02.02-D29 and also listed in Table 12.

6.5.2 Conduct of Verification Exercise

6.5.2.1 Verification Exercise Preparation

(1) Installation and start of a MET-GATE Prototype instance on a network node

(2) Availability of HTTP connection to the running MET-GATE Prototype instance from the test machine

(3) Installation and setup of the MET-GATE Test Library on the test machine

(4) Configuration of the MET-GATE Test Suite with respect to service connection parameters

6.5.2.2 Verification Exercise execution

Feed of the MET-GATE Prototype instance using MET information files to be ingested by the Prototype collection service.

Feed of the MET-GATE Prototype instance using MET information files with illegal file size to verify the error handling mechanism

Inspection of available MET information in the MET-GATE Prototype database

Inspection of returned message content of a HTTP response originated by an initial MET information request

Inspection of logged information by the MET-GATE Prototype instance in related server log files (here JBOSS) for different severity levels (info, warning, error)

6.5.2.3 Deviation from the planned activities

N/A

6.5.3 Verification exercise Results

6.5.3.1 Summary of Verification exercise Results

Only a fraction of the overall defined verification objectives in this exercise were a priori verifiable due to a limited MET-GATE Prototype release as noted in 3.3.2.

The fraction which was not verifiable was labelled ‘Not Available (not tested)’ in the column ‘Exercise Results’ in Table 12.

6.5.3.2 Analysis of Verification Exercise Results

The following aspects associated to the expected monitoring and control capabilities could be verified:

(1) Internal logging of information to server side internal log files by the MET-GATE Prototype instance related to data ingestion, subscription management and request/reply transactions

(2) Generation of feedback responses to a HTTP requestor when the request cannot be satisfied due to missing MET information in the MET-GATE Prototype database

(3) Triggering of alarm functions related to exceptional process states or data states in the MET-GATE Prototype instance and their corresponding logging in the MET-GATE Prototype database. Furthermore the persisted alarm information could be read afterwards by a related alarm information service via a REST web service. An alarm function was only available in relation to the file size check rule which is applied to incoming MET information during the data ingestion process.

6.5.3.3 Unexpected Behaviours/Results

N/A

6.5.4 Conclusions and recommendations

6.5.4.1 Conclusions

The verification exercise was successful for the set of verification objectives which could be a priori verify at all.

6.5.4.2 Recommendations

The alarm handling mechanism is to be extended to the other use cases which are demanded by the technical requirements but which were not yet implemented in the current Prototype release.

Monitoring of server status had to be done by introspection of log files. This could be optimized to be less time consuming and tedious.

A more effective procedure to find and localize information coming from server logging activities is desirable. At the moment this is only supported for information originated from alarm based server events.

6.6 Verification EXE-11.02.02-VP-4DWC.0006 Report

6.6.1 Verification Exercise Scope

This exercise is at function level. It intends to verify that the MET-GATE Prototype provides the demanded MET information types to satisfy the related verification objectives specified in the Verification Plan 11.02.02-D29 and also listed in Table 12.

6.6.2 Conduct of Verification Exercise

6.6.2.1 Verification Exercise Preparation

(1) Installation and start of a MET-GATE Prototype instance on a network node

(2) Availability of HTTP connectivity to the running MET-GATE Prototype instance from the test machine

(3) Installation and setup of the MET-GATE Test Library on the test machine

(4) Configuration of the MET-GATE Test Suite with respect to service connection parameters

(5) Initial load of MET information into the MET-GATE Prototype database.

6.6.2.2 Verification Exercise execution

Execution of the set of Test Suite tests related to as hoc HTTP requests on MET information and evaluation of the HTTP response message.

6.6.2.3 Deviation from the planned activities

N/A

6.6.3 Verification exercise Results

6.6.3.1 Summary of Verification exercise Results

Only a fraction of the overall defined verification objectives in this exercise were verifiable due to a limited MET-GATE Prototype release as noted in 3.3.2.

The fraction which was not verifiable was labelled ‘Not Available (not tested)’ in the column ‘Exercise Results’ in Table 12.

6.6.3.2 Analysis of Verification Exercise Results

The availability of MET information was restricted in the current MET-GATE Prototype release to the following types:

- SIGMET (IWXXM format)
- METAR (including TREND)
- TAF
- ASPOC (convection data)

- AROME (4-dimensional coverage data for temperature and pressure fields, binary NetCDF4 format)

6.6.3.3 Unexpected Behaviours/Results

N/A

6.6.4 Conclusions and recommendations

6.6.4.1 Conclusions

The verification exercise was successful for the preceding enumerated set of MET information types.

6.6.4.2 Recommendations

Additional MET information types should be made available in the next release of the MET-GATE Prototype.

6.7 Verification EXE-11.02.02-VP-4DWC.0007 Report

6.7.1 Verification Exercise Scope

In contrast to the verification exercises before this exercise concentrates on the verification of non-functional aspects in the MET-GATE service domain.

It intends to verify that the MET-GATE Prototype provides the demanded non-functional capabilities to satisfy the related verification objectives specified in the Verification Plan 11.02.02-D29 and also listed in Table 12.

6.7.2 Conduct of Verification Exercise

6.7.2.1 Verification Exercise Preparation

N/A

6.7.2.2 Verification Exercise execution

The preferred verification methods here were *inspection* and *design review*. The aspects to be verified included especially compatibility and performance requirements.

The requirement on consistent MET information has been verified by exercises EXE-11.02.02-VP-LOC1.0001, EXE-11.02.02-VP-TER1.0001 and EXE-11.02.02-VP-NET1.0001.

6.7.2.3 Deviation from the planned activities

N/A

6.7.3 Verification exercise Results

6.7.3.1 Summary of Verification exercise Results

Only a fraction of all the defined verification objectives in this exercise were available to be verified due to a limited MET-GATE Prototype release as noted in 3.3.2.

The fraction which was not available to get verified was labelled ‘Not Available (not tested)’ in the column ‘Exercise Results’ in Table 12.

The consistency of MET information has been verified successfully.

6.7.3.2 Analysis of Verification Exercise Results

Among the compatibility requirements only a subset could be satisfied, but featuring very important and basic aspects including the support of the following network protocols which are also essential to demonstrate SWIM compliancy

- TCP/IP
- HTTP
- OGC Standards

With regards to examined performance aspects only the index mechanism applied to MET information processing could be verified.

It is verified that the MET prototypes provide consistent MET information in a specific geographical domain which depends on the kind of MET information. Considering the currently limited areas for some MET elements the requirement REQ-11.02.02-TS-4DWC-0012 has been verified successfully. A more detailed analysis of the results is described in the MET prototypes verification reports [10]

6.7.3.3 Unexpected Behaviours/Results

N/A

6.7.4 Conclusions and recommendations

6.7.4.1 Conclusions

The verification exercise was successful for the set of verification objectives which could be a priori verify at all. The index mechanism was only analysed with regards to its implementation. Bulk tests confirming also its suitability in high-performance cases were not yet implemented.

6.7.4.2 Recommendations

The MET-GATE Prototype needs still extension by preference in the next release to cover more non-functional requirements and to demonstrate full SWIM compliancy.

7 References

7.1 Applicable Documents

[1] Requirements and V&V Guidelines 03.01.00
https://extranet.sesarju.eu/Programme%20Library/Requirements%20and%20VV%20Guidelines.doc

[2] EUROCONTROL ATM Lexicon
https://extranet.eurocontrol.int/http://atmlexicon.eurocontrol.int/en/index.php/SESAR

[3] ISO/IEC 25010 Software and systems engineering – Systems and software Quality Requirements and Evaluation

7.2 Reference Documents

[4] MET Information Systems Development, Verification & Validation (11.02.02), Technical Specification: 4DWxCube, Del.ID. 11.02.02-D27, Ed. 00.01.00, October 2015

[5] MET Information Systems Development, Verification & Validation (11.02.02), Interface Requirements Specification: 4DWxCube, Del.ID. 11.02.02-D28, Ed. 00.01.00, October 2015

[6] MET Information Systems Development, Verification & Validation (11.02.02), Updated Verification Plan: 4DWxCube-MET-GATE, Del.ID. 11.02.02-D29, Ed. 00.01.00, October 2015

[7] Requirements for MET Information, (11.02.01) , MET Technical Architecture Description (TAD), Del.ID P11.02.01-D31, Ed 00.02.00, October 2015

[8] MET Information Systems Development Verification & Validation (11.02.02), Updated Technical Specification – 4DWxCube Local/Sub-regional/Network MET prototypes, 11.02.02-D13/D14/D15, Ed. 00.01.00, October 2015

[9] MET Information Systems Development Verification & Validation (11.02.02), Updated Verification Plan – 4DWxCube Local/Sub-regional/Network prototypes, 11.02.02-D16/D18/D20, Ed 00.01.00, October 2015

[10]MET Information Systems Development Verification & Validation (11.02.02), Final Verification Report - 4DWxCube Local/Sub-regional/Network MET prototypes, 11.02.02-D17/D19/D21, Ed 00.01.00, February 2016

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