



## Process and methodology for developing semantic agreements

JOINING UP GOVERNMENTS



---

## DOCUMENT METADATA

Property	Value
Release date	08/02/2013
Status	Accepted
Version	1.00

**This report was prepared for the ISA programme by:**

*PwC EU Services*

**Disclaimer:**

The views expressed in this report are purely those of the authors and may not, in any circumstances, be interpreted as stating an official position of the European Commission.

The European Commission does not guarantee the accuracy of the information included in this study, nor does it accept any responsibility for any use thereof.

Reference herein to any specific products, specifications, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favouring by the European Commission.

All care has been taken by the author to ensure that s/he has obtained, where necessary, permission to use any parts of manuscripts including illustrations, maps, and graphs, on which intellectual property rights already exist from the titular holder(s) of such rights or from her/his or their legal representative.

## Table of Contents

Document Metadata .....	2
Table of Contents .....	3
List of Figures .....	5
1 Introduction.....	6
1.1 Aims and Objectives .....	6
1.2 Context .....	7
1.3 Structure .....	7
2 Stakeholders .....	8
2.1 The Authority .....	8
2.2 The Activity Members .....	8
2.3 The wider community .....	8
3 Specification Process .....	9
3.1 Actors and Roles .....	9
3.1.1 Endorsement Group (EG) .....	9
3.1.2 Secretariat .....	9
3.1.3 The Activity Leader (AL) .....	9
3.1.4 The Expert Pool (EP).....	9
3.1.5 The Domain Model Working Group (DM-WG) .....	9
3.1.6 The Data Entity Subgroups (DESG).....	10
3.1.7 The Review Group (RG).....	10
3.2 Process steps .....	10
3.2.1 Set up overall work-plan .....	12
3.2.2 Establish a working environment and culture .....	12
3.2.3 Establish Expert Pool .....	14
3.2.4 Prepare IPR arrangements .....	14
3.2.5 Establish Review Group .....	15
3.2.6 Establish Domain Model Working Group .....	16
3.2.7 Set up DM-WG work-plan.....	16
3.2.8 Prepare Working Draft(s) of Domain Model .....	17
3.2.9 Review Working Draft(s) of Domain Model .....	18
3.2.10 Issue Last Call Domain Model Working Draft .....	18

---

3.2.11	Review Last Call Domain Model Working Draft .....	19
3.2.12	Publish Draft Domain Model.....	19
3.2.13	Identify Data Entities for further specification .....	19
3.2.14	Establish Data Entity Subgroups .....	19
3.2.15	Set up DESG work-plan .....	20
3.2.16	Draft Working Draft(s) of specification of Data Entity .....	20
3.2.17	Review Working Draft(s) of specification of Data Entity .....	20
3.2.18	Issue Last Call Working Draft of specification of Data Entity .....	21
3.2.19	Review Last Call Working Draft of specification of Data Entity .....	21
3.2.20	Submit specification of Data Entity .....	21
3.2.21	Create Final Domain Model.....	21
3.2.22	Review Final Domain Model.....	22
3.2.23	Publish Final Domain Model.....	22
3.2.24	Endorse Final Domain Model .....	22
3.3	Persistence policy.....	22
3.3.1	Editorial changes only .....	23
3.3.2	Fundamental changes .....	23
4	Methodology.....	24
4.1	Phase One: Determine Use Cases and Requirements.....	27
4.1.1	Use Cases .....	27
4.1.2	Requirements .....	28
4.2	Phase Two: Develop Domain Model .....	28
4.2.1	Identify and analyse existing models.....	28
4.2.2	Derive necessary elements from Use Cases and Requirements .....	28
4.2.3	Identify and analyse models used elsewhere .....	29
4.2.4	Create cross-reference table for Data Entities and relationships.....	29
4.2.5	Select set of core data entities and core relationships .....	30
4.2.6	Document Draft Domain Model .....	30
4.3	Phase Three: Specify Data Entities.....	30
4.3.1	Identify attributes and controlled vocabularies used in the local implementations..	30
4.3.2	Derive necessary attributes from Use Cases and Requirements .....	30
4.3.3	Identify and analyse Data Entity descriptions used or standardised elsewhere .....	31
4.3.4	Create cross-reference table for attributes.....	31
4.3.5	Perform semantic clustering of attributes .....	31

---

4.3.6	Identify and compare controlled vocabularies .....	32
4.3.7	Choose recommended controlled vocabularies .....	32
4.3.8	Document core set of attributes and recommended vocabularies .....	33
4.4	Phase Four: Integrate Data Entities into Domain Model .....	33
4.4.1	Add Data Entity attributes to the Domain Model .....	33
4.4.2	Harmonise attributes across the Domain Model .....	33
4.4.3	Harmonise controlled vocabularies across the Domain Model .....	33
4.4.4	Finalise Domain Model .....	34
4.5	Phase Five: Specify Conformance Criteria .....	34
5	Implementation.....	35
5.1	HTML.....	35
5.2	XML .....	35
5.3	RDF .....	35
Appendix A	References .....	36
Appendix B	Terminology and Glossary .....	37
Appendix C	ISA Contributor Agreement v1.1 .....	38
Appendix D	Specification Template .....	44
Appendix E	Summary of Process Steps .....	47
Appendix F	Summary of Method Steps.....	48

## List of Figures

Figure 1: Overview of the DM-WG process .....	11
Figure 2 Overview of the DSEG process .....	12
Figure 3 Overview of Domain Model methodology .....	26
Figure 4 Overview of Data Entity methodology.....	27

---

## 1 INTRODUCTION

This document describes the process and methodology for the development of common models and specific data entities that can be used as a basis for interoperability among information systems.

Interoperability entails the exchange of data across sectors, organisations and borders. This data will exist in information systems of a group of co-operation partners and may be represented using different vocabularies and formalisms.

This document works on the assumption that, in order to automate and make the exchange of this data seamless and interoperable, the organisations that wish to interoperate establish an **Activity** that follows a process and methodology for building consensus among the participants on a **Domain Model** comprising of:

- **One or more Data Entities;**
- **Relationships** between Data Entities;
- **Attributes** of Data Entities; and
- Recommended **controlled vocabularies** that will provide values to the attributes.

The resulting Domain Model with its components is intended to support semantic interoperability across the participating systems in order to provide common services. The result of the work, the final Domain Model, will contain a set of **semantic agreements** covering the overall model, the data entities and the controlled vocabularies.

There may also be more simple environments where the Domain Model is already known and agreed, and where only consensus on a specific Data Entity is required. For such simple cases, a basic implementation of the process and methodology is described.

### 1.1 AIMS AND OBJECTIVES

This document has two aims:

- **To define a process** through which semantic agreements can be reached among participants in a consensus-building activity.
- **To define the methodology** through which semantic agreements are developed. We can break this down into the following objectives:
  - To define clearly the kind of problems the domain model and the data entities will solve;
  - To make the overall structure and components of the domain model clear;
  - To follow best practice when publishing the semantic agreements.

## 1.2 CONTEXT

This document has been prepared in the context of Action 1.1<sup>1</sup> of the ISA Programme<sup>2</sup>. A first inspiration of the current document was the ISA Deliverable “*Process and Methodology for Developing Core Vocabularies*”<sup>3</sup> which was aimed specifically to support the development of core vocabularies. A further activity within Action 1.1 of the ISA programme considered a more complex case involving the development of a common data model with a number of data entities. That activity was specifically aimed at providing guidelines for the Cooperation Project for the Common Information Sharing Environment (CISE) for the EU Maritime Domain<sup>4</sup>, resulting in the “*Report on reaching semantic agreements within CISE*”<sup>5</sup>.

Based on the input of the two above-mentioned documents, the current document aims to provide a generalised view on these types of consensus-building activities. In practical cases, not all the roles and steps might be necessary, and any activity applying this process and methodology should critically consider how to adapt the approach to its particular needs and circumstances.

## 1.3 STRUCTURE

The remainder of this document is structured as follows:

Chapter 2 “Stakeholders” outlines the various groups and their interests in the interoperability that the semantic agreements will enable.

Chapter 3 “Specification Process” describes the roles of the various groups involved in the specification process and the process steps necessary to reach the semantic agreements, including the establishment of the working group and subgroups, the drafting of documents and the review and endorsement of the model and its components.

Chapter 4 “Methodology” describes the approach towards developing the model and its components, in particular the intellectual content of the work that the working group and the subgroups need to undertake.

Chapter 5 “Implementation” includes a number of issues that are related to the publication of the model and its components in human-readable form as an HTML document and in machine-readable form as RDF and XML schemas.

---

<sup>1</sup> [http://ec.europa.eu/isa/actions/01-trusted-information-exchange/1-1action\\_en.htm](http://ec.europa.eu/isa/actions/01-trusted-information-exchange/1-1action_en.htm)

<sup>2</sup> <http://ec.europa.eu/isa/>

<sup>3</sup> <http://joinup.ec.europa.eu/elibrary/document/isa-deliverable-process-and-methodology-developing-core-vocabularies>

<sup>4</sup> [http://ec.europa.eu/maritimeaffairs/policy/integrated\\_maritime\\_surveillance/index\\_en.htm](http://ec.europa.eu/maritimeaffairs/policy/integrated_maritime_surveillance/index_en.htm)

<sup>5</sup> <https://joinup.ec.europa.eu/community/semic/document/d631-%E2%80%93-report-reaching-semantic-agreements-within-cise>

## 2 STAKEHOLDERS

In the process of developing and maintaining semantic agreements, the following stakeholders can be identified:

### 2.1 THE AUTHORITY

The Activity will in general be undertaken under the responsibility of a higher body, be it the Board of Directors of a company, a funding agency for a project or programme, or a Directorate or department in an administration. This top-level stakeholder will be referred to as the “**Authority**”.

### 2.2 THE ACTIVITY MEMBERS

The Activity will be undertaken by and for a group of organisations that have decided to build common services that require their information systems to interoperate. Typically, they will be data owners that need the semantic agreements to be able to exchange data and build common services. These primary stakeholders will be referred to as “**Members**”.

### 2.3 THE WIDER COMMUNITY

Beyond the Members of the Activity, there may be other organisations that have an interest in the agreements reached by the Activity as it will allow them to build on these agreements either to participate in the common services with the Members or to build similar services among another set of organisations. These organisations will be collectively referred to as “**Community**”.



---

## 3 SPECIFICATION PROCESS

This chapter specifies the process through which consensus can be reached among stakeholders. It outlines the roles that the different actors in this process play and the process steps that need to be taken.

### 3.1 ACTORS AND ROLES

The goal of the development process is to create, review and, finally, agree and endorse a new specification. These different steps are executed by distinct groups.

#### 3.1.1 Endorsement Group (EG)

The Endorsement Group (EG) may be a multidisciplinary ad-hoc group composed of representatives of third parties that have an interest in the semantic agreements from a higher perspective, for example including user communities, legal experts and researchers in the domain area or in information and computer sciences.

#### 3.1.2 Secretariat

The Activity may be supported by a Secretariat that facilitates the communication between the Activity and the EG. The Secretariat may be involved in identifying and inviting external experts to participate in the Activity. If an Activity does not have a Secretariat, the Activity Leader takes care of this task.

#### 3.1.3 The Activity Leader (AL)

The management and coordination of the work are assigned to the Activity Leader (AL). The AL is responsible for the overall planning and execution of the work. The AL is also responsible for inviting the members of the working group and the subgroups, for the appointment of chairs and editors, and for communicating the outcomes of the working group and the subgroups to the Authority, the Members and the Community.

#### 3.1.4 The Expert Pool (EP)

The actual work of developing the semantic agreements is done by experts with a deep understanding of existing implementations in terms of the underlying data models, data entities and description approaches. In addition, external experts with knowledge of the domain and relevant application area may be invited to be part of the EP. These experts may be associated with the wider Community (see section 2.3) including other organisations in Europe and beyond. Members of the Working Group and the Subgroups are recruited from the EP.

#### 3.1.5 The Domain Model Working Group (DM-WG)

The DM-WG brings together a group of experts from the Expert Pool with knowledge of data models and data flows underlying existing implementations, and external experts who are involved in similar activities. The size of the DM-WG depends on the number of existing implementations to be considered, but it may be useful to limit the size of the group to a maximum of fifteen people. The DM-WG is responsible for developing the Domain Model.

### 3.1.6 The Data Entity Subgroups (DESG)

A number of DESGs are established, one for each Data Entity defined in the Domain Model, each consisting of experts who know how a particular data entity is described in existing implementations (e.g. databases and information systems). The size of the DESGs is dependent on the number of implementations of a certain Data Entity. An optimum for a DESG may be between five and ten people. DESGs are responsible for discussing and agreeing core sets of attributes and controlled vocabularies for each of the Data Entities under consideration.

### 3.1.7 The Review Group (RG)

A Review Group is established that monitors the work of the various groups. All interim and final results of the groups are made available to the RG for review and comment. Membership in the RG is open for any member of the Authority, EG and EP. Members of the DM-WG and the DESGs are also automatically members of the RG and take a role in reviewing the work of the groups they do not participate themselves in.

## 3.2 PROCESS STEPS

The following sections set out the steps of the process that must be taken by the various actors identified in section 3.1.

Figure 1 illustrates the different steps of the process to be followed by the DM-WG and the actors responsible for carrying out each step. Likewise, Figure 2 illustrates the different steps of the process to be followed by the DESG.

Please note that the process can be implemented in two variants:

1. For complex activities: a full implementation including Domain Model Working Group and two or more Data Entity Subgroups;
2. For simple projects where *the Domain Model is already established*: a basic implementation in which Domain Model Working Group and Data Element Subgroup are merged into one group that follows the process as outlined for a Data Element Subgroup.

In the basic implementation, process steps 7-14 and 23-25 are skipped. After the invitations and signing of the contributor agreements, the chair and editor of the merger group are invited and appointed, and the result of the work of the DESG is published and then directly submitted to the EG for endorsement.

A border case is when the Domain Model is not previously established but only involves one Data Entity. In that case, the specification of the Data Entity constitutes a simple Domain Model. As a consequence, there is no need for separate groups (DM-WG and DESG) and the process is identical to the basic implementation.

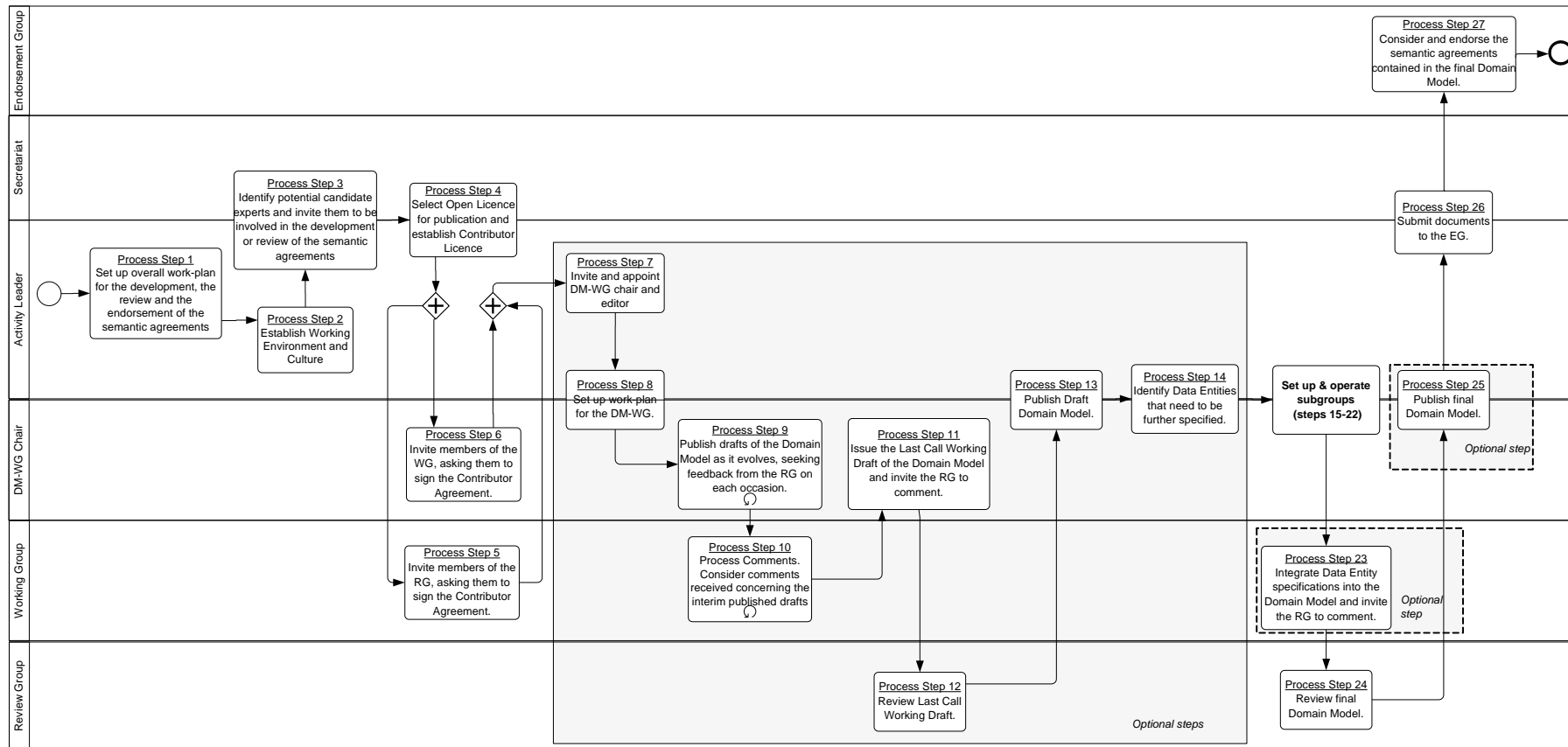


Figure 1: Overview of the DM-WG process<sup>6</sup>

<sup>6</sup> NB: when an activity spans across two swim lanes, this indicates that both actors are involved in the delivery of that activity.

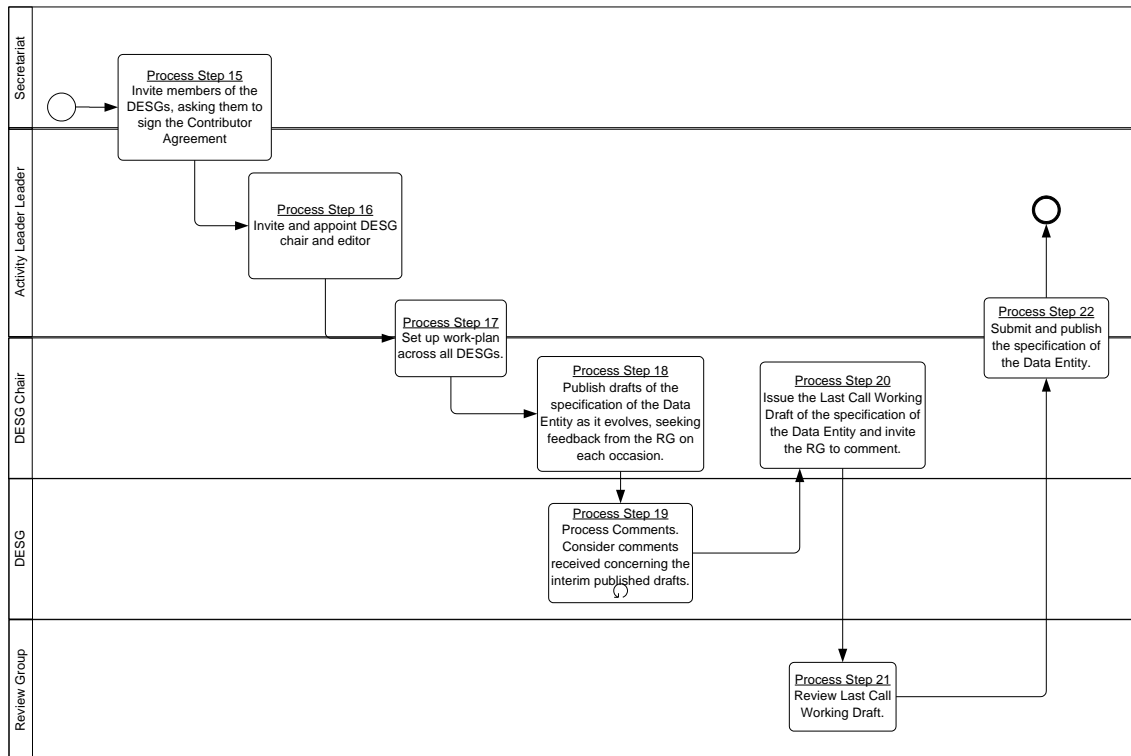


Figure 2 Overview of the DSEG process

### 3.2.1 Set up overall work-plan

Before any work starts, the activities leading to the development of the semantic agreements and the endorsement need to be planned. The AL produces the work plan, including a description of the tasks, the deliverables and the time plan.

#### Tasks

**Process Step 1. (AL) Set up overall work-plan for the development, the review and the endorsement of the semantic agreements**

### 3.2.2 Establish a working environment and culture

As the development of semantic agreement is very much a collaborative effort, it is essential that an effective working environment is set up and a collaborative culture is agreed upon.

#### Communication

All groups (DM-WG, DESGs, and RG) must have appropriate tools for communication.

The following tools need to be foreseen:

- A cooperative workspace, like a Wiki for document sharing;
- Mailing lists, e.g.:
  - A private mailing list for the DM-WG for discussions in the Working Group during the development of the Domain Model;
  - Private mailing lists for each of the DESGs for discussions in the Subgroups during the development of the Data Entities;
  - A mailing list of the RG for announcements of drafts for review and for comments by the RG on the drafts;
- A Web conferencing system with audio channel, chat channel and screen sharing functions for virtual meetings. The chat channel can act both as the medium through which meeting minutes are taken and as a channel through which terms, references and hyperlinks can be communicated easily;
- An issue tracking system to record issues and comments and the resolution of those issues and comments.

A schedule for virtual meetings is determined on the basis of the schedule for the work as established at the start of the work of a particular group. One virtual meeting per two weeks could be a reasonable frequency to aim for.

In addition to the virtual meetings, a (face-to-face) kick-off meeting could be envisaged at an appropriate time and place to which all members of all groups (DM-WG, DESGs, and RG) are invited. Other meetings may be scheduled as necessary. Any meeting should be planned with ample advance notice. Meetings can provide useful points in the calendar by which milestones are met. They also act as a focus for group cohesion. These aspects are hard to quantify against the cost in time and money of arranging and participating in a face-to-face meeting, but experience shows that “a lot gets done” during such a meeting.

### Transparency and record keeping

Transparency and record keeping is an important aspect of achieving consensus. To this end, all groups must take care to document their work. This is done either by sending messages to one of the mailing lists, creating and updating issues in the issue tracker, or publishing documents on the cooperative workspace.

The following measures provide a full history of the work:

- All mailing lists must have archives;
- Agendas must be distributed by e-mail ahead of all meetings;
- Meeting minutes must be kept and published on the Wiki;
- All issues discussed on any of the mailing list or during meetings and review comments and their resolutions must be recorded in the issue tracker.

Discussion on an issue should quote the identifier of the issue in the issue tracker. Issues should be resolved by the group and the resolution recorded before the issue is marked as ‘closed’.

Action items are assigned to individual participants during meetings. These, too, are recorded, clearly stating to whom the action was assigned and the date by which the assignee agreed to complete it.

Once a comment has been dealt with, the commenter is informed of the group's decision(s) and reasoning. This may be an iterative process but, ultimately, the group needs to be able to show that every comment has been dealt with to the satisfaction of the commenter.

All members of the DM-WG, DESGs, RG and EG must have access to all of the documentation listed above.

## Dispute resolution

The goal is to achieve consensus. However, there may be times when consensus cannot be reached on an issue or on a comment received. In such cases, one possible course of action is to seek external guidance. This could be done by asking for advice from the RG or any of the other groups. Alternatively, the group may take a simple vote to settle an issue with the chair having the casting vote; such votes are recorded in meeting minutes. Ultimately, the AL, in consultation with the EG, may settle a dispute but this is very much a last resort as it shows that full consensus has not been reached.

## Tasks

**Process Step 2. (AL) Establish a working environment and culture**

### 3.2.3 Establish Expert Pool

Before work can start, the people that are going to be involved need to be identified. The AL, in consultation with the Secretariat, identifies the candidates for the EP. Sources of experts are the Members in the Activity and a list of external experts to be proposed by the AL in consultation with the EG and Secretariat.

As part of the invitation process, the candidates are asked whether they want to be involved, whether they are available in the timeframe that the work will take place, whether they want to participate actively as a member in the DM-WG or a DESG, or as a reviewer in the RG.

## Tasks

**Process Step 3. (AL, Secretariat) Identify potential candidate experts and invite them to be involved in the development or review of the semantic agreements**

### 3.2.4 Prepare IPR arrangements

While the ownership and maintenance of the semantic agreements (documentation and machine-readable schemas) is with the Authority, the objective is to ensure that anyone can freely use and distribute the semantic agreements. At the same time, the link to the semantic agreements must be maintained in all derivative works, and the Authority must be protected

against false statements of endorsement and any liability claims for damage resulting from the use of the semantic agreements. To achieve this, the semantic agreements and all related documentation are published under an open licence that satisfies the above-mentioned requirements. Examples of candidate licence are the ISA Open Metadata Licence v1.1<sup>7</sup> or the Creative Commons Attribution licence<sup>8</sup>.

To grant the rights of free reuse and redistribution on the outgoing side, the Authority must acquire sufficient rights on the incoming side. For this, a **Contributor Agreement** is concluded with all experts who contribute intellectual property in the process of specifying a semantic agreement. All members of the DM-WG, DESGs and RG must sign the Contributor Agreement. An example of a Contributor Agreement is the ISA Contributor Licence v1.1, included in Appendix C.

This will allow defending the specification if a legal dispute arises concerning the contributed content. The AL takes steps to ensure that individuals and organisations invited to participate in the DM-WG, DESGs and RG are made aware of the licensing arrangements for the completed work. All contributors to the semantic agreement will be acknowledged in the final specification, including their affiliation if applicable.

In the invitations to the experts to join the DM-WG, one of the DESGs or the RG, the AL makes the experts aware of the licensing arrangements and requests them to sign the Contributor Agreement. If an expert does not sign the agreement, that expert will be excluded from participating.

## Tasks

**Process Step 4. (AL) Select Open Licence for publication, establish Contributor Licence**

### 3.2.5 Establish Review Group

The first group to be established is the Review Group which will be involved in reviewing all drafts produced by the DM-WG and the DESGs. The AL sends out invitations to members of the EP that have indicated their willingness to participate as reviewers.

## Tasks

**Process Step 5. (AL) Invite members of the Review Group, asking them to sign the Contributor Agreement**

<sup>7</sup> <https://joinup.ec.europa.eu/category/licence/isa-open-metadata-licence-v11>

<sup>8</sup> <http://creativecommons.org/licenses/by/3.0/>

### 3.2.6 Establish Domain Model Working Group

The first group to start work is the DM-WG tasked to develop the Domain Model that identifies the Data Entities and their relationships.

The AL sends out invitations to people who have expressed to be a member of the DM-WG and fit the profile outlined in section 3.1.5, and asks them to sign the Contributor Agreement.

#### Tasks

**Process Step 6. (AL) Invite members of the DM-WG, asking them to sign the Contributor Agreement**

As soon as the members of the DM-WG have been selected, a chair and an editor need to be appointed. The AL identifies the candidate chairs and editors and invite them, communicating the tasks that are associated with these roles.

The role of the chair is to:

- Gather the group and maintain a positive and productive environment;
- Organise and chair the meetings;
- Distribute an agenda and reminder about each meeting in good time;
- Ensure that minutes are taken and archived;
- Ensure that decisions are recorded;
- Guide the group through the development of the Domain Model;
- Ensure that consensus is achieved within the group;
- Act as primary point of contact for the group;
- Ensure that the comments of reviewers are sought and acted upon when received, and that reviewers are content with the response of the DM-WG.

This is clearly an important role and so the choice of chair is critical. It is sometimes possible for the chair's duties to be shared by two co-chairs although a higher number is rarely desirable or successful.

The role of the editor is to draft the documentation that is the result of the work of the group. . Again, this task can be shared between individuals.

#### Tasks

**Process Step 7. (AL) Invite and appoint DM-WG chair and editor**

### 3.2.7 Set up DM-WG work-plan

In order to ensure an organised approach to the work in the DM-WG, a work plan is necessary. After appointment of the DM-WG chair, the AL and the chair produce a work plan with tasks,



deliverables and a time plan for the DM-WG. The work plan of the DM-WG must be aligned with the overall work plan of the Activity (taking into account project deadlines and milestones).

## Tasks

### Process Step 8. (AL, DM-WG chair) Set up work-plan for the DM-WG

#### 3.2.8 Prepare Working Draft(s) of Domain Model

The DM-WG is responsible for developing the Domain Model, but at the same time the wider stakeholder group is engaged in the RG, thus ensuring the broadest possible consensus.

Each draft is published at its own stable URI. A 'latest version' URI is established that maps to whichever is the latest version. For example, a particular group (e.g. a hypothetical subgroup considering an agreement on the description of vessels) might publish drafts on the 1<sup>st</sup> of February and the 14<sup>th</sup> of March 2013, in which case the URIs of those drafts might be analogous to:

```
http://example.org/vessel/draft/20130201  
http://example.org/vessel/draft/20130314
```

The URI `http://example.org/vessel` would initially be mapped to `http://example.org/vessel/draft/20130201` but would switch to the later draft when it was published. All these URIs must be chosen with care as they should be 'persistent' in the sense that it should be possible to access the various versions in the future.

Each draft should also link to its predecessor so that reviewers can easily navigate back through the agreement's development.

The DM-WG chair announces each published draft to the mailing list of the RG with a request for feedback.

A minimum of two interim drafts should be foreseen:

- A first draft with the first outline of the agreement reached by the DM-WG;
- The second foreseen draft is expected to be of such quality that it would only receive minor comments.

The release schedule must be made available on the Wiki. The group can decide to publish drafts more frequently. However, the minimal amount of time between two subsequent releases must be at least two weeks. This helps ensure that reviewers have sufficient time to review the draft and submit comments.

The frequency and timing of such publications is determined by the group. There should be a balance between showing that work is actively being carried out and bombarding the

stakeholders with too-frequent requests for comments. Typically, at least two working drafts should be made available.

The specification template (see Appendix C) provides guidance on the structure of the document.

## Tasks

**Process Step 9. (DM-WG chair) Publish drafts of the Domain Model as it evolves, seeking feedback from the RG on each occasion**

### 3.2.9 Review Working Draft(s) of Domain Model

Each published draft of the Domain Model is reviewed by the RG. Every draft includes the e-mail address of the mailing list of the RG to which comments should be sent. When comments are received, the editor creates an issue in the issue tracker for each comment within each e-mail. The resolution of each comment is discussed by the group, usually within a meeting, but it is sometimes more practical to deal with some comments through the group's mailing list.

The group must resolve each comment in one of three ways:

#### Accepted

This usually means that changes will be made that will be reflected in the next draft.

#### Rejected

No changes will be made to the draft.

#### Partially accepted

Some of the comment is accepted but other parts are rejected.

After consideration of the comment, the editor records the resolution and sends a response to the reviewer through the mailing list of the RG including the original comment, the resolution by the DM-WG and the justification for the resolution, particularly in case the comment is rejected.

## Tasks

**Process Step 10. (DM-WG) Process Comments. Consider comments received concerning the interim published drafts**

### 3.2.10 Issue Last Call Domain Model Working Draft

When the group concludes that consensus has been reached, it publishes a Last Call Working Draft and announces it through the mailing list of the RG, requesting feedback.

---

The chair of the group indicates that this draft is the Last Call Working Draft and that no additional draft will be published. The chair also communicates a deadline by which comments must be received. The Last Call period must be at least four weeks.

## Tasks

**Process Step 11. (DM-WG chair) Issue the Last Call Working Draft of the Domain Model and invite the RG to comment**

### 3.2.11 Review Last Call Domain Model Working Draft

There is no difference between the way a comment received on the Last Call Working Draft is handled and any of its predecessors.

If the comments received lead to substantive changes to the agreement, then the Last Call process must be repeated. If, however, the comments received lead to only trivial or editorial changes, a further call will not be necessary and the agreement can progress to the next stage.

## Tasks

**Process Step 12. (RG) Review Last Call Working Draft**

### 3.2.12 Publish Draft Domain Model

After the consideration and resolution of all comments received, the DM-WG chair submits the specification of the Domain Model to the AL who publishes it on the Wiki.

## Tasks

**Process Step 13. (DM-WG chair, AL) Publish Draft Domain Model**

### 3.2.13 Identify Data Entities for further specification

The AL and the DM-WG chair identify the Data Entities that need to be further specified, based on the published version of the Domain Model.

## Tasks

**Process Step 14. (AL, DM-WG chair) Identify Data Entities that need to be further specified**

### 3.2.14 Establish Data Entity Subgroups

For each of the Data Entities identified in Process Step 14, the AL sends out invitations to people who have expressed to be a member of one of the DESGs and fit the profile outlined in section 3.1.6, and asks them to sign the Contributor Agreement if they haven't already done so at an earlier stage.

## Tasks

**Process Step 15. (AL) Invite members of the DESGs, asking them to sign the Contributor Agreement**

As soon as the members of the DESGs have been selected, chairs and editors need to be appointed. The AL identifies the candidate chairs and editors and invites them, communicating the tasks that are associated with these roles. The description of those roles is contained in section 3.2.6.

## Tasks

**Process Step 16. (AL) Invite and appoint DESG chairs and editors**

### 3.2.15 Set up DESG work-plan

The AL and the DESG chairs establish a work-plan across all DESGs, determining whether DESGs can work in parallel or need to be done sequentially. This will depend on the availability of the experts, whether there is overlap between the members of the DESGs, and ultimately also on the overall timeline as set in the overall work-plan established in Process Step 1.

## Tasks

**Process Step 17. (AL, DESG chairs) Set up work-plan across all DESGs**

The next five steps (Process Step 18 through Process Step 22) need to be executed by each of the DESGs.

### 3.2.16 Draft Working Draft(s) of specification of Data Entity

Every DESG is responsible for developing the specification of one of the Data Entities. The description of this activity is identical to what is described for the DM-WG in section 3.2.8, replacing references to the “Domain Model” by “the specification of the Data Entity”, “DM-WG” by “DESG” and “Working Group” by “Subgroup”.

## Tasks

**Process Step 18. (DESG chair) Publish drafts of the specification of the Data Entity as it evolves, seeking feedback from the RG on each occasion**

### 3.2.17 Review Working Draft(s) of specification of Data Entity

The description of this activity is identical to what is described for the DM-WG in section 3.2.9, replacing references to the “Domain Model” by “the specification of the Data Entity”, “DM-WG” by “DESG” and “Working Group” by “Subgroup”.

## Tasks

**Process Step 19. (DESGs) Process Comments. Consider comments received concerning the interim published drafts**

### 3.2.18 Issue Last Call Working Draft of specification of Data Entity

The description of this activity is identical to what is described for the DM-WG in section 3.2.10, replacing references to the “Domain Model” by “the specification of the Data Entity”, “DM-WG” by “DESG” and “Working Group” by “Subgroup”.

## Tasks

**Process Step 20. (DESG chair) Issue the Last Call Working Draft of the specification of the Data Entity and invite the RG to comment**

### 3.2.19 Review Last Call Working Draft of specification of Data Entity

The description of this activity is identical to what is described for the DM-WG in section 3.2.11, replacing references to the “Domain Model” by “the specification of the Data Entity”, “DM-WG” by “DESG” and “Working Group” by “Subgroup”.

## Tasks

**Process Step 21. (RG) Review Last Call Working Draft**

### 3.2.20 Submit specification of Data Entity

After resolution of all comment, the DESG chair submits the specification of the Data Entity to the AL who published in on the Wiki.

## Tasks

**Process Step 22. (DESG chair, AL) Submit and publish the specification of the Data Entity**

### 3.2.21 Create Final Domain Model

After all specifications of the Data Entities identified in Process Step 14 have been completed, submitted and published, the DM-WG resumes its work to integrate the specifications of the Data Entities in the description of the final Domain Model which will form the totality of the semantic agreements.

## Tasks

**Process Step 23. (DM-WG) Integrate Data Entity specifications into the Domain Model and invite the RG to comment**

### 3.2.22 Review Final Domain Model

The description of this activity is identical to what is described for the DM-WG in section 3.2.11.

#### Tasks

**Process Step 24. (RG) Review final Domain Model**

### 3.2.23 Publish Final Domain Model

After resolution of all comments, the DM-WG chair submits the final Domain Model to the AL who publishes it for endorsement.

**Process Step 25. (DM-WG chair, AL) Publish final Domain Model**

### 3.2.24 Endorse Final Domain Model

The final stage in the process is to secure endorsement. The AL and Secretariat formally submit the final Domain Model to the EG, together with a report on the process that was followed in its development.

The EG discusses and endorses the semantic agreement. If the EG does not agree with the semantic agreement, it sends it back to the AL who may instruct the DM-WG or any of the DESGs to redo some or all of the process and submit a new proposed semantic agreement.

#### Tasks

**Process Step 26. (AL; Secretariat) Submit documents to the EG**

**Process Step 27. (EG) Consider and endorse the semantic agreements contained in the final Domain Model**

## 3.3 PERSISTENCE POLICY

The final "version 1.0" of any agreement must be stable. This means that it may not be edited ('the bytes are locked'). If necessary, the documentation can include a link to a separate errata document which can be edited.

The only change that can be made to the frozen document is when a new version is created and endorsed. In such case, a suitable notice should be added to the original agreement pointing to the new version which supersedes it.

### **3.3.1 Editorial changes only**

If minor editorial changes need to be made to the text of the agreement, such as correcting typographical errors or clarifying a model term without changing its meaning, then such changes can be recorded in the errata document.

### **3.3.2 Fundamental changes**

If, after publication of the agreement, fundamental problems or new requirements are identified, this entails a new version of the semantic agreement to be developed. The process defined in this document would therefore need to be followed again, up to and including endorsement, to create the new version.

---

## 4 METHODOLOGY

In this section, we set out the technical stages that an Activity must go through in its development of a semantic agreement.

The methodology has five phases:

1. First the DM-WG determines a set of Use Cases that describe the common services from several perspectives (service user, service provider, content contributor etc.), and derive the requirements that the Domain Model needs to support.
2. Based on those requirements, the DM-WG develops a (draft) Domain Model that addresses the top-level view of entities and relationships; the details of the specification of the attributes of the Data Entities are done in the third phase. The draft model is reviewed by the RG.
3. In the third phase, DESGs consider the attributes for the Data Entities in the draft Domain Model and the controlled vocabularies to be recommended. All Data Entity specifications are reviewed by the RG.
4. In the fourth phase, The DM-WG integrates the results of the DESGs into the Domain Model and checks the complete picture for consistency and overlaps. The final model is reviewed by the RG before submission to the EG for endorsement.
5. In the fifth and final phase, a conformance statement is developed.

All implementations may skip phase one if the use cases and requirements are already known before the start of the Activity. In line with the approach described in section 3.2, the basic implementation only involves phases 3 and 5.

This methodology proposes a 'meet-in-the-middle' approach<sup>9</sup>. In such an approach model elements emerge, on one hand, from the top-down perspective based on the requirements related to the shared services and, on the other hand, from the bottom-up view based on the local implementations.

It is important that discussions to come to a common view are focused on commonalities rather than on differences. As the participants are experienced and very familiar with their own implementations, they may be tempted to defend their approach against perceived attacks. Instead of concentrating on the specifics of the various existing implementations (thinking 'from-the-inside-out'), participants at this stage should take the objectives of the set of Use Cases as the leading perspective (thinking 'from-the-outside-in').

---

<sup>9</sup> Approach based on the article "A collaborative method for developing a semantic model for interlinking Cancer Chemoprevention linked data sources" by Dimitris Zeginis, Ali Hasnain, Nikolaos Loutas, Helena Futscher Deus, Ronan Fox, Konstantinos Tarabanis. <http://www.semantic-web-journal.net/sites/default/files/swj263.pdf>



Figure 3 summarises the different steps of the methodology to be followed and the stakeholder responsible for carrying out each step<sup>10</sup>. Likewise, Figure 4 illustrates the different steps of the methodology to be followed for developing the Data Entities and the controlled vocabularies.

The various steps in the five phases are described in more detail in the following sections.

---

<sup>10</sup> NB: when an activity spans across two swim lanes, this indicates that both actors are involved in the delivery of that activity.

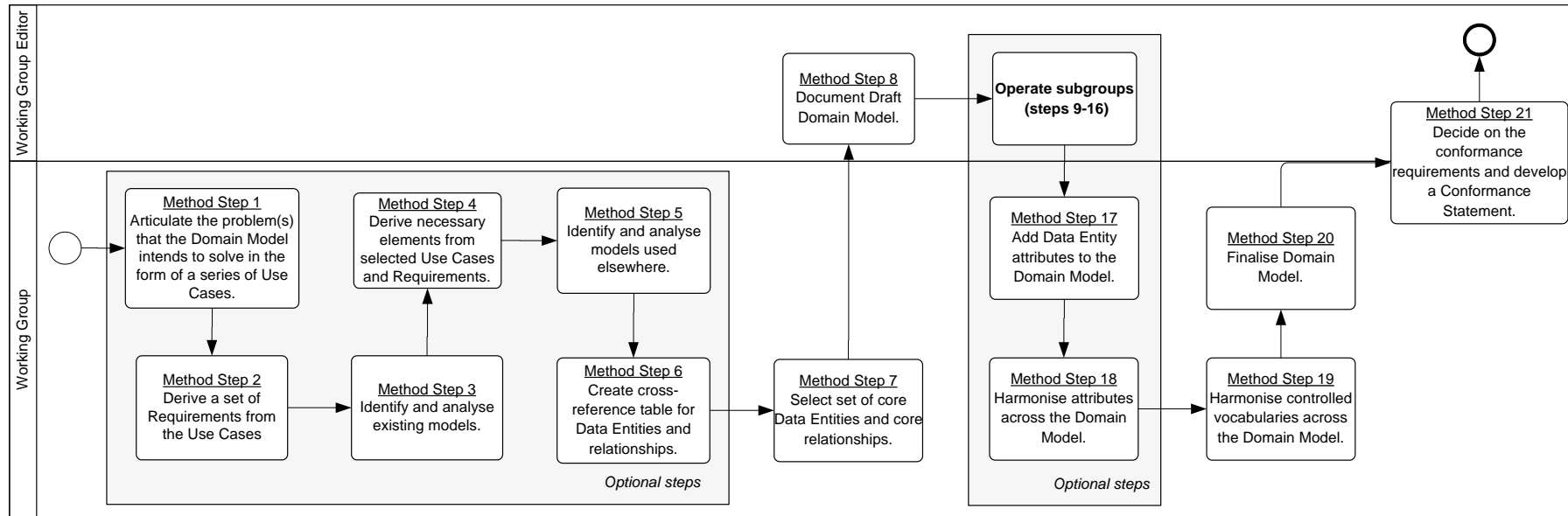


Figure 3 Overview of Domain Model methodology

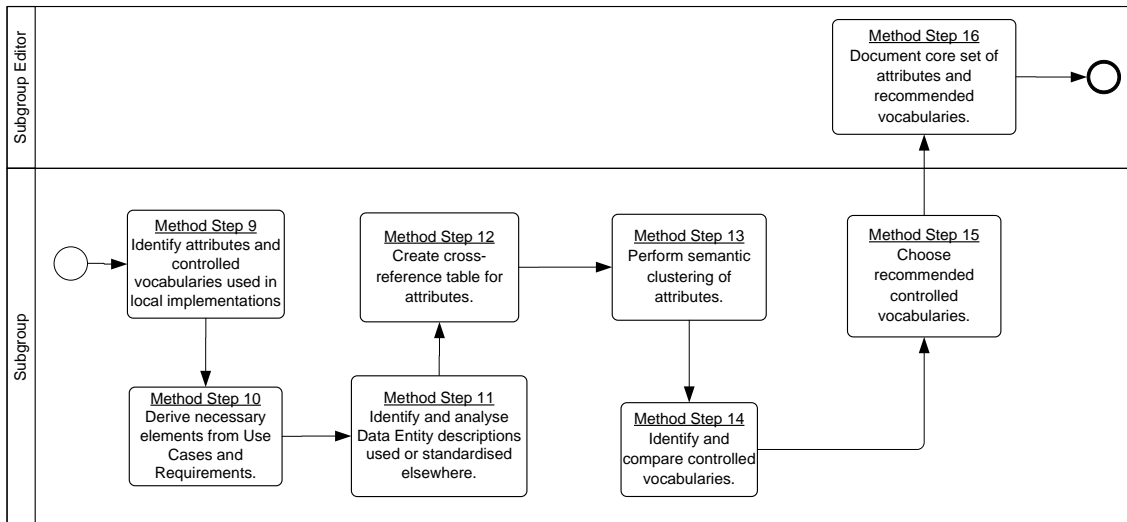


Figure 4 Overview of Data Entity methodology

## 4.1 PHASE ONE: DETERMINE USE CASES AND REQUIREMENTS

This phase is executed by the DM-WG. This phase can be skipped if use cases and requirements are already known ahead of the start of the Activity.

### 4.1.1 Use Cases

A series of Use Cases are articulated. These are written in prose and are typically of the form:

**Business need:** *Stakeholder group X needs to find, compare and exchange information in an electronic fashion and hereby requires a minimum level of semantic interoperability.*

**Usage scenario:** *Alice is trying to do X. She finds resources A, B, and C and wishes to combine them to get an overall picture. Noticing that they all involve a common set of data entities, she is able to match up the data.*

**Derived requirements:** *The following data entities, attributes and relationships need to be agreed on...*

These Use Cases are at the heart of the development of the Domain Model and Data Entities so they should be quite specific about what it is that the model will enable users to do that they currently cannot do. In other words, the Use Cases should set out the problem, or problems, that the model is expected to solve.

It is worth encouraging all members of the group to propose and formulate Use Cases and share those in the cooperative workspace. This improves the likelihood that each member's perspective is taken into account.

---

**Method Step 1. Articulate the problem(s) that the Domain Model intends to solve in the form of a series of Use Cases**

#### 4.1.2 Requirements

Once the Use Cases have been written and agreed, these should be reduced to a set of Requirements that the model must meet. In complex cases, it may be appropriate to assign a priority to each requirement using the familiar RFC2119<sup>11</sup> keywords of MUST, SHOULD and COULD. At the end of the process, it should be possible to match the final draft of the model against this list of requirements and ensure that they have indeed all been met.

The Use Cases and Requirements may be published as a separate document, or be integrated in the specification of the Domain Model and its Data Entities.

**Method Step 2. Derive a set of Requirements from the Use Cases**

## 4.2 PHASE TWO: DEVELOP DOMAIN MODEL

This phase is executed by the DM-WG. In the basic implementation this phase is skipped.

### 4.2.1 Identify and analyse existing models

Participants of the DM-WG describe the data entities and relationships that they have in their local implementation. The DM-WG decides the common format of those descriptions (e.g. as text, in tabular form or as UML<sup>12</sup> diagrams).

#### Tasks

**Method Step 3. Identify and analyse existing models**

### 4.2.2 Derive necessary elements from Use Cases and Requirements

From the description of Use Cases and Requirements a set of necessary elements (Data Entities and relationships) is identified. This task may be assigned to an ad-hoc task group of two or three people who report back to the DM-WG.

#### Tasks

**Method Step 4. Derive necessary elements from selected Use Cases and Requirements**

---

<sup>11</sup> <http://www.ietf.org/rfc/rfc2119.txt>

<sup>12</sup> <http://www.uml.org/>

### 4.2.3 Identify and analyse models used elsewhere

All DM-WG members may propose models to be included. The task of analysing the models may be assigned to an ad-hoc task group of two or three people who report back to the DM-WG. Special attention should be paid to open standards and models that can easily be reused by the Activity without imposing strict copyright conditions.

#### Tasks

##### Method Step 5. Identify and analyse models used elsewhere

### 4.2.4 Create cross-reference table for Data Entities and relationships

A comparison is done between elements derived from Use Cases and Requirements, related models and local implementations. The editor creates a table in Excel and makes initial assignments across data entities and relationships. The DM-WG discusses the assignments and works towards consensus.

Situations that may occur are:

- A local implementation uses a more general concept, e.g. Use Cases may consider different types of vessels (e.g. cruise ships and tankers) as separate entities, while a local implementation does not make that distinction.
- Local implementation uses a more specific concept, e.g. Use Cases may consider a single entity for all types of vessels, while a local entity distinguishes among different types of vessels.

Other issues could occur when relationships that are available in one local implementation do not exist in another, or when the specificity of relationships is different across implementations.

A common view across implementations needs to be found. This could mean that more specific views need to be simplified to more general views. If different implementations have different levels of specificity, the common view may be reached on a more general common denominator. Care should be taken that a balance is found between the capabilities of the various local implementations and the Requirements derived from the Use Cases.

These and other incompatibilities need to be considered when a set of core data entities and relationships is selected, always working towards 'meeting in the middle'. If necessary, an approach could be agreed to first handle the easier and less controversial data entities and relationships in the first draft of the model, and leave more complicated or controversial elements to a second draft, in order to enable early feedback from the RG that could help the further consensus process.

#### Tasks

##### Method Step 6. Create cross-reference table for Data Entities and relationships

#### 4.2.5 Select set of core data entities and core relationships

On one hand, the selected data entities and relationships need to satisfy the Requirements; on the other hand, the local implementations need to be able to provide the necessary information. Again, a balance needs to be found between the Requirements and the capabilities of the local implementations.

The chair proposes a common set of entities and relationships. The DM-WG discusses and works towards consensus. It may be necessary to select a subset for the first draft that consists of the 'low-hanging-fruit' and address the more controversial or complex entities and relationships for the second draft.

##### Tasks

**Method Step 7. Select set of core data entities and core relationships**

#### 4.2.6 Document Draft Domain Model

The model should be presented in the form of a UML diagram with description of data entities and relationships. The editor constructs the working draft based on the consensus in the DM-WG and prepares the document for review by the RG.

##### Tasks

**Method Step 8. Document Draft Domain Model**

### 4.3 PHASE THREE: SPECIFY DATA ENTITIES

This phase is executed by the DESGs.

#### 4.3.1 Identify attributes and controlled vocabularies used in the local implementations

Participants describe the attributes used in the description of the Data Entity in local implementation and indicate the controlled vocabularies that are used as values for each of the attributes.

##### Tasks

**Method Step 9. Identify attributes and controlled vocabularies used in local implementations**

#### 4.3.2 Derive necessary attributes from Use Cases and Requirements

Particular pieces of information about the Data Entity are necessary to support common functionality as outlined in the Use Cases and Requirements. This task may be assigned to an ad-hoc task group of two or three people who report back to the DESG.

## Tasks

**Method Step 10. Derive necessary attributes from the Use Cases and Requirements**

### 4.3.3 Identify and analyse Data Entity descriptions used or standardised elsewhere

There may be standards for the Data Entity under consideration, or other projects or services may have developed an attribute set for the same or similar Data Entities. All DESG members may propose candidates to be included.

The task of analysing the description approaches may be assigned to an ad-hoc task group of two or three people who report back to the DESG. Once again, special attention should be paid to open standards and models that can easily be reused by the Cooperation Project without imposing strict copyright conditions.

## Tasks

**Method Step 11. Identify and analyse Data Entity descriptions used or standardised elsewhere**

### 4.3.4 Create cross-reference table for attributes

The attributes of the Data Entity in the local implementations are compared with the attributes from the Use Cases and Requirements. The editor creates a table in Excel and makes initial assignments across attributes. The DESG discusses the assignments and works towards consensus.

## Tasks

**Method Step 12. Create cross-reference table for attributes**

### 4.3.5 Perform semantic clustering of attributes

Wherever attributes do not convey exactly the same information, 'semantic clusters' of similar attributes should be constructed to find a common, higher-level, and more general attribute to which the more specific attributes can be mapped. For example, if one implementation distinguishes between different dates related to a data entity (e.g. when an observation was made as opposed to when it was recorded) while another implementation does not, all attributes with dates will be clustered in a more general (less differentiated) date attribute.

The chair proposes a set of 'semantic clusters' and an initial mapping from local attributes to these clusters. The DESG discusses and works towards consensus. It may be necessary to select a subset for the first draft that consists of the 'low-hanging-fruit' and address the more controversial or complex attributes for the second draft.

## Tasks

**Method Step 13. Perform semantic clustering of attributes**

### 4.3.6 Identify and compare controlled vocabularies

Once a core set of common attributes has been agreed, the set of controlled vocabularies for those attributes need to be analysed. The editor creates a table with the common attributes along one dimension and the local implementation along the other dimension, placing the controlled vocabularies used in the cells.

## Tasks

**Method Step 14. Identify and compare controlled vocabularies**

### 4.3.7 Choose recommended controlled vocabularies

Based on the table of controlled vocabularies, the DESG discusses which controlled vocabularies are the most appropriate to be recommended. This may be based on the status of particular vocabularies (e.g. if they are based on an international standard) or on their usage across multiple implementations. The DESG may also consider how difficult it will be to map local vocabularies to the recommended ones.

Issues that may occur are:

- Some implementations may use controlled vocabularies for attributes where other implementations allow free text to be entered. In such cases, it may be necessary for implementations with free text to investigate possibilities to create a controlled vocabulary from the free text through a process of term clustering similar to the approach proposed for attributes in section 4.3.5, and to consider upgrading their system in the future.
- Different implementations may use different, but equally standardised or widely used vocabularies. In such cases, the group could decide to recommend the use of more than one controlled vocabulary, but at the same time provide a mapping table between the vocabularies.

Solutions to any issues should aim for using standardised or widely used vocabularies as much as possible, but at the same time should be mindful of the cost of mapping existing local vocabularies to the recommended ones.

## Tasks

**Method Step 15. Choose recommended controlled vocabularies**



#### 4.3.8 Document core set of attributes and recommended vocabularies

The editor constructs the working draft based on the consensus in the DESG and prepares the document for review by the RG.

##### Tasks

Method Step 16. Document core set of attributes and recommended vocabularies

### 4.4 PHASE FOUR: INTEGRATE DATA ENTITIES INTO DOMAIN MODEL

This phase is again executed by the DM-WG. In the basic implementation this phase is skipped.

#### 4.4.1 Add Data Entity attributes to the Domain Model

The attributes defined in the specifications of the Data Entities are included in the Data Entities in the Domain Model. The editor copies the attributes into the UML diagram and the textual description. The DM-WG discusses the overall diagram, referring back to the Use Cases and Requirements, and identifies if there are any overlaps or gaps.

##### Tasks

Method Step 17. Add Data Entity attributes to the Domain Model

#### 4.4.2 Harmonise attributes across the Domain Model

The DM-WG checks the consistency of the Data Entity specifications across the Domain Model and may propose changes to the attribute sets, for example to harmonise the names and definitions across Data Entities or solve inconsistencies. The DM-WG consults with the DESG that was responsible for the Data Entity that is affected before finalising the model.

##### Tasks

Method Step 18. Harmonise attributes across the Domain Model

#### 4.4.3 Harmonise controlled vocabularies across the Domain Model

The DM-WG considers all controlled vocabularies recommended by the various DESGs and identifies any overlaps or gaps. The DM-WG may propose changes to the recommendations, for example if different controlled vocabularies have been recommended for identical or similar attributes. The DM-WG consults with the DESGs that were responsible for the Data Entities that are affected before finalising the recommendations.

##### Tasks

Method Step 19. Harmonise controlled vocabularies across the Domain Model

#### 4.4.4 Finalise Domain Model

The complete model is expressed as an UML diagram with textual description of the Data Entities, relationships, attributes and controlled vocabularies. The editor constructs the final Domain Model document and prepares it for review by the Review Group.

#### Tasks

**Method Step 20. Finalise Domain Model**

### 4.5 PHASE FIVE: SPECIFY CONFORMANCE CRITERIA

The DM-WG must agree on the conformance requirements. The editor then includes a conformance statement into the Domain Model. That is, a statement that says what an implementation must do in order to be considered conformant with the model.

Examples are:

*A conformant implementation of this model MUST understand all model terms defined in this document.*

It is possible that the model has natural divisions so that it might be appropriate to set different conformance levels. For example, a model used to describe vehicles may have a group of terms related specifically to motor vehicles that could be used in an implementation that had no need to understand the terms that relate to bicycles and scooters. In such a situation there might be different levels of conformance:

*A level M conformant implementation of this model MUST understand the following terms: Lorry, van, car...*

*A level B conformant implementation of this model MUST understand the following terms: bicycle, scooter...*

*A fully conformant implementation of this model MUST understand all model terms defined in this document.*

#### Tasks

**Method Step 21. Decide on the conformance requirements and develop a Conformance Statement**

## 5 IMPLEMENTATION

The Domain Model or, in the case of a basic implementation, the Data Entity agreed in the previous steps is the end result of the development phase of the semantic agreements. The Model or Entity may be implemented in three variants that contain the same information in different formats:

1. A human-readable version in HTML
2. An XML schema
3. An RDF schema

The following sections provide basic information related to each of those variants.

### 5.1 HTML

In this variant, the Domain Model or Data Entity is described for a human audience. It should contain the text of the Domain Model or Data Entity as endorsed by the EG. See Appendix D for a template for the HTML specification.

### 5.2 XML

For XML<sup>13</sup> implementations, an XML Schema<sup>14</sup> should be provided. The XML approach may be based on the UN/CEFACT Core Components Library<sup>15</sup>.

### 5.3 RDF

For RDF<sup>16</sup> implementations both a namespace document and associated RDF schema<sup>17</sup> will be provided. An example of a namespace document is the one that was the result of the work on the Asset Description Metadata Schema (ADMS)<sup>18</sup>. An RDF schema should as much as possible, re-use existing, standardised, widely used and well-maintained RDF vocabularies such as FOAF<sup>19</sup>, DCMI Metadata Terms<sup>20</sup>, DCAT<sup>21</sup>, the eGovernment Core Vocabularies, ADMS, RADion<sup>22</sup> and others. A list of such vocabularies is available from Linked Open Vocabularies (LOV)<sup>23</sup>. A list of reusable semantic assets is also available through the ADMS-based federation of semantic asset repositories on Joinup<sup>24</sup>.

---

<sup>13</sup> <http://www.w3.org/XML/>

<sup>14</sup> <http://www.w3.org/XML/Schema.html>

<sup>15</sup> [http://www.unece.org/cefact/codesfortrade/unccl/ccl\\_index.html](http://www.unece.org/cefact/codesfortrade/unccl/ccl_index.html)

<sup>16</sup> <http://www.w3.org/RDF/>

<sup>17</sup> <http://www.w3.org/TR/rdf-schema/>

<sup>18</sup> <http://www.w3.org/ns/adms#>

<sup>19</sup> <http://xmlns.com/foaf/spec/>

<sup>20</sup> <http://dublincore.org/documents/dcmi-terms/>

<sup>21</sup> <http://www.w3.org/TR/vocab-dcat/>

<sup>22</sup> <http://www.w3.org/ns/radion>

<sup>23</sup> <http://lov.okfn.org/dataset/lov/>

<sup>24</sup> <http://joinup.ec.europa.eu/asset/all>

---

## APPENDIX A REFERENCES

**Action 1.1.** Improving semantic interoperability in European eGovernment systems.

[http://ec.europa.eu/isa/actions/01-trusted-information-exchange/1-1action\\_en.htm](http://ec.europa.eu/isa/actions/01-trusted-information-exchange/1-1action_en.htm)

**ADMS.** Asset Description Metadata Schema. Namespace Document.

<http://www.w3.org/ns/adms#>

**ADMS-based federation of semantic asset repositories on Joinup.** Activity under Action 1.1 of the ISA Programme. <http://joinup.ec.europa.eu/asset/all>

**CISE.** Common Information Sharing Environment for the EU Maritime Domain.

[http://ec.europa.eu/maritimeaffairs/policy/integrated\\_maritime\\_surveillance/index\\_en.htm](http://ec.europa.eu/maritimeaffairs/policy/integrated_maritime_surveillance/index_en.htm)

**Creative Commons Attribution licence.** Licence that allows sharing, remixing and commercial use of the resource published under this licence. <http://creativecommons.org/licenses/by/3.0/>

**DCAT. Data Catalogue Vocabulary.** <http://www.w3.org/TR/vocab-dcat/>

**DCMI Metadata Terms.** <http://dublincore.org/documents/dcmi-terms/>

**FOAF. Friend Of A Friend.** <http://xmlns.com/foaf/spec/>

**ISA Open Metadata Licence v1.1.** <https://joinup.ec.europa.eu/category/licence/isa-open-metadata-licence-v11>

**ISA Programme.** Interoperability Solutions for European Public Administrations.

<http://ec.europa.eu/isa/>

**Linked Open Vocabularies (LOV).** <http://lov.okfn.org/dataset/lov/>

**Meet-in-the-middle approach.** Approach based on the article “A collaborative method for developing a semantic model for interlinking Cancer Chemoprevention linked data sources” by Dimitris Zeginis, Ali Hasnain, Nikolaos Loutas, Helena Futscher Deus, Ronan Fox, Konstantinos Tarabanis. <http://www.semantic-web-journal.net/sites/default/files/swj263.pdf>

**Process and Methodology for Developing Core Vocabularies.**

<http://joinup.ec.europa.eu/elibrary/document/isa-deliverable-process-and-methodology-developing-core-vocabularies>

**RADion.** Repository Asset Distribution. <http://www.w3.org/ns/radion>

**RDF. Resource Description Framework.** <http://www.w3.org/RDF/>

**RDF Schema. RDF Vocabulary Description Language 1.0.** <http://www.w3.org/TR/rdf-schema/>

**RFC2119.** Key words for use in RFCs to Indicate Requirement Levels.

<http://www.ietf.org/rfc/rfc2119.txt>

**UML.** Unified Modeling Language. <http://www.uml.org/>

**UN/CEFACT Core Component Library.**

[http://www.unece.org/cefact/codesfortrade/uncl/ccl\\_index.html](http://www.unece.org/cefact/codesfortrade/uncl/ccl_index.html)

**XML. Extensible Markup Language.** <http://www.w3.org/XML/>

**XML Schema.** <http://www.w3.org/XML/Schema.html>

## APPENDIX B TERMINOLOGY AND GLOSSARY

**Activity.** The totality of the work to be done in establishing the semantic agreements. This could be a project in itself or a work package in a larger project.

**Attribute.** A characteristic of a data entity in a particular dimension such as the weight of an object, the name of an organisation or the date and time that an observation was made.

**Authority.** The organisation or group that has overall responsibility for the Activity. Examples are a Board of Directors of a company, a Steering Committee of a collaborative project, or a funding agency.

**Community.** The wide group of stakeholders beyond the Members of the Activity that have an interest in the semantic agreements that the Activity develops.

**Contributor Agreement.** A formal document, signed by contributors, that outlines the rights and obligations of the contributor, in particular stating that the contributions to the result of the work can be included in the public deliverable under the public licence specified in the agreement.

**Controlled Vocabulary.** A set of terms (keywords, codes or references) that are used as values for metadata attributes.

**Data Entity.** A 'thing', such as a vessel, a geographic location, a sensor, a map or something more abstract like an incident, an event or an observation.

**Domain Model.** A simplified, reusable, and extensible data model based on generalisation of more specific data models. The shared model can be used as a mapping target from more complex and specific models in order to enable meaningful exchange of data to support common services.

**Member.** An organisation that is formally involved in the Activity. Examples are departments in a company, companies that have a cooperation agreement or partners in a collaborative project.

**Relationship.** A link between two concepts; examples are the link between an observation and the sensor that produced it, the link between a document and the organisation that published it, or the link between a map and the geographic region it depicts.

**Semantic agreement.** Consensus among a group of co-operation partners on the model and data entities that support common services. Apart from the typology of the data entities, the consensus also covers the characteristics of the data entities as expressed in metadata and the use of common controlled vocabularies.

---

## APPENDIX C ISA CONTRIBUTOR AGREEMENT V1.1

This agreement is based on the Harmony contributor agreements [harmonyagreements.org](https://harmonyagreements.org)

Thank you for your interest in contributing to the project “[Project name]” currently developed on the collaborative platform “[Platform name]” and owned by the European Union (the “Project Owner”, hereafter “We” or “Us”).

This contributor agreement (“Agreement”) documents the rights granted by contributors to Us. To make this document effective, please sign it and send it to Us by mail, email, fax, or electronic submission, following the instructions published on the [Platform name]. This is a legally binding document, so please read it carefully before agreeing to it. The Agreement may cover more than one project managed by Us.

### 1. Definitions

“You” (Individual) means the individual who Submits a Contribution to Us.

“You” (Entity) means any Legal Entity on behalf of whom a Contribution has been received by Us. “Legal Entity” means an entity which is not a natural person. “Affiliates” means other Legal Entities that control, are controlled by, or under common control with that Legal Entity. For the purposes of this definition, “control” means (i) the power, direct or indirect, to cause the direction or management of such Legal Entity, whether by contract or otherwise, (ii) ownership of fifty percent (50%) or more of the outstanding shares or securities which vote to elect the management or other persons who direct such Legal Entity or (iii) beneficial ownership of such entity.

“Contribution” means any work of authorship that is Submitted by You to Us in which You own or assert ownership rights including, but not limited to Copyright. If You do not fully own the entire work of authorship, please ensure that a paper copy of this Agreement is signed by all relevant copyright holders.

“Copyright” means all rights protecting works of authorship owned or controlled by You [or Your Affiliates], including copyright, moral and neighbouring rights, as appropriate, for the full term of their existence including any extensions by You.

“Work” means the work of authorship which is made available by Us to third parties. When this Agreement covers more than one project, the Work means the work of authorship to which the Contribution was Submitted. After You Submit your Contribution, it may be included in the Work.

“Submit” means any form of electronic, verbal, or written communication sent to Us or our representatives, including but not limited to electronic mails, attachments, lists, source code

control systems, and issue tracking systems that are managed by, or on behalf of, Us for the purpose of discussing and improving the Work, but excluding communication that is conspicuously marked or otherwise designated in writing by You as "Not a Contribution."

"Submission Date" means the date on which You Submit a Contribution to Us.

"Effective Date" means the date You execute this Agreement or the date You first Submit a Contribution to Us, whichever is earlier.

"Media" means any Contribution or portion of a Contribution which is not software: data, metadata, data bases, documents, manuals, images, video, etc.

## **2. Grant of Rights**

### *2.1 Copyright Assignment*

(a) At the time the Contribution is Submitted, You irrevocably assign to Us all right, title, and interest worldwide in all Copyright covering the Contribution; provided that this transfer is conditioned upon compliance with Section 2.3. In particular, You agree to transfer the following rights:

- the right to use and to re-use in a whole or in part;
- the right to modify, including the right to translate and to re-write in a different form;
- the rights to licence and sub-licence any of the rights herein;
- the right to distribute copies and cause the distribution;
- the right to display publicly;
- the right to communicate to the public by telecommunication, by electronic publication, by press information services, by downloadable and non-downloadable files, by communication with computer terminals; by sending of telegrams, messages and wire service, by electronic and non-electronic publications;
- the right to reproduce by any mean including paper, digital, electronic or non-electronic format;
- the right to integrate and incorporate into any existing or future Work;
- the right to transfer to another environment (hardware, software, computer electronic, Web, multimedia or other);
- the right to make improvements and derivative works;
- the right to store;
- the right to licence the above-mentioned rights.

(b) To the extent that any of the rights in Section 2.1(a) cannot be assigned by You to Us, You grant to Us a perpetual, worldwide, exclusive, royalty-free, transferable, irrevocable licence under such non-assigned rights, with rights to sublicense through multiple tiers of sub licensees, to practice such non-assigned rights, including, but not limited to, the right to reproduce, modify, display, perform and distribute the Contribution; provided that this licence is conditioned upon compliance with Section 2.3.

(c) To the extent that any of the rights in Section 2.1(a) can neither be assigned nor licensed by You to Us, You irrevocably waive and agree never to assert such rights against Us, any of our successors in interest, or any of our licensees, either direct or indirect; provided that this agreement not to assert is conditioned upon compliance with Section 2.3.

(d) Upon such transfer of rights to Us, to the maximum extent possible, We immediately grant to You a perpetual, worldwide, non-exclusive, royalty-free, transferable, irrevocable licence under such rights covering the Contribution, with rights to sublicense through multiple tiers of sub licensees, to reproduce, modify, display, perform, and distribute the Contribution. The intention of the parties is that this licence will be as broad as possible and to provide You with rights as similar as possible to the owner of the rights that You transferred. This licence back is limited to the Contribution and does not provide any rights to the Work, which shall be subject to the outbound licence(s) as provided in Section 2.3.

## *2.2 Patent Licence*

For patent claims including, without limitation, method, process, and apparatus claims which You [or Your Affiliates] own, control or have the right to grant, now or in the future, You grant to Us a perpetual, worldwide, non-exclusive, transferable, royalty-free, irrevocable patent licence, with the right to sublicense these rights to multiple tiers of sub licensees, to make, have made, use, sell, offer for sale, import and otherwise transfer the Contribution and the Contribution in combination with the Work (and portions of such combination). This licence is granted only to the extent that the exercise of the licensed rights infringes such patent claims; and provided that this licence is conditioned upon compliance with Section 2.3.

## *2.3 Outbound Licence(s)*

As a condition on the grant of rights in Sections 2.1 and 2.2, We agree to license the Contribution under the terms of the following initial licences (including any right to adopt any future version of these licences):

To the extent the Work includes software (source code or binaries):

- The EUPL v1.1 or later
- To the extent the Work includes Media:
- The ISA Open Metadata Licence v1.1 or later

Without prejudice to the former conditions - and for the exclusive purpose of ensuring copyleft compatibility, We may licence the Contribution under any licences which are approved by the Open Source Initiative, or the Free Software Foundation, or Creative Commons or equivalent non-proprietary licences published by the European Commission on or after the Effective Date, including both permissive and copyleft licences, whether or not such licences are subsequently disapproved by relevant organisations (including any right to adopt any future version of these licences).





#### *2.4 Moral Rights.*

If moral rights apply to the Contribution, to the maximum extent permitted by law, You waive and agree not to assert such moral rights against Us or our successors in interest, or any of our licensees, either direct or indirect.

#### *2.5 Our Rights.*

You acknowledge that We are not obligated to use Your Contribution as part of the Work and may decide to include any Contribution We consider appropriate.

#### *2.6 Reservation of Rights.*

Any rights not expressly assigned or licensed under this section are expressly reserved by You.

### **3. Agreement**

You confirm that:

- (a) You have the legal authority to enter into this Agreement.
- (b) You [or Your Affiliates] own the Copyright and any other proprietary rights in the Contribution, including patent claims where applicable, which are required to transfer or grant the rights as provided under Section 2.
- (c)(Individual) The grant of rights under Section 2 does not violate any grant of rights which You have made to third parties, including Your employer. If You are an employee or official, You have had Your employer approve this Agreement or sign the Entity version of this document. If You are less than eighteen years old, please have Your parents or guardian sign the Agreement on your behalf.
- (c)(Entity) The grant of rights under Section 2 does not violate any grant of rights which You or Your Affiliates have made to third parties.
- (d) You communicated to Us a paper copy of this Agreement, signed by all relevant copyright holders, if You do not own the Copyright in the entire work of authorship Submitted.

### **4. Disclaimer**

EXCEPT FOR THE EXPRESS WARRANTIES IN SECTION 3, THE CONTRIBUTION IS PROVIDED "AS IS". MORE PARTICULARLY, ALL EXPRESS OR IMPLIED WARRANTIES INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NON-INFRINGEMENT ARE EXPRESSLY DISCLAIMED BY YOU TO US [AND BY US TO YOU]. TO THE EXTENT THAT ANY SUCH WARRANTIES CANNOT BE DISCLAIMED, SUCH WARRANTY IS LIMITED IN DURATION TO THE MINIMUM PERIOD PERMITTED BY LAW.

## 5. Consequential Damage Waiver

TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, IN NO EVENT WILL YOU [OR US] BE LIABLE FOR ANY LOSS OF PROFITS, LOSS OF ANTICIPATED SAVINGS, LOSS OF DATA, INDIRECT, SPECIAL, INCIDENTAL, CONSEQUENTIAL AND EXEMPLARY DAMAGES ARISING OUT OF THIS AGREEMENT REGARDLESS OF THE LEGAL OR EQUITABLE THEORY (CONTRACT, TORT OR OTHERWISE) UPON WHICH THE CLAIM IS BASED.

## 6. Miscellaneous

6.1 This Agreement will be governed by and construed in accordance with the laws of the jurisdiction in which the Project Owner has its principal place of business.

Any litigation resulting from the interpretation of this Agreement, arising between the European Commission, as the project owner, and any Contributor, will be subject to the jurisdiction of the Court of Justice of the European Communities, as laid down in article 238 of the Treaty establishing the European Community. Any litigation arising between Parties, other than the European Commission, and resulting from the interpretation of this Agreement, will be subject to the exclusive jurisdiction of the competent court where the Project Owner resides or conducts its primary business.

6.2 This Agreement sets out the entire agreement between You and Us for Your Contributions to Us and overrides all other agreements or understandings.

6.3 If You or We assign the rights or obligations received through this Agreement to a third party, as a condition of the assignment, that third party must agree in writing to abide by all the rights and obligations in the Agreement.

6.4 The failure of either party to require performance by the other party of any provision of this Agreement in one situation shall not affect the right of a party to require such performance at any time in the future. A waiver of performance under a provision in one situation shall not be considered a waiver of the performance of the provision in the future or a waiver of the provision in its entirety.

6.5 If any provision of this Agreement is found void and unenforceable, such provision will be replaced to the extent possible with a provision that comes closest to the meaning of the original provision and which is enforceable. The terms and conditions set forth in this Agreement shall apply notwithstanding any failure of essential purpose of this Agreement or any limited remedy to the maximum extent possible under law.



---

Us – the electronic acceptance process of this Agreement, implemented on the [Joinup](#) site, is considered as our valid signature.

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

You (Individual) – the electronic acceptance process of this Agreement, implemented on the [Joinup](#) site, is considered as your valid signature.

Name: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

You (Legal Entity or Employer, or any other relevant copyright holder if applicable) – In such case, only a paper copy of this agreement, signed by all relevant stakeholders' legitimate representatives, will be considered as a valid commitment. Please repeat the signature below for all copyright holders.

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

---

## APPENDIX D SPECIFICATION TEMPLATE

A template is available to aid the development of the HTML document. It is similar in style and layout to specification documents produced by other organisations, notably the W3C, and therefore will be familiar to many members of the target audience. The sections of the template are as follows.

### TITLE AND VERSION CONTROL

- The title of the model. This may, but is not expected to, change throughout the development process.
- A subtitle that gives the type of document (working draft, final draft or, when published in its stable form, the version number, typically "1.0").
- Identifiers and links to the current, latest and previous versions (see section 0).
- Links to the XML and RDF representations of the model. These do not need to be created until the Final Draft is to be published so that earlier working drafts need not include these links.
- The name(s) of the editor(s).
- The copyright notice.

### ABSTRACT

The abstract should give a busy reader an immediate overview of what the document covers.

### STATUS OF DOCUMENT

The template provides wording appropriate for different stages in the development and publication of the model. Text wrapped in multiple @@@ symbols must be edited before publication (and the @@@ symbols removed). The group's editor should delete or comment out the unwanted sections for each publication such that the text will be broadly as set out below for each version. Groups are encouraged to add extra text to the status section if it aids clarity. For example, the group may be seeking feedback on a particular aspect of the model.

#### Early Working Drafts

*This section describes the status of this document at the time of its publication. Other documents may supersede it.*

This document was produced by the @@@Name of group@@@, following the process and methodology described in the Report on reaching semantic agreements.

Publication as a Working Draft does not imply endorsement by @@@the EG@@@ or its representatives. This is a draft document and may be updated, replaced or made obsolete by other documents at any time. It is inappropriate to cite this document as other than work in progress. The group will seek further endorsement by the @@@ the EG @@@.

Comments on the model are invited via the public mailing [link](#) to the Review Group mailing list with [archive](#) in the Subject line.

### **Last Call Working Draft**

*This section describes the status of this document at the time of its publication. Other documents may supersede it.*

This document was produced by the [Name of group](#), following the process and methodology described in the Report on reaching semantic agreements.

Publication as a Last Call Working Draft does not imply endorsement by [the EG](#) or its representatives. This is a draft document and may be updated, replaced or made obsolete by other documents at any time. It is inappropriate to cite this document as other than work in progress. The Subgroup will seek further endorsement by the [the EG](#).

This is the Last Call Working Draft of the model. Comments are sought via the public mailing [link](#) to the Review Group mailing list with [archive](#) in the Subject line by [Date](#).

### **Final Draft**

*This section describes the status of this document at the time of its publication. Other documents may supersede it.*

This document was produced by the [Name of group](#), following the process and methodology described in the Report on reaching semantic agreements.

This document has been reviewed by the Review Group. Publication of this Final Draft does not imply endorsement by the [the EG](#) or its representatives. This is a draft document and may be updated, replaced or made obsolete by other documents at any time. It is inappropriate to cite this document as other than work in progress. The Subgroup will seek further endorsement by the [the EG](#).

Comments on the model are invited via the public mailing [link](#) to the Review Group mailing list with [archive](#) in the Subject line.

### **Final Published Version**

*This section describes the status of this document at the time of its publication. Other documents may supersede it.*

This document was produced by the [Name of group](#), following the process and methodology described in the Report on reaching semantic agreements.

This document has been endorsed by @@@the EG@@@ . It is a stable document and may be used as reference material or cited from another document.

## **THE BODY OF THE DOCUMENT**

The remainder of the document is self-explanatory. Subgroups may include additional sections and sub-sections: the template is provided as an aid, not a limit. Subgroups may wish to include a Change Log at the end of the document but this is not mandatory.

## **HTML/CSS**

The template is written as a polyglot HTML document [PG]. Use of this particular mark-up is not mandatory: acceptable alternatives are XHTML Transitional (1.0 or 1.1) or HTML5. If using either HTML5 or the polyglot mark-up, the HTML5 'shim' must be included as in the template for backwards compatibility with older browsers.

The style sheet is derived from that used on the joinup.eu platform. Additional styles may be added, perhaps to highlight issues and questions during the document development process, but these must not override styles in the style sheet provided. Therefore, styles should be declared at document level above the link to the `base_semic_spec_style.css` style sheet.

## APPENDIX E SUMMARY OF PROCESS STEPS

Process Step 1.	(AL) Set up overall work-plan for the development, the review and the endorsement of the semantic agreements.....	12
Process Step 2.	(AL) Establish a working environment and culture .....	14
Process Step 3.	(AL, Secretariat) Identify potential candidate experts and invite them to be involved in the development or review of the semantic agreements .....	14
Process Step 4.	(AL) Select Open Licence for publication, establish Contributor Licence ...	15
Process Step 5.	(AL) Invite members of the Review Group, asking them to sign the Contributor Agreement.....	15
Process Step 6.	(AL) Invite members of the DM-WG, asking them to sign the Contributor Agreement	16
Process Step 7.	(AL) Invite and appoint DM-WG chair and editor .....	16
Process Step 8.	(AL, DM-WG chair) Set up work-plan for the DM-WG .....	17
Process Step 9.	(DM-WG chair) Publish drafts of the Domain Model as it evolves, seeking feedback from the RG on each occasion.....	18
Process Step 10.	(DM-WG) Process Comments. Consider comments received concerning the interim published drafts .....	18
Process Step 11.	(DM-WG chair) Issue the Last Call Working Draft of the Domain Model and invite the RG to comment.....	19
Process Step 12.	(RG) Review Last Call Working Draft.....	19
Process Step 13.	(DM-WG chair, AL) Publish Draft Domain Model .....	19
Process Step 14.	(AL, DM-WG chair) Identify Data Entities that need to be further specified	19
Process Step 15.	(AL) Invite members of the DESGs, asking them to sign the Contributor Agreement	20
Process Step 16.	(AL) Invite and appoint DESG chairs and editors.....	20
Process Step 17.	(AL, DESG chairs) Set up work-plan across all DESGs .....	20
Process Step 18.	(DESG chair) Publish drafts of the specification of the Data Entity as it evolves, seeking feedback from the RG on each occasion .....	20
Process Step 19.	(DESGs) Process Comments. Consider comments received concerning the interim published drafts .....	21
Process Step 20.	(DESG chair) Issue the Last Call Working Draft of the specification of the Data Entity and invite the RG to comment.....	21
Process Step 21.	(RG) Review Last Call Working Draft.....	21
Process Step 22.	(DESG chair, AL) Submit and publish the specification of the Data Entity .	21
Process Step 23.	(DM-WG) Integrate Data Entity specifications into the Domain Model and invite the RG to comment.....	21
Process Step 24.	(RG) Review final Domain Model .....	22
Process Step 25.	(DM-WG chair, AL) Publish final Domain Model .....	22
Process Step 26.	(AL; Secretariat) Submit documents to the EG .....	22
Process Step 27.	(EG) Consider and endorse the semantic agreements contained in the final Domain Model	22

## APPENDIX F SUMMARY OF METHOD STEPS

Method Step 1.	Articulate the problem(s) that the Domain Model intends to solve in the form of a series of Use Cases .....	28
Method Step 2.	Derive a set of Requirements from the Use Cases .....	28
Method Step 3.	Identify and analyse existing models.....	28
Method Step 4.	Derive necessary elements from selected Use Cases and Requirements .	28
Method Step 5.	Identify and analyse models used elsewhere.....	29
Method Step 6.	Create cross-reference table for Data Entities and relationships.....	29
Method Step 7.	Select set of core data entities and core relationships .....	30
Method Step 8.	Document Draft Domain Model .....	30
Method Step 9.	Identify attributes and controlled vocabularies used in local implementations	30
Method Step 10.	Derive necessary attributes from the Use Cases and Requirements .....	31
Method Step 11.	Identify and analyse Data Entity descriptions used or standardised elsewhere	31
Method Step 12.	Create cross-reference table for attributes .....	31
Method Step 13.	Perform semantic clustering of attributes .....	32
Method Step 14.	Identify and compare controlled vocabularies .....	32
Method Step 15.	Choose recommended controlled vocabularies .....	32
Method Step 16.	Document core set of attributes and recommended vocabularies .....	33
Method Step 17.	Add Data Entity attributes to the Domain Model .....	33
Method Step 18.	Harmonise attributes across the Domain Model .....	33
Method Step 19.	Harmonise controlled vocabularies across the Domain Model .....	33
Method Step 20.	Finalise Domain Model .....	34
Method Step 21.	Decide on the conformance requirements and develop a Conformance Statement	34