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1 IMM Guideline

This report provides the guideline & definitions for using the Interoperability Maturity Model (IMM) for assessing and improving the interoperability maturity of a public service. First, we provide an introduction to the most important definitions in the context of the IMM. Then, we present the objectives of IMM, the defined maturity levels and the areas of interoperability and interoperability attributes that are the subject of observation of IMM. The first chapter is concluded with an explanation of the structure of the IMM questionnaire and the method how the maturity level is determined. The second chapter provides an overview of all the definitions used in the IMM.

1.1 Two important definitions

The following two definitions are important to understand before the model is explained:

- **Public service** – public services are economic activities that public authorities identify as being of particular importance to citizens (A2C), businesses (A2B) and public administrations (A2A) and that would not be supplied (or would be supplied under different conditions) if there were no public intervention;

- **Interoperability** – the ability of disparate and diverse organisations to interact towards mutually beneficial and agreed common goals, involving the sharing of information and knowledge between the organisations, through the business processes they support, by means of the exchange of data between their respective IT systems.\(^1\)

1.1.1 Public service

From a conceptual point of view, a public service starts with a trigger, follows a number of steps and delivers an outcome towards an end user. The outcome may, but must not necessarily, be a public decision (e.g. issuing of a license involves a decision; whilst communicating the results of a job search does not). This conceptual model of public services is illustrated in Figure 1.

For illustration purposes, the conceptual model is applied to the public service “Income Tax Declaration”. In simple terms:

- The service’s process trigger is “the new fiscal year”.
- The main process steps it comprises are:
  - Collect information;
  - Let citizen validate information;
  - Check declaration;
- The outcome is the public decision on the amount of income tax which is due.

The following three design rules apply when defining a public service:

1. The public service has a single service outcome / public decision. When multiple service outcomes are recognized, multiple public services will need to be defined;
2. The public service has a single service ownership (the public administration responsible for the service). When the ownership of a service is distributed amongst multiple public administrations (e.g. multiple local administrations providing birth certificates), each service owner needs to conduct a separate assessment for his service;
3. The public service has a primary end user group. Service can be delivered towards three types of end users: citizens, business and other public administrations. In case the same kind of public service has to be delivered to different types of end-user, multiple public services should be assessed, one for each type of end user.

Examples of proper defined public services are (note that the numbers refer to the three design rules above):

- Citizens (3) are offered the service to access their Electronic Health Record (1) via the eHealth portal of the Danish Sunhed (2);
- Businesses (3) are offered the service to register and pay for the filling of patents (1) via the website of the PRV (2);
- Administrations (3) are offered the service to obtain European vehicle information (1) via the web service of EUCARIS (2).

### 1.1.2 Interoperability

Interoperability in its core addresses how organisations work together towards agreed common goals. Figure 2 displays the public service in the context of interoperability. All elements inside the internal domain that do not have an external relationship with other services or administrations, business or citizens are not relevant/ eligible for the IMM. All relationships that interconnect the public service with the outside environment are considered in the domain of interoperability and are taken into account when assessing and improving the interoperability of a public service following the IMM.
1.2 Model objectives

The IMM has the objective to deliver insight into two important aspects of interoperability maturity:

- Provide insight into the current interoperability maturity of a public service based on a set of defined interoperability attributes and maturity stages;
- Provide guidelines how the public service can improve interoperability maturity.

Although the IMM is publicly available for all interested organisations and citizens, the main target audience are the service owners of public services that operate in an environment in which interoperability is required to deliver a public service towards end users.

Improving interoperability is a continuous activity. Therefore organisations are motivated to frequently use the model and the improvement guidelines it contains.

1.3 Maturity levels

The IMM uses a five stage model to indicate the interoperability maturity of the public service. The reason for the usage of these various maturity levels is two-fold:

- To measure the interoperability maturity of the public service as a whole and of the underlying aspects;
- To indicate which capabilities and next steps are required to improve interoperability maturity.

A five stage approach is seen often in proven maturity models and is considered ideal for assessing and improving organisational maturity. The five maturity levels for the IMM are summarised in the table below:
### 1.4 Areas of Interoperability

#### 1.4.1 Overview

In the context of interoperability maturity, the IMM measures how well a public service is able to interact with other organisations to realise mutually beneficial and agreed common goals through the exchange of information and reuse of services.

Figure 3 displays all possible instances where interoperability with the outside world may occur from the viewpoint of a public service. Summarising what has been said so far, the following interactions may occur. The numbering of the areas (B, C, etc.) is based on the sections of the questionnaire. As there is a service context section (A) in the questionnaire the numbering of the areas starts with B.

- **Service Delivery (B)** – Providing end-users accessibility to the public service;
- **Service Consumption (C)** – Consumption of reusable services from other public administrations and businesses. This can include the consumption of functionalities, base registry information and security services;
- **Service Provisioning (D)** – Provisioning of reusable services towards other public administrations and businesses;
- **Service Management (E)** – Controlling and monitoring the process flow related to external service interactions from trigger to outcome. This area includes Service Management aspects such as architecture, procurement and cost-benefit analysis.
The areas (hereafter referred to as Interoperability Areas) indicated in the figure above are the object of measurement in IMM as they indicate where interoperability plays a role from a service management, service delivery, service provisioning and service consumption viewpoint.

1.4.2 Service Delivery (B)

The public administration delivers the public service towards end users i.e. citizens, businesses or other administrations. We call this Service Delivery. It covers the interoperability aspects from an end-user perspective only. Note that a public service only used by internal employees of the public administration does not encompass service delivery. The most important interoperability aspect covered by the service delivery area is how the service is made accessible towards the end-users through various delivery channels (e.g. counter, paper forms, software application, online portal). A public service is considered more interoperable when end-user service delivery is conducted electronically and supported by multiple channels and devices to enhance accessibility.

1.4.3 Service Consumption (C)

For delivering the public service towards the end user it may be required to consume services of other public administrations or businesses. This area is called Service Consumption.

There are various types of services that can be consumed by public services:

- **Functional service** – a common functionality (e.g. issuing a license, procurement, planning, risk assessment module) shared across organisations;

- **Security service** – a specific type of functional service to share common security functions (e.g. identity provisioning and authentication) across organisations;

- **Base registry service** – a specific type of functional service to share trusted, authentic and verified data (about e.g. citizens, land, vehicles) across public administrations.

Public services that consume existing services where possible are considered more interoperable than organisations that develop own proprietary services without reusing existing functionalities.
1.4.4 Service Provisioning (D)

Service Provisioning focuses on the provisioning of services towards other public administrations and business. Service Provisioning delivers no services directly towards end-users (this is the area Service Delivery). For example, the Income Tax Declaration service provides a tax validation service to third-party intermediaries to include in their electronic tax advisory solutions (citizens can choose to use the tax authority website or to use an intermediary to file their income tax declaration). Service Provisioning takes place between the public service and the third-party intermediaries and is manifested as a machine-to-machine interface, while Service Delivery takes place between the public service and the end-users through a direct delivery channel (in this example a software application to conduct a tax form declaration for citizens).

1.4.5 Service Management (E)

This area focuses on important Service Management aspects such as architecture, orchestration, procurement and cost-benefit analysis that detail to what extend the organisation has mechanisms in place to facilitate for interoperability.

Depending on the type of public service involved, the service can be either delivered autonomously by a public administration or require service interactions with other public administrations or businesses. These service interactions can be either based on consumption (the public service consumes other services) or on provisioning (the public service provides a service towards another organisation). Service Management encompasses the coordination of all external interactions to ensure the outcome of the public service is established in the right manner. Organisations are considered more interoperable when there is a fully automated central point of control to facilitate this coordination due to the up-to-date status information and prevention of manual faults.

1.4.6 Case examples

The following case examples (see Table 2) illustrate the interoperability areas of delivery, provisioning and consumption. They are taken from real-life examples based on which the Interoperability Maturity Model has been developed and should guide users of the model in defining and delimiting their public service’s interconnections correctly.

<table>
<thead>
<tr>
<th>Public Service</th>
<th>Service Delivery</th>
<th>Service Provisioning</th>
<th>Service Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic Health Record Access</td>
<td>Citizens are offered the service to access their Electronic Health Record via the eHealth portal.</td>
<td>Not applicable</td>
<td>Payment services</td>
</tr>
<tr>
<td></td>
<td>Case example: The service called “My Health summary” is available through the Danish eHealth portal 'Sundhed.dk' for citizens and allows authenticated users to obtain an overview of their own patient data.</td>
<td></td>
<td>Identity and access management services</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>eSignature services</td>
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<td></td>
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<td>Personal medicine data</td>
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<td>Donor registration</td>
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<td></td>
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<td>Living will registration</td>
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<td></td>
<td></td>
<td></td>
<td>Laboratory data</td>
</tr>
<tr>
<td>Online Patent Filing</td>
<td>Businesses are offered the service to register and pay for the filing of patents.</td>
<td>Search classification service</td>
<td>Payment services</td>
</tr>
<tr>
<td></td>
<td>Case example: The EPO Online Filing client application provides applicants with a standard form for filing patent applications online with the European Patent</td>
<td></td>
<td>Identity and access management services</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>eSignature services</td>
</tr>
</tbody>
</table>
Office. Once the request is filed, the applicant receives an electronic notification of receipt. If the applicant has set up an online Mailbox, he will receive all further communication from the EPO via this Mailbox, including requests for rectifying the application and the invitation to pay claims fees.

<table>
<thead>
<tr>
<th>Government E-invoicing</th>
<th>Business are offered the service to send online invoices towards the various government administrations. Case example: Businesses can send all their invoices in electronic format to the Dutch government. In total, more than 78 government bodies have implemented electronic invoicing. The sending and receipt of e-Invoices can take place through two channels: Digipoort (direct access or via an intermediary) or the e-Invoicing portal <a href="http://www.facturerenaandeoverheid.nl">www.facturerenaandeoverheid.nl</a>.</th>
<th>Open Data provisioning Purchasing catalogue service Contract register Purchase order sender Invoice receiver</th>
<th>Payment services Identity and access management services eSignature services</th>
</tr>
</thead>
</table>

| Cross-Border Vehicle Identification Service | Administrations are offered the service to obtain vehicle information Case example: EUCARIS is the European CAR and driving license Information System. It enables public authorities to amongst others share their car registration information. A check in the European registers typically takes place during the re-registration of used vehicles that (possibly) originate from another country and have been registered before. Checks are carried out during vehicle registration after import and during vehicle registration in general, if it is noticed that the vehicle was or still is registered elsewhere. | Vehicle inquiry for registration authority end users Vehicle inquiry for registration authority through customized client application Vehicle inquiry for enforcers Vehicle inquiry for enforcers through customized client application | Payment services Identity and access management services eSignature services Data access Vehicle Information PKI Data storage (e.g. logging) |

Table 2  Examples of Interoperability Areas for public services

As the table indicates, it can be the case that an interoperability area of the model does not apply to a public service (for example Service Provisioning is not relevant for the public service 'Electronic Health Record Access').
1.5 Interoperability Attributes

IMM assesses each interoperability area using a set of interoperability attributes. These interoperability attributes form the core of the IMM and are used for measurement and improvement of interoperability maturity. This section explains how we defined and categorised the interoperability attributes.

1.5.1 Collection and definition of Interoperability Attributes

Various important sources have been utilised to build the current set of Interoperability Attributes in this version of the model:

- **European Interoperability Framework** - the European Interoperability Framework (EIF) serves as an important framework for organisations to promote and improve interoperability and therefore is considered as an important starting point in defining the Interoperability Attributes. To make this interrelation explicit, each interoperability attribute within IMM is linked towards one or more EIF-layers (technical interoperability, semantic interoperability, organisational interoperability and legal interoperability);

- **Research Study** - various research papers were used to collect and define interoperability attributes. The research that has served as input for this study is listed in the appendix;

- **Case Studies** - four case studies have been used to validate, enhance and expand the collection of interoperability attributes;

- **Benchmark** – five benchmark participants have been used to fine-tune the interoperability attributes and their practical application in real-world situations.

1.5.2 Interoperability Patterns

When examining the characteristics of interoperability attributes a number of patterns emerge. Definition and combination of interoperability patterns helps in defining the core elements of interoperability and the way how to measure them. Figure 4 illustrates the relationship between the interoperability maturity and the pattern. The interoperability patterns form the basis for the interoperability scoring. The interoperability patterns are:

1. **From paper-based information exchange to digital information exchange**: a public service working with paper documents is considered less interoperable than a public service which uses digital information;

2. **From manual to automated processing**: a public service manually processing transactions is considered less interoperable than a public service which has fully automated the process execution;

3. **From ad hoc to standard**: a public service developing its own (ad hoc) protocols and formats is considered less interoperable than a public service adopting widely used, standard-based solutions;

4. **From individual to collaboration**: a public service working stand-alone is not reusing available services and therefore is considered less interoperable than a public service which collaborates with other public administrations and organisations where applicable.
1.5.3 Interoperability Categorisation

IMM distinguishes between two types of interoperability attributes:

- **Enablers**: these attributes focus on the *prerequisites* for implementing interoperability (e.g. the participation in a discussion forum to define interoperability standards); Enablers are likely to give an indication of the readiness of a public service for interoperability maturity.\(^1\)

- **Manifestations**: these attributes provide insight in how interoperability is actually *realised* (e.g. a set of common semantic standards). Manifestations indicate the actual interoperability maturity of a public service.

1.6 Questionnaire

The IMM uses a questionnaire for assessing the interoperability maturity. This section details the question types and questionnaire structure in more detail.

1.6.1 Question types

The questionnaire distinguishes between five types of questions. This distinction is required to properly implement the questionnaire in a tool.

- **Open questions**: these questions use a free text field format to gather information. Open questions are not scored and serve contextual purposes only;

- **Category questions**: these questions use a fixed number of options to categorise the public service. Category questions are mainly used for contextual purposes and are of value in the analysis of benchmarking results;

- **List questions**: these questions are used to list services which are relevant to take into account for the maturity assessment. List questions can contain a mixture of pre-defined options and user-defined options;

\(^1\) The correlation of scores between Enablers and Manifestations will be examined in the next phase of the IMM project.
- **Elementary attribute questions**: these questions are asked once per interoperability area. Each answer directly corresponds to a single maturity level. Elementary attribute questions are used within the areas Service Management and Service Delivery;

- **Repeated attribute questions**: these questions are asked multiple times, i.e. for each service listed through the list questions. The final maturity level takes into account the entire set of responses. Repeated attribute questions occur for service consumption and service provisioning.

### 1.6.2 Questionnaire Structure

This section outlines the structure of the questionnaire that is provided with the help of a tooling as a self-assessment. The five main sections of the questionnaire are in line with the earlier presented overview of interoperability areas (section 1.4.1):

- **Service Context (A)**: This section assesses the scope of the public service (the object of measurement, i.e. the public service to examine), service landscaping and gathers important information for follow-up (contact details, etc.);

- **Service Delivery (B)**: The section assesses how the public service delivers the public service towards end-users;

- **Service Consumption (C)**: This section assesses if and how services are consumed from other administrations and businesses;

- **Service Provisioning (D)**: This section assesses if and how services are provisioned towards other administrations and businesses;

- **Service Management (E)**: This section assesses how the public service arranges the consumption and provisioning of external services and includes Service Management aspects such as architecture, procurement and cost-benefit analysis.

The questionnaire routing is sequential on the level of the main areas (A, B, C, D, E). The questions within area A, B and E are also defined sequentially and do not contain complex questionnaire routing. This is different for the areas C and D in which the routing is based on the given answers.
## IMM Definitions

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Process</td>
<td>‘A business process is a sequence of linked activities that creates value by turning inputs into a more valuable output.’ <a href="http://ec.europa.eu/isa/documents/isa_annex_ii_eif_en.pdf">http://ec.europa.eu/isa/documents/isa_annex_ii_eif_en.pdf</a></td>
<td></td>
</tr>
<tr>
<td>Business Process Model</td>
<td>‘A model that defines the business process, by the definition of strict steps of the business processes, precise rules, and the description of the processed data.’ (EIA Project - Specific contract N° 83)</td>
<td></td>
</tr>
<tr>
<td>Choreography Service</td>
<td>‘The Choreography Service enables the collaboration among groups of Services which, in turn, make up a larger, composite Service, or which interact across organizational boundaries in order to obtain and process information.’ (Based on W3C <a href="http://www.w3.org/TR/ws-cdl-10/">http://www.w3.org/TR/ws-cdl-10/</a>)</td>
<td></td>
</tr>
<tr>
<td>Data</td>
<td>‘Facts represented as text, numbers, graphics, images, sound, or video. Data is the raw material used to represent information, or from which information can be derived.’ (DAMA – Data Management International - <a href="http://www.dama.org/">http://www.dama.org/</a>)</td>
<td></td>
</tr>
<tr>
<td>Interoperability</td>
<td>‘The ability of disparate and diverse organisations to interact towards mutually beneficial and agreed common goals, involving the sharing of information and knowledge between the organisations, through the business processes they support, by means of the exchange of data between their respective IT systems.’ (based on EIF 2.0)</td>
<td></td>
</tr>
<tr>
<td>Machine to Machine Interface</td>
<td>‘Description of a boundary between a system and other systems, usually including the mechanisms by which information is transferred.’ (Definition from DG TAXUD)</td>
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</tbody>
</table>
| Metadata                      | ‘Metadata is structured information of two types, data models and reference data, which can be defined as follows:  
- A data model is a collection of entities, their properties and the relationships among them, which aims at formally representing a domain, a concept or a real-world thing. In practice, data models drive the design and development of information systems, as they can express the different types of information managed by an organization.  
- Reference data is a small, discrete set of values that are not updated as part of business transactions but are usually used to impose consistent classification. Reference data normally has a low update frequency. Reference data is relevant across more than one business systems belonging to different organizations and sectors.’ (ISA Action 1.1) |
| Private Network               | ‘A Private Network is a network that is used for the only purpose of realizing the physical communication among Interoperable European Systems (e.g. sTESTA), and cannot be accessed by the public.’ (EIA Project - Specific contract N° 42) |
| Public Network                | ‘A Public Network is a Network that can be accessed by the public (public administrations, businesses and citizens) without specific authorizations. Interoperable European Systems can rely on Public Networks (e.g. the Internet) to realize the physical communication between nodes’. (EIA Project - Specific contract N° 42) |
| Public Policy                 | ‘A course or principle of action proposed or adopted by a policy making body.’ (Based on Oxford Dictionary) / Aligned with definition given by EIRA) |
| Public Service                | ‘Public Services are economic activities that public authorities identify as being of particular importance to citizens (A2C), businesses (A2B) and public administrations (A2A) and that would not be supplied (or would be supplied under different conditions) if there were no public intervention.’ |
(Based on DG Competition http://goo.gl/M9CKCJ)

(Public) Service Catalogue
‘A catalogue of (public) Services is a collection of descriptions of active public Services that are provided by a public administration at any administrative level (i.e. local, regional, national or pan-European). These descriptions are created following or mapped to a common data model for representing public Services.’
(ISA Action 1.3)

Specification
‘A Specification is a document describing the functional/technical specifications of a solution.’
(EIA Project - Specific contract N° 83)

Users
‘Public Administrations, Business and Citizens are consumers of Public Services.’
(based on EIF 2.0)

Sharing & Reuse
‘Reuse means that public administrations confronted with a specific problem seek to benefit from the work of others by looking at what is available, assessing its usefulness or relevance to the problem at hand, and deciding to use solutions that have proven their value elsewhere. In some cases, the solutions are reused once they have been adapted to specific requirements or linguistic environments.’
(Sharing & Reuse Action - Def.9)