

D5.2

Interim report on the status of the Interoperability Network for the Energy Transition



int:net

Interoperability Network for
the Energy Transition

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ABSTRACT

This document provides an 18-month status update on the Interoperability Network for the Energy Transition (int:net). It highlights progress in establishing the int:net community, based on the project's cornerstones including the knowledge base, Interoperability Maturity Model (IMM), testing framework, and community network.

The knowledge base is actively developing, with a repository of interoperability initiatives and ongoing Use Case analysis. The IMM concept is evolving to assess community maturity and testing procedures. Discussions on the IMM's relation to the "int:net approved" label are ongoing. Roadmap development workshops and the int:net community platform have been established to support a self-sufficient interoperability community.

Looking ahead, the report shortly outlines plans for the second half of the project, emphasizing the integration of all aspects to further enhance interoperability in the energy transition.

KEYWORD LIST

Cornerstones, interoperability, maturity model, knowledge base, platform, governance, testing procedures, roadmap.

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EXECUTIVE SUMMARY

Deliverable D5.2 reports on the “status of the Interoperability Network for the Energy Transition” after 18 months of project duration. This is an interim report and will be updated in month 36 at the end of the project.

This deliverable starts with a brief presentation and overview of the four cornerstones of int:net: knowledge base, Interoperability Maturity Model, framework for interoperability testing and community network. The comprehensive knowledge base is designed to encourage collaboration, encompassing best practices, methodologies, and reference use cases. The Interoperability Maturity Model (IMM) in int:net is developing to assess the maturity of interoperability standards, providing a roadmap for the integration of new technologies and continual improvement in this critical domain. The pan-European community of interoperability testing facilities will harmonize existing testing procedures, introduce the “int:net approved” label, and standardize testing criteria. Standards and Governance Guidance: To address the challenge of inconsistent development and cross-domain alignment in standardization, int:net is developing a new governance process, using the SGAM framework, and conducting “Connectathons” with stakeholders to enhance standardization’s effectiveness in promoting interoperability and the adoption of technical innovations.

An overview of the status of activities related to setting-up the cornerstones is given.

The development of the knowledge base is well on its way, with a repository of interoperability initiatives already published and Use Case analysis and connection to SGAM in process. The concept of IMM was initially described and will be developed further – on the one hand towards assessing the interoperability maturity of communities, on the other hand towards assessing the maturity of interoperability testing procedures. Discussions on the relation of the IMM and the “int:net approved” label is ongoing. For the development of a self-sufficient and long-term interoperability community, a roadmap development workshop was held, another one is planned. To give the community a place to prosper, the int:net community platform was developed and set-up. Included in the platform is the option to create “Interoperability Focus Groups” to be able to work on specific topics.

In a final step, the report gives a short outlook on the work in the second half of the project, focusing on bringing all aspects together.

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1 Introduction

For the energy transition to succeed, it's essential not only to establish connectivity within the energy sector but also to align energy-related processes and products across all sectors. To ensure widespread adoption, technology should be user-friendly, avoiding complex interfaces, costly adaptations, incomprehensible data sheets, and closed standards that hinder the implementation of advanced solutions. What's required is a coherent, resilient, and financially sustainable ecosystem of solutions.

1.1 Objectives of the work reported

The Interoperability Network for the Energy Transition project (int:net) aims at forming an inclusive cross-domain community that unites all relevant stakeholders in the European energy sector to collaboratively focus on creating, testing, and implementing interoperable energy services. This community's establishment will be formalized to ensure its continuation beyond the project's duration.

1.2 How to read this document

This document gives a short overview of the current status of activities leading towards the formal establishment of the community. A final report on the status of the network / community is planned for the end of the project, M36. It is not necessary to read any other deliverables to be able to understand this report.

1.3 Structure of the document

This deliverable is composed of three main chapters. Chapter 2 introduces the cornerstones of the network / community, and which are necessary but not sufficient for the establishment of a network of this kind. Chapter 3 provides an overview of the current status of activities. Chapter 4 concludes the report.

2 Cornerstones of the Interoperability Network for the Energy Transition

The int:net project's objective is to establish a community of practice to ensure the continuity of ongoing interoperability efforts, while also facilitating the coordination and alignment of relevant projects and initiatives across various geographical levels. Without such a community, there is a risk that interoperability expertise will remain dispersed among a small group of technical experts, resulting in redundant and isolated initiatives. Additionally, changes in requirements, emerging use cases, test scenarios, and regulatory conditions may not be adequately considered, hindering the full achievement of interoperable energy services within a future integrated energy system. The establishment of the Interoperability Network for Energy Transition will guarantee the sustainability of the int:net approach beyond the project's borders and its duration.

In the following section, we will address the four key cornerstones on which the Interoperability Network for the Energy Transition (int:net) bases. These pillars encompass:

1. A common knowledge base, intended to tackle the issue of convergence/lack of consensus among various stakeholders (refer to Section 2.1).
2. An interoperability maturity model (refer to Section 2.2).
3. A testing and certification framework (refer to Section 2.3), designed to address the industry's lack of shared tools and standards.
4. Standards and governance guidance (refer to Section 2.4), which aims to bridge the existing gap between RD&I and formal standardization activities.

These cornerstones guide the int:net approach, illustrated in Figure 2-1. The int:net approach commences with the collection and evaluation of existing frameworks and successful models (Cornerstone 1: Knowledge Base). This information then feeds into the int:net maturity model (Cornerstone 2: Maturity Model). These components provide the means and metrics for assessing interoperability within an expanding network of testbeds and testing facilities (Cornerstone 3: Testing and Certification). Finally, they are proposed to framework setters for integration into their policies and support programs (Cornerstone 4: Standards and Governance). The insights gained from such assessments and the establishment of favourable frameworks are subsequently incorporated into the knowledge base of successful examples, thus closing the virtuous circle of interoperability.

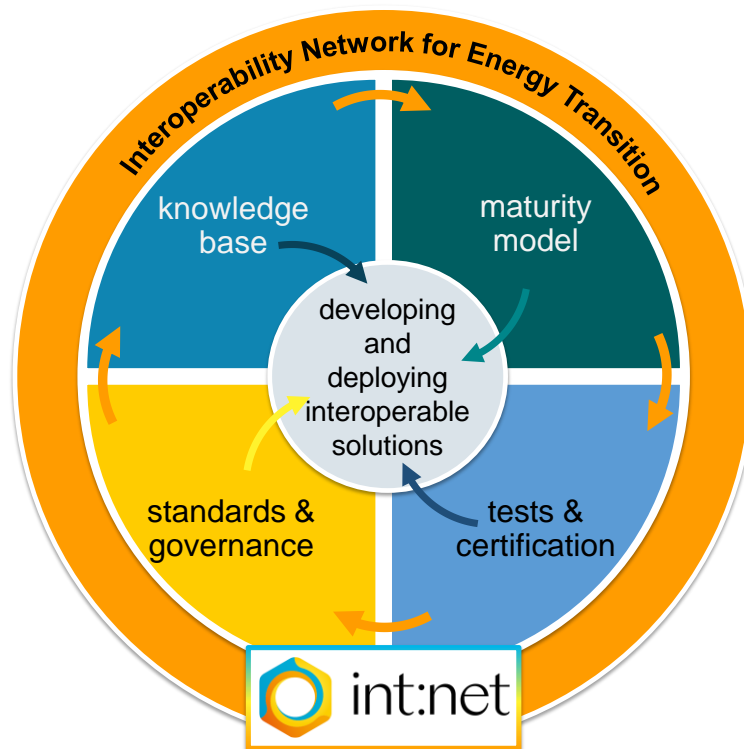


Figure 2-1 Interoperability Network for Energy Transition approach with its cornerstones

2.1 Common knowledge base for interoperability activities on energy services in Europe

The int:net project aims to enhance interoperability in energy services, data, and platforms, addressing both functional and business layers. This is pursued through several measures, one being the establishment and maintenance of a knowledge base following FAIR principles (Findability, Accessibility, Interoperability, and Reusability). Firstly, the project seeks to gain a comprehensive understanding of European-level energy service interoperability. Secondly, it aims to provide a repository for project results accessible to the public through planned dissemination efforts.

int:net is utilising FAIR principles to create a knowledge base of interoperability actions and best practices. It is in the process of analysing relevant use cases from existing repositories, such as BRIDGE, ETIP SNET, EPRI, and LOV4IoT-Energy ontology catalogue. Additionally, the project will assess the entire interoperability value chain, considering both functional and economic aspects.

The knowledge base aims to go beyond being a mere repository; it will encourage collaboration on selected documents and existing initiatives, connecting to established platforms. It will include best practices, methodologies, and reference use cases from EU-wide and international initiatives. A growing community of registered users, supported by the Interoperability Network for Energy Transition, ensures its sustainability beyond the project's completion.

2.2 Comprehensive and accepted Interoperability Maturity Model (IMM)

The second cornerstone to reach the aim of the int:net project to ensure ongoing interoperability in European energy services and communities is the development of the Interoperability Maturity Model (IMM) and an assessment methodology. Interoperability is vital for integrating new technologies into the energy system to reach a green energy system. Initially, the project defined domains and characteristics for the IMM, spanning from initiating to pioneering maturity levels. This guides the industry in prioritizing improvements in interoperability standards.

Eventually, a reference IMM implementation will enable organizations to assess their progress in implementing interoperability concepts. Workshops organised by int:net will offer guidance and practical use cases for the model towards those who want to use the IMM. Continuous assessment documentation helps track industry progress, fostering the adoption of new technologies and improving understanding of interoperability concepts.

In essence, the IMM and its methodology facilitate the integration of cutting-edge technologies and promotes continual enhancement in this vital domain.

2.3 Framework for interoperability testing in a network of interoperability testing facilities

Achieving interoperability involves principles like interoperability-by-design, reference architectures, and agreed standards. However, ensuring interoperability requires testing procedures and certificates to demonstrate successful interconnection. Existing interoperability testing approaches in smart grids and energy systems vary widely, and there is no comprehensive overview across EU research infrastructures. Current approaches are more advanced at the component/device level than at the system level, often still in the research stage, and diverse in their criteria.

int:net is in the process of creating a pan-European community of interoperability testing facilities. It aims to harmonize existing testing procedures, develop and integrate testing facilities, and form a cohesive pan-European network of testing facilities and certification centres. The registration of a formal landmark, "int:net approved," and establishment of a labelling process is in development.

Notable system-level interoperability testing approaches include the Joint Research Centre's "Smart Grid Interoperability Testing Methodology", the Austrian initiative "IES – Integrating the Energy System", the Interoperability Test "CIM for System Development and Operations", and the "ERIGrid Holistic Test Description Approach". int:net's efforts aim to streamline and standardize these approaches for improved interoperability in European energy systems.

2.4 Community network for a European interoperability ecosystem

Standardization plays a crucial role in ensuring the adoption of best practices, technical solutions, and seamless interoperability among independent vendors, fostering global competitiveness. However, formal standardization involves various bodies, domains, and layers, leading to a high number of relevant standards for critical infrastructures. Inconsistent development and a lack of cross-domain alignment can be challenges.

Additionally, regulation often adapts technical innovations to national requirements, not guaranteeing technical interoperability across different countries. Divide-and-conquer methods address various levels of interoperability, focusing on semantic, structural, and syntactic aspects.

Int:net is working on developing a new governance process to address these challenges. Building on the IES experience, it uses the SGAM and existing maturity models to facilitate co-creation sessions, called “Connectathons.” Participants, including end-users, operators, product developers, and vendors, will collaborate to align technical standards with market requirements, testing interoperability of solutions. The results will find its way into policy recommendations presented to program managers and funding agencies. This approach aims to enhance standardization’s effectiveness in promoting interoperability and facilitating the adoption of technical innovations.

3 Overview and current status of activities

In the following, an overview of activities for the erection of the described cornerstones and its foundation is given, including their current status. As activities are strongly interconnected, a strict separation according to the above-described cornerstones is not always possible.

3.1 Development of knowledge base

The int:net project is making significant progress in developing a common knowledge base and making it publicly available.

1. **Initiative Repository:** A crucial step taken by int:net was the creation of a repository to catalogue various initiatives related to interoperability in relevant fields. This repository is accessible on the int:net website, although it is currently available in CSV format. The ultimate goal is to transform it into a more adaptable repository that facilitates collaborative work. This is to enable int:net community members to include further relevant initiatives with the aim to extend the community. Deliverable D1.1 gives a more detailed documentation and explanatory manual on this repository.
2. **Use Cases Collection and Analysis:** The project is actively engaged in collecting and analysing use cases in which interoperability is crucial. This ongoing effort aims to expand the knowledge base on interoperability. Use cases serve as valuable real-world examples that help in identifying common challenges and best practices. They are a critical component of the project's mission to promote interoperability in energy services.
3. **Use Case selection and SGAM:** The project has a strong connection to the Smart Grid Architecture Model (SGAM). SGAM serves as a valuable framework for understanding the various aspects of interoperability in the energy domain. In this context, int:net is actively working on integrating a sixth layer into SGAM, which encompasses governmental and framework aspects. For in-depth information on this development, see Deliverable D4.3.

3.2 IMM, testing and labelling

The Interoperability Maturity Model (IMM), the requirements definition and assessment of interoperability testing facilities as well as the planned "int:net approved" label are considered to be closely connected to each other.

1. **Initial Concept for IMM:** int:net introduced the initial concept for the Interoperability Maturity Model (IMM). This concept was designed to assess the maturity of standards, profiles, or solutions that have been developed. The IMM serves as a valuable tool for evaluating the readiness and effectiveness of these components in achieving interoperability objectives. Detailed information on this initial concept can be found in Deliverable D2.1.
2. **Evolution of IMM:** Building upon the foundation of the IMM, the project is now in discussions regarding a further development. One area of focus is extending the IMM's applicability to measure the maturity of capabilities of communities. This expansion aligns with the broader goal of maturity assessments, which commonly aim to evaluate the readiness and effectiveness of capabilities, processes, or solutions.

3. **Maturity Model for interoperability testing procedures:** Alongside the development of the IMM, int:net has been actively working on the creation of a Maturity Model specific to interoperability (IOP) testing procedures. This model is designed to assess the maturity and effectiveness of testing procedures, a crucial aspect of ensuring interoperability. The development of this model is the bases for the establishment of the testing facility network as a network within the int:net.
4. **Labelling:** To be able to hand out the label “int:net approved”, it needs to be decided what is to be labelled – a community, a solution or even both, when it should be labelled, what requirements need to be fulfilled, and who should be responsible for conducting assessments – distributed testing facilities on their own or centrally organized “Connectathons”. These deliberations are essential for ensuring a standardized and effective approach to an interoperability label. Therefore, the development and registration of the trademark “int:net approved” depend on the outcome of the discussions about labelling, which are ongoing and closely connected to the roadmap development workshops described in the following chapter.

3.3 Roadmap development workshops

The int:net is supposed to be a self-sufficient network capable of existing and prospering after the end of the int:net project. To lay a solid foundation, a roadmap to the establishment, organisation and practices of the network / community needs to be developed. The int:net consortium is in the process of conducting workshops to develop this roadmap.

In June 2023, a workshop with the aim to collect best practice approaches from existing initiatives was organised. The CEO of EEBUS e. V. and a representative¹ from the Austrian Research Promotion Agency (FFG)/ Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) were invited to present the work done in their projects.

3.3.1 Focus of EEBUS

EEBUS describes the communication interface (i.e., application, transportation, communication) in order to allow for the interconnection between energy management relevant devices and the corresponding control systems. EEBUS empowers the digitalisation of energy transition by creating a data model that ensures cross-domain interoperability among all energy relevant devices and systems.

The main challenge reported by their CEO is to combine independent stakeholders and their differing interests and interactions at the same grid connection point. Each of them wants to influence the operation of energy-relevant devices inside the building with different goals (e.g., cost-optimised, grid-supporting etc.).

The big aim of EEBUS is to introduce standardised communication interface between device manufacturers (device to device) as well as between DSOs and device manufacturers. EEBUS is also testing practical use case implementations and gather input from regulatory and legislative authorities. Furthermore, test specifications and implementation instructions for bidirectional applications &

¹ Names removed due to data privacy requirements.

processes are standardised and made public. int:net is pointing in a similar direction and that is why EEBUS can serve as a best practice example for the project.



STRONG COMMUNITY: CROSS-INDUSTRY ASSOCIATIONS RELY ON EEBUS AS NON-PROFIT ORGANISATION







AS WELL AS LEADING COMPANIES





















































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2023/06/05 int:net workshop
EEBUS. SPEAK ENERGY.

Figure 3-1 Successful community of EEBUS

3.3.2 Focus of Integrating the Healthcare Enterprise (IHE) and Integrating the Energy System (IES)

In the European Interoperability Framework, defined and used in the health sector, different layers come into action – the legal, organisational, semantic and technical layer. The legal layer defines the legal basis for data exchange, the organisational layer defines the business processes required for data exchange, the semantic layer describes the meaning and value of exchanged data, and the technical layer describes the required technical systems and standards. Various sectors, including healthcare, energy, and railways, have already engaged in cross-sector knowledge transfer. The approach in the healthcare sector serves as a worldwide reference for the established process (ISO TR 28380).

Contacts and co-operation of IES-Project with other projects and initiatives



Figure 3-2 Cross-sectoral community around IHE and IES

3.3.3 Interactive discussion and insights

In the final segment of the workshop, the two experts, alongside int:net members, engaged in discussions concerning the relevance of the presented examples and their applicability within the int:net context. Key topics addressed during the discussion encompassed standardization, community-building, validation, and labelling.

Regarding standardization, insights were gained from EEBUS, where a standardised communication framework between Distribution System Operators (DSOs) and device manufacturers was developed. Similarly, IHE offers standardized guidance for vendors, and the "Gazelle" test platform facilitates the translation of information into a standardized language. int:net, in parallel, actively provides guidance for vendors and participates in standardization bodies. Furthermore, our intention is to engage policy makers in discussions to influence standardization processes effectively.

A pivotal question raised during the workshop pertained to what the labelling mechanism of int:net should aim at. The fundamental rationale behind the need for labelling is to assist customers in comparing and selecting the most suitable solution for their devices or tools. Notably, EEBUS and IHE do not currently employ labelling, opting instead for prequalification of interoperability. During the workshop, int:net participants were surveyed to gauge their perspectives on the necessity of labelling. The results indicated that 50% were uncertain about the need for labelling, while 40% expressed the view that labelling was indeed necessary. This issue remains open for further clarification within the consortium. A preliminary step could involve the creation of a website with a comprehensive database, enabling stakeholders to assess interoperability. Subsequently, the introduction of a formal labelling system, particularly tailored to end-users, could be considered as a subsequent step.



Figure 3-3 Documentation of joint discussion on a Miro board

A second roadmap development workshop to collect experiences from other initiatives is planned for Q1 2024 at the latest. Further workshops with focus on developing a roadmap for the int:net community are in planning for year 2024.

3.4 Building of the int:net community

The foundation of a strong community is its members. To reach as many possible members as possible, int:net partners have been and will continue to present int:net at as many occasions as possible.

This includes events and conferences such as Enlit, EUSEW and InnoGrid, to only name a few, which are organised by other institutions. It also includes events organised by int:net such as one workshop on “General introduction to standardisation” and “Smart Energy Grid Data Modelling”, both reported as Milestones (MS1 and MS2). int:net is closely working together with other initiatives working on related topics, including the Data Space Support Centre (DSSC) and the International Data Spaces Association (IDSA). The existing connection to EEBus and the already well-established FlexCommunity is planned to be deepened.

Based on the collection of initiatives, int:net partners are in the process of inviting initiatives and contacts to join the community. To have a virtual place to meet, int:net has set-up a community platform (see Section 3.5). It is the aim to kick-off the community platform in a dedicated session at Enlit 2023 together with a presentation of the IMM concept. Work within the community will be organised in so-called “Interoperability Focus Groups” (IFG), described in detail in Section 3.5. The promote the increasing activities and work of the community and its IFGs, thematic webinars and workshops will be organised in the following months after the community platform kick-off at Enlit end of November.

3.5 int:net Community Platform

The project has provided the necessary community platform for int:net. The network platform is enabling a collaborative workflow including functionalities to share information, to communicate between the stakeholders and to organise tasks between the stakeholders. The platform is accessible for everyone who is interested in the topics of interoperability, data spaces and digitalisation.

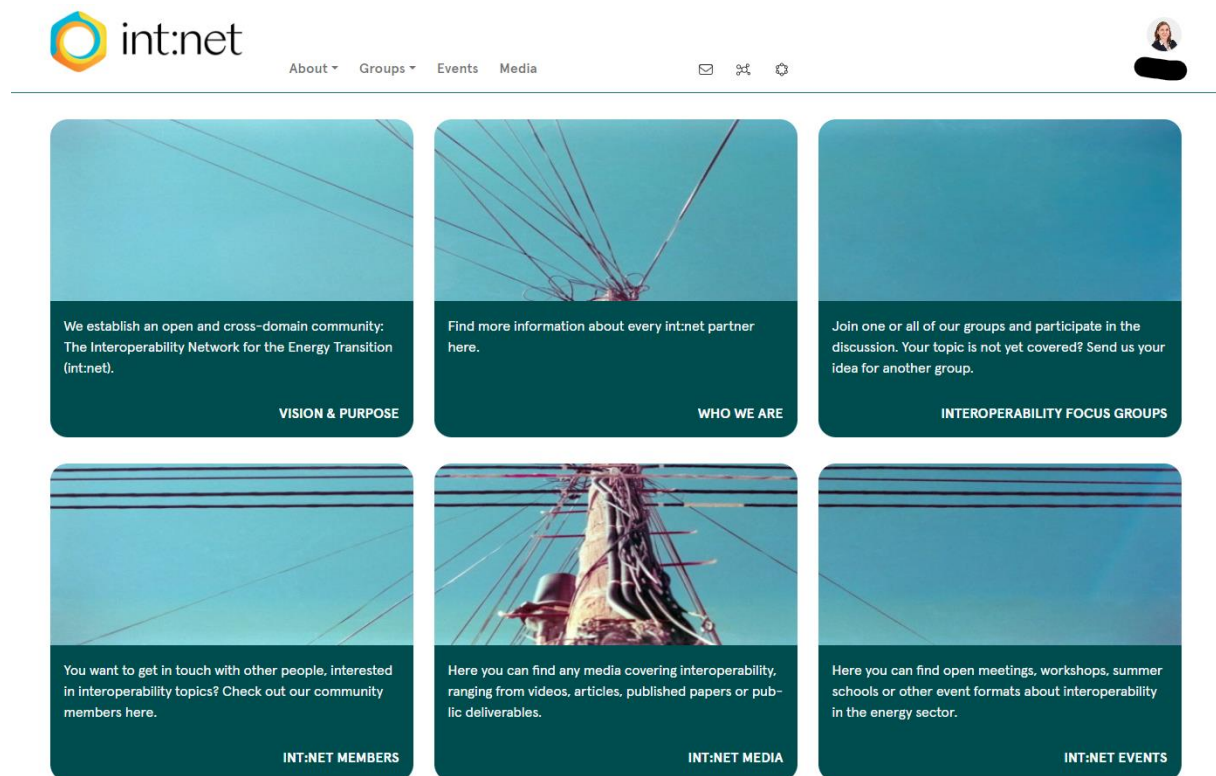


Figure 1 – The int:net community platform

Activities in the community are organized in Interoperability Focus Groups (IFG) and taskforces. The current set of working groups is the following, which can be changed at any time according to needed thematic focus points member want to set:

IFG-1: "Interoperability Profiles in Data Spaces"

IFG-2: "Increasing Maturity in Interoperability"

IFG-3: (in development; topic planned to focus on legal and regulatory issues)

IFG-4: (in development; topic planned to focus on SGAM and use cases)

IFG-5: "Building the Interoperability Community"

IFG-6: "B2B Visibility of Interoperability"

IFG-7: "B2C Visibility of Interoperability"

Each IFG is guided by one or two moderator(s). The moderators ought to lead the discussion, initiate new topics and animate other participants to contribute content. Every member of an Interoperability Focus Group is encouraged to deliver input and ideate new topics. Topics to discuss in the Groups can be freely chosen by the members. There is no limit to what is expected as an output or result of a IFG. To mention just some of possible outputs: reported discussions, position papers, surveys or roadmaps.

Other sources of information and functionalities are for example the events section and the media section which are only accessible for registered users. Within the events section, you can find interesting events that are either organized by int:net or involve int:net. Within the media section, any media covering interoperability, ranging from videos, articles, published papers or public deliverables is available.

Registration for the community platform is free and possible for everybody, interested in the subject. It is easily accessible via the int:net website by visiting "get connected" and clicking on the link for the community. In appearance the community platform is very similar to the original int:net website as we wanted to have a clear connection between the int:net project website and the community website.

4 Conclusion

The activities within int:net are interconnected and include the development of a common knowledge base, the IMM, testing procedures, and the int:net community. The project is focused on building a strong community of members, collaborating with related initiatives, and organizing thematic webinars and workshops.

The development of the Common Knowledge Base is still ongoing, focusing on the assessment of Use Cases related to interoperability. A repository of interoperability initiatives is already available on the int:net website and will further be developed together with the community members. The project has developed a first concept of an Interoperability Maturity Model (IMM) and assessment methodology to evaluate the maturity of interoperability standards, guiding improvements in standards and promoting the integration of new technologies. In the next step, this IMM will be further developed on two paths: on the one hand to make an assessment of communities possible, and on the other to enable an assessment of interoperability testing procedures. Based on this, int:net is working on creating a pan-European community of interoperability testing facilities to harmonize existing procedures and establish a cohesive network.

The int:net Community Platform is a key part of the community establishment efforts, providing a collaborative space for stakeholders to share information, communicate, and organize tasks. It includes Interoperability Focus Groups (IFGs) to discuss various aspects of interoperability, such as profiles in data spaces, increasing maturity, legal and regulatory issues, Smart Grid Architecture Model (SGAM), and more.

In summary, the int:net project has developed building blocks, but they are stand-alone so far. The next step is to bring these individual building blocks or cornerstones together to establish a sustainable and long-lasting community. The int:net partners will in the second half of the project focus on fostering the work within the community to make it a living ecosystem.

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6 List of Abbreviations

BMK	Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology
DSSC	Data Space Support Centre
DSO	Distribution System Operator
FFG	Austrian Research Promotion Agency
IDSA	International Data Spaces Association
IHE	Integrating the Healthcare Enterprise
IES	Integrating the Energy System
IFG	Interoperability Focus Group
IMM	Interoperability Maturity Model
int:net	Interoperability Network for the Energy Transition project
IOP	Interoperability
MS	Milestone

