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WHITEBOOK

D4.3 ENGAGEMENT TOWARDS INTEROPERABILITY IN GOVERNANCE (V 1.0)

int:net

Interoperability Network for the Energy Transition

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ABSTRACT

This document summarizes the research and discussion of the int:net consortium with respect to interoperability aspects of administrative, political and industrial governance institutions. It introduces new elements for the Smart Grid Architecture Model (SGAM) which shall allow adding governance considerations to interoperability models and solutions.

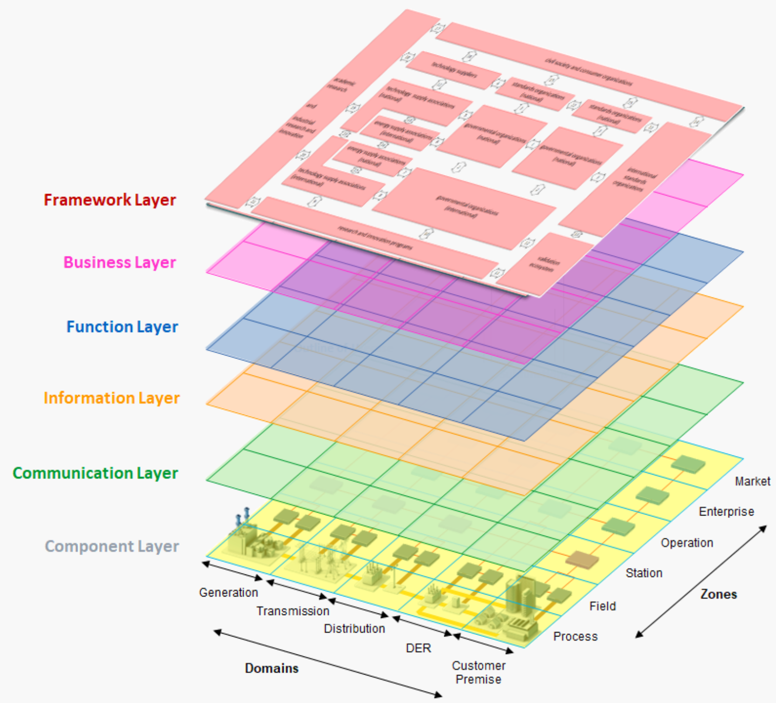
KEYWORD LIST

SGAM, governance, organisational interoperability, Connectathon

DISCLAIMER

EXECUTIVE SUMMARY

The future energy system will be way more complex. Distributed systems explode not only the numbers of installations but also the number of involved stakeholders. Their roles need to be defined with rights and obligations. But not only the number of participants in the system grow, the number of interfaces, dependencies, and potential inconsistencies explodes as well. Political and regulatory, standardization, validation and involvement frameworks need to cope with that situation. Institutions need to agree which standards shall be mandatory to follow in specific cases. They need to agree on a level of interoperability that shall be mandatory for the implementation in their country or business domain. Owners of funding programs would need to agree on interoperability prerequisites for projects to be funded. And last not least there needs to be a governance framework that defines how interoperability shall be validated. As depicted in Fig. 0, the interoperating entities can be considered to constitute a layer six of the Smart Grid Architecture Model (SGAM). Chapter 2.2 introduces this model, but it needs further investigation and will be discussed in the second half of the int:net project.



source: B.A.U.M.

Fig. 0 SGAM plus: interoperability in governance as the 6th layer

Chapter 2.3 introduces yet another model to structure interoperability discussions using SGAM. With the “tube in the cube” model, int:net describes the notion of “broad key use cases” and relates the hundreds of use cases that have been identified to each other to allow for better modelling and assessing their interoperability maturity (cf. chapter 2.4).

Chapter 2.5 introduces the “Connectathon model” for the validation of maturity in interoperability. This method has been successfully used in the medical domain and shall now make its way to the energy sector.

CONTENTS

1 Introduction

1.1 Objectives of the work reported

The int:net consortium strives to promote holistic interoperability in a future energy system. While it relies on existing means and methods to describe, foster and validate interoperability, it tries to close gaps and to make the topic more tangible for a broad range of stakeholders. Not the least int:net has identified gaps in collaboration in the field of governance as well as in holistic descriptions of systems. To that end, int:net has set out to add new views and methods to close such gaps.

1.2 How to read this document

This document gives an overview of the mindset and some envisioned int:net tools. It is short enough for the reader to read it through and learn about the details in other int:net deliverables. This version of the document introduces the new models and approaches, while after many more discussions in the second half of int:net, the final Whitebook will contain more details and a clear guidance on how to work with these new tools.

1.3 Structure of the document

Chapter 2 (Towards Holistic Interoperability) introduces …

- a holistic approach to modelling use cases with the Smart Grid Architecture Model (SGAM). It introduces the concept of a “tube in the cube”,
- a new layer for SGAM to allow describing collaboration of framework setters,
- a set of “broad key use cases” which int:net decided to use for checking the described and other means and measures for interoperability,
- the validation methodology “Connectathon” which has been successfully used in other sectors (e.g. health).

Chapter 3 will be added with version 2 of this Whitebook. It will summarize the experiences and it will give further guidance to use the proposed means and measures in preparing good frameworks to allow for and foster interoperability.

2 Towards Holistic Interoperability

2.1 Background of architecture models

The SGAM was developed under the European mandate M/490 by the Smart Grid Coordination Group, supported by the European Committee for Standardisation (CEN), the European Committee for Electrotechnical Standardisation (CENELEC) and the European Telecommunications Standards Institute (ETSI). The original aim was to identify gaps in smart grid standardisation. Meanwhile the SGAM has gained broad acceptance and is has been increasingly used in the development of smart grid system architectures.

The SGAM development process is described hereafter.

2009: First consideration on the development of a model in CEN_-CENELEC – ETSI Smart Grid Coordination Group based on US NIST models (National Institute for Standardisation)

2010-2012: Coordination of efforts by DKE (German Commission on Energy Standardisation) in the framework of E-Energy and European projects; project moma extremely active in standardisation gremia to promote cellular models.

2013: Intensifying cooperation of EU und US Institutions: Harmonization of in the 3rd *NIST Framework Report for Smart Grid Interoperability.*

2014: EU mandate M /490 to develop an architecture model.

2023: int:net attempts to add a framework layer to SGAM to cover interoperability in governance

The Smart Grid Architecture Model describes 5 layers (literally quoted from CEN/CENELEC document):

Business Layer

The business layer represents the business view on the information exchange related to smart grids. SGAM can be used to map regulatory and economic (market) structures and policies, business models, business portfolios (products & services) of market parties involved. Also business capabilities and business processes can be represented in this layer. In this way it supports business executives in decision making related to (new) business models and specific business projects (business case) as well as regulators in defining new market models.

Function Layer

The function layer describes functions and services including their relationships from an architectural viewpoint. The functions are represented independent from actors and physical implementations in applications, systems and components. The functions are derived by extracting the use case functionality which is independent from actors.

Information Layer

The information layer describes the information that is being used and exchanged between functions, services and components. It contains information objects and the underlying canonical data models. These information objects and canonical data models represent the common semantics for functions and services in order to allow an interoperable information exchange via communication means.

Communication Layer

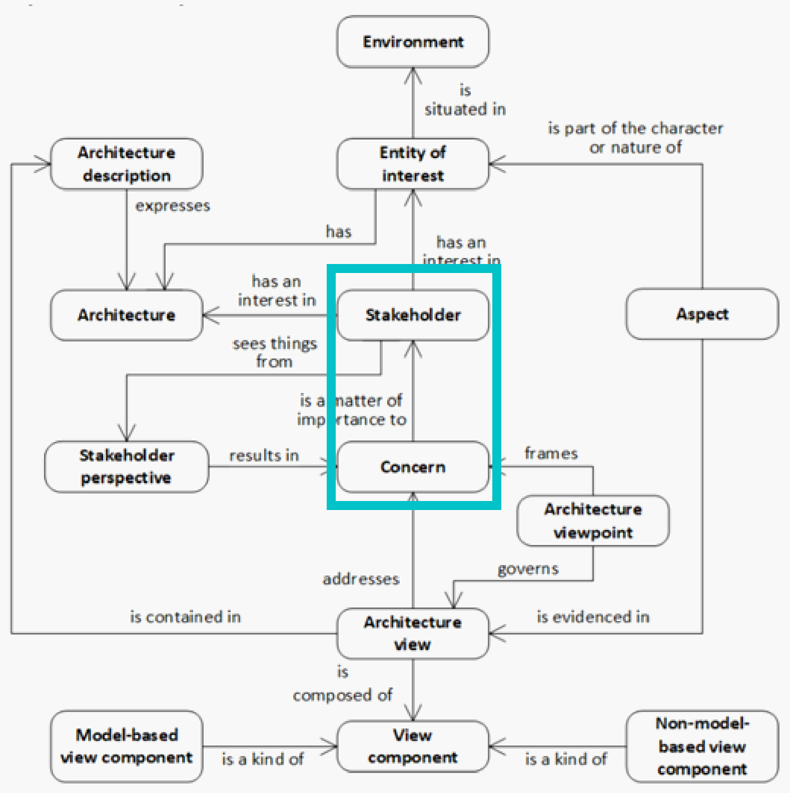
The emphasis of the communication layer is to describe protocols and mechanisms for the interoperable exchange of information between components in the context of the underlying use case, function or service and related information objects or data models.

Component Layer

The emphasis of the component layer is the physical distribution of all participating components in the smart grid context. This includes system actors, applications, power system equipment (typically located at process and field level), protection and tele-control devices, network infrastructure (wired / wireless communication connections, routers, switches, servers) and any kind of computers.

Need to extend SGAM

When experts under mandate M/490 developed SGAM, there was discussion already whether it would be necessary to define a "framework layer" on top of the "business layer". Chapter "7.3.4.1 European market structure alignment" of the Smart Grid Reference Architecture document gives some hints by discussing the relation of SGAM with market frameworks such as the "Harmonized Electricity Market Role Model" (HEMRM)[1]. The SGAM document says that "… the roles used in the business interactions must be defined and agreed upon, or otherwise the responsibilities carried out by those roles are inconsistent and the interactions (and consequently the interfaces) between roles are unclear. This results in a system that is not interoperable."



Source: ISO/IEC/IEEE 42010 Architecture Description.

Fig. 1 People in the centre of interoperability

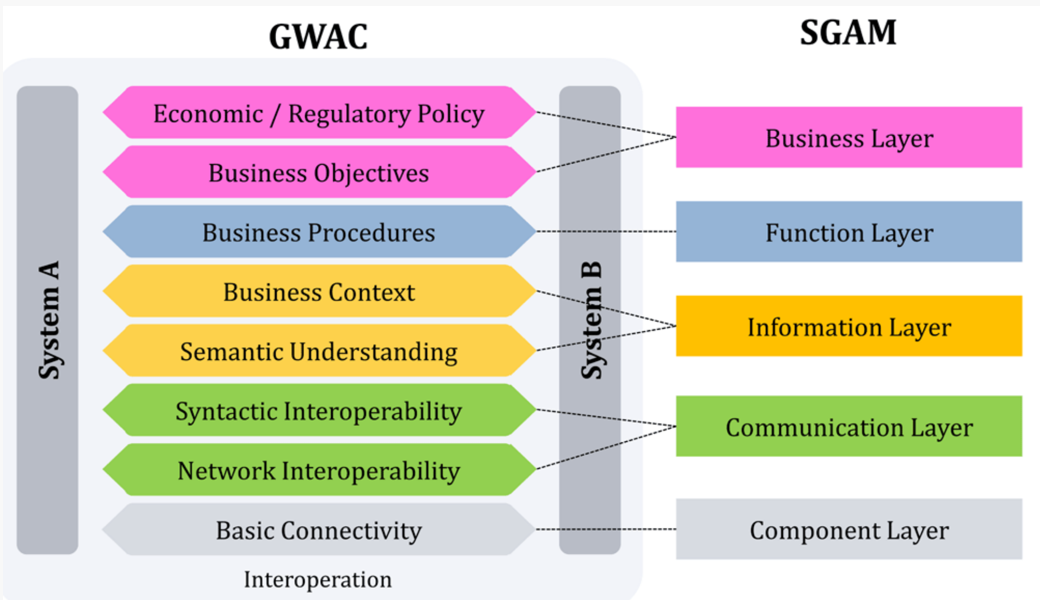
[1] The Harmonised Electricity Market Role Model (HEMRM) – Entso- https://eepublicdownloads.entsoe.eu/clean-documents/EDI/Library/HRM/2015-September-Harmonised-role-model-2015-01.pdf

Respecting stakeholders' needs and expectations and their roles in the energy systems are taking centre stage in the development of the future energy system. This is for example reflected in the ISO/IEC/IEEE 42010 Architecture Description, an international standard for architecture descriptions of systems and software.

Technical and societal interoperability requirements shall be integrated in solution architectures such as

- Services
- Digital twins
- Data spaces.

Other research has as well pointed to the societal deficiency or missing dimension of SGAM and de facto calls for a social layer. In a paper "The (still unexplored) Social Side of Smart Grid Development", scientists state that "the facilitation of new business models and competition in the energy domain is not purely a technological issue. Besides technological complexity, stakeholders with different knowledge, expertise, and methods are necessary for Smart Grid developments. This heterogeneity also results in specific social challenges." That paper deals with the necessity for integrating social collaboration in the SGAM. It analyses the extent to which social interaction has already been considered in the SGAM, but also looks at the increasing needs to describe the energy system with respect to the growing diversity of stakeholders.



Source: [A case study research on interoperability ... | Open Research Europe (europa.eu)] by Johann Schütz, Mathias Uslar and Jürgen Meister

Fig. 2 Relation of GWAC and SGAM

SGAM has been developed with close relation to the so-called GWAC-Stack of the GridWise® Architecture Council (GWAC). This framework gives interoperability 3 dimensions "technical", “informational” and “organizational” with 8 categories. It describes – more than SGAM - cross-cutting issues that have to be considered in all interoperability discussions. Matching the SGAM layers with the GWAC categories suggests that the GWAC “economic / regulatory policy” category should either be integrated in the SGAM “business layer – or added on top of it.

Discussions in the framework of the int:net project suggested that an attempt should be made to describe key elements and processes of interoperability in the various frameworks for a future energy system. Chapter 2.2 outlines those elements and tries to give a structure to the respective discussion. For clarity reasons and with respect to GWAC, int:net decided to describe them as a separate “layer 6”. For consistency with the existing SGAM descriptions, these elements could of course also be built into the SGAM “business layer”.

2.2 SGAM Layer 6: interoperability of stakeholders and institutions

The future energy system will be way more complex. Distributed systems explode not only the numbers of installations but also the number of involved stakeholders. Their roles need to be defined with rights and obligations. The “Harmonized Electricity Market Role Model” (HEMRM) [].is an exhaustive attempt to describe these roles – at least for the world of electricity.[2] But not only the number of participants in the system grow, the number of interfaces, dependencies, and potential inconsistencies explodes as well. Political and regulatory, standardization, validation and involvement frameworks need to cope with that situation. In such a governance framework, institutions need to agree which standards shall be mandatory to follow in specific cases. They need to agree on a level of interoperability that shall be mandatory for the implementation in their country or business domain. Owners of funding programs would need to agree on interoperability prerequisites for projects to be funded. And last not least there needs to be a governance framework that defines how interoperability shall be validated. Chap. 2.5 presents the “Connectathon model” for validation exercises. This approach clearly strives to involve governance institutions which should get trust in the tested solutions and may refer to them in legislation, regulation or product policies.

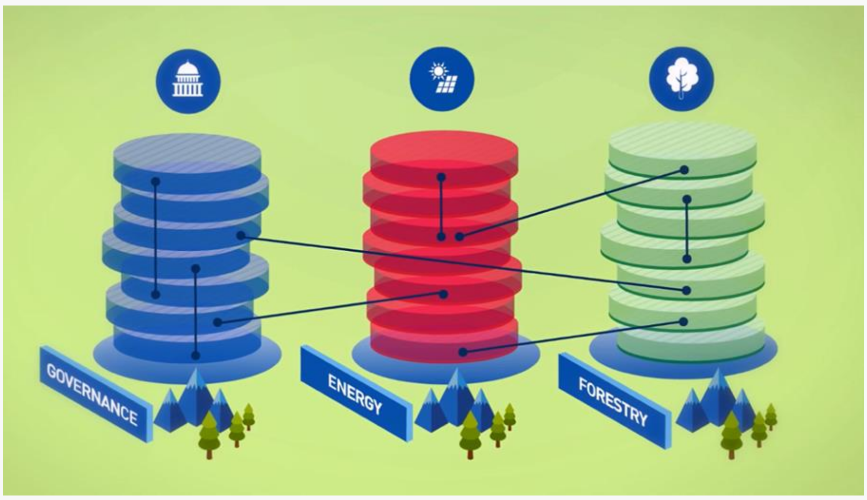
Such considerations need to accompany the approaches developed with SGAM. The 5th layer of SGAM (business layer) covers some of these aspects with respect to the feasibility of business cases for solutions described on SGAM layers 1 – 4. However, this layer is much oriented to business cases and cannot cover political or regulatory and not at all societal interoperability in broad systems. Therefore, the proposal of int:net is the addition and definition of another SGAM layer. When talking about such a “6th layer” (see Fig. 4 SGAM plus), interoperability of a broad range of stakeholder groups needs to be addressed, amongst those:

- Policy makers in politics and public authorities on multiple levels from national to municipal
- Regulatory bodies
- Market operators (from global to national to regional and local marketplaces)
- Standardisation organisations (national and international)

[2] The EC funded project Platone together with various other projects has described an extension to the existing HEMRM. With respect to the changing frameworks, mainly in the fields of digitalisation and distributed systems, it extends the model with various other roles.

- Supplier associations
    - for energy (e.g., ENTSO-E, DSO Entity)
    - for technology (e.g., T&D Europe, AIOTI)
- Consumption Associations
    - Industry and other business associations
    - Building associations
    - Consumer associations
- Research, innovation and other funding programs (national, transnational, international)
- Institutions for education and human capital development
- Infrastructure operators (e.g., for transport, health)
- Finance and investment institutions (e.g., ECB, EIB, EU facilities, EFRAG).

Such associations and institutions act on national or international and on multiple governance levels. The Interreg Alpine Space funded project IMEAS (Integrated and Multi-level Energy models for the Alpine Space) has outlined the need of horizontal, vertical, and transversal collaboration (graphically depicted in Fig. 3 and explained in the IMEAS video). The IMEAS project described models of cooperation between the governance silos of various domains. In Europe, almost every domain is oragnized in 6-7 governance layers. In Policy they range from European commission to national government down to administration of city districts. In the energy domain the range is from European wide associations (e.g. ENTSO-E, E.DSO) through national industry associations and industrial groups to homeowners associations. Inside a silo, stakeholder groups have developed decent means and measures of collaboration and decision making. Often cooperation is low between the respective layers of multiple silos. When it comes to interoperability in the energy system, collaboration and matching of standards and approaches in multiple “silos” is key.

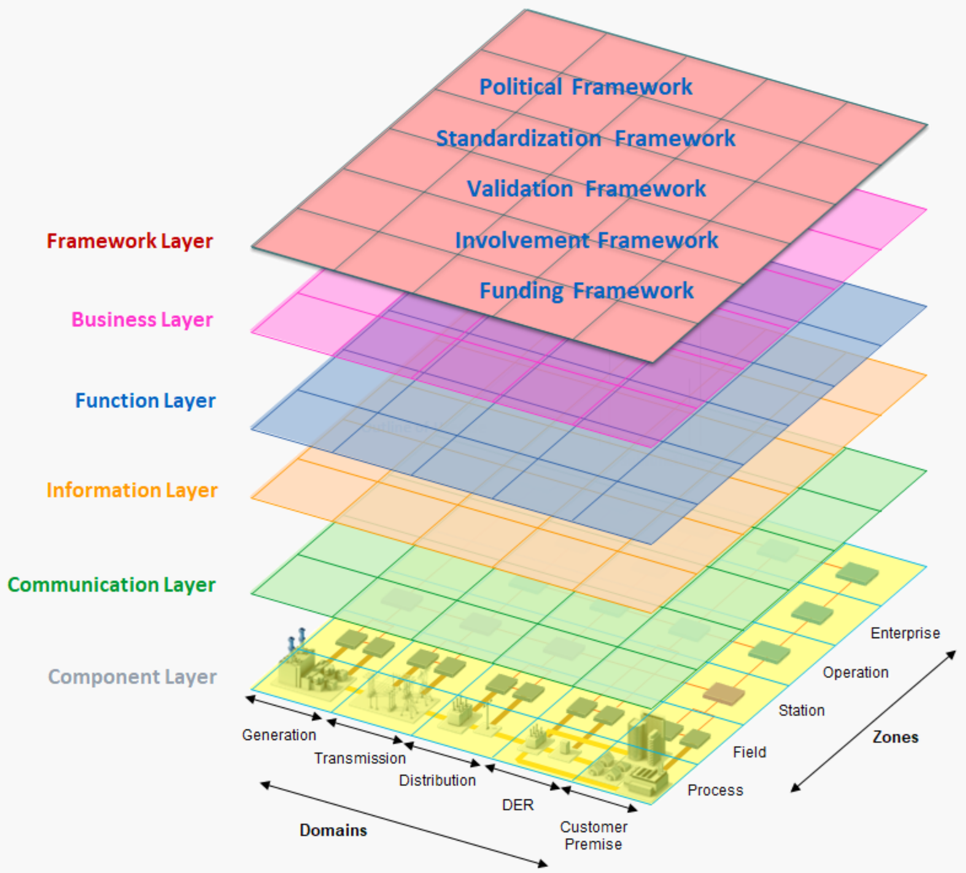


Source: https://www.imeas.eu/

Fig. 3 Multilevel sector coupling

Yet another attempt to foster collaboration across boundaries is the National Stakeholders Coordination Group (NSCG) in the framework of ETIP SNET. The NSCG "provides a sounding board and exchange platform for national R&I stakeholders in the area of energy systems and networks. Its purpose and goal is to support the implementation of SET-Plan Action 4 on Integrated and Flexible Energy Systems. It enables national stakeholders to contribute actively and in a coordinated way to the SET-Plan goals."

Drawing from the mentioned initiatives and to support those and other framework setting entities, int:net develops and describes methods to improve and foster collaboration as a key ingrediency of interoperability.



source: B.A.U.M.

Fig. 4 SGAM plus: the 6th layer

Chapter 3 will elaborate more on the interdependencies, interfaces and interoperability challenges on SGAM Layer 6. As a first overview, Fig. 5 outlines the key roles and their activities while Table 1: Roles on SGAM layer 6 and Table 2 give an overview of the topics to be discussed at the interfaces.

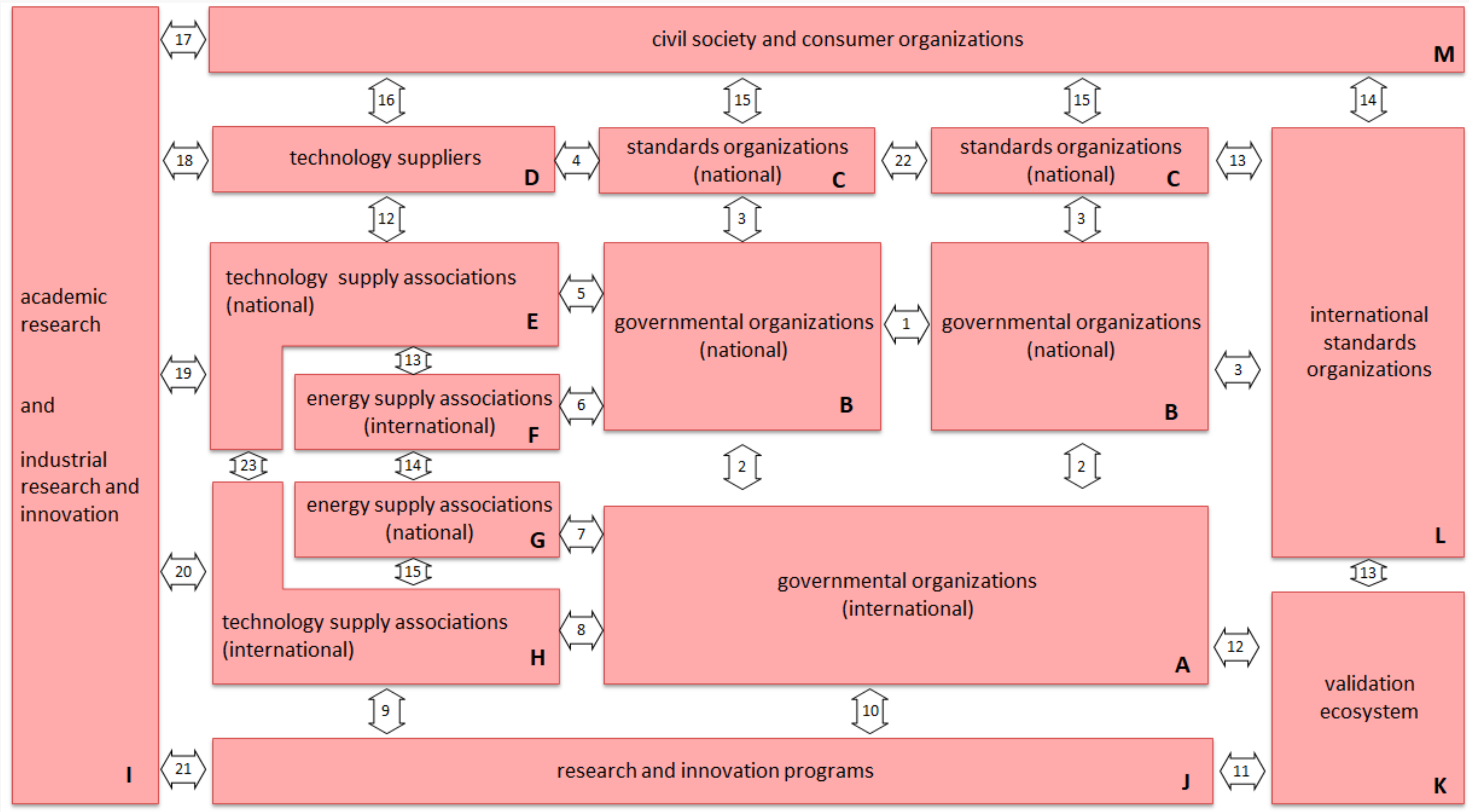


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Fig. 5 Roles and interfaces on the 6th layer of SGAM

Table 1: Roles on SGAM layer 6

interface	type of entity	typical activities	examples
(A)	governmental organizations(international)	• y • y • y	• European Commission •
(B)	governmental organizations (national)	•	• ministries • regulatory bodies
(C)	standards organizations (national)	•	• DKE •
(D)	technology suppliers	•	• Siemens, ABB, …
(E)	technology supply associations (national)	•	• BDI
(F)	energy supply associations (international)	•	• ENTSO-E, E.DSO • DSO Entity, GEODE, …
(G)	energy supply associations (national)	•	• BDEW, VKU •
(H)	technology supply associations (international)	•	• T&D Europe • AIOTI •
(I)	academic research and industrial research and innovation	•	• universities • research centers •
(J)	research and innovation programs	•	• EU programs (Horizon, Life, …) • national funding programs • ERA-Net, Partnerships • Interreg •

under discussion; to be completed in the second half of the int:net project

interface	type of entity	typical activities	examples
(K)	validation ecosystem	•	• DERLAB •
(L)	international standards organizations	•	• CENELEC • CEN • ISO • IEC
(M)	civil society and consumer organizations	•	• ECC-Net •

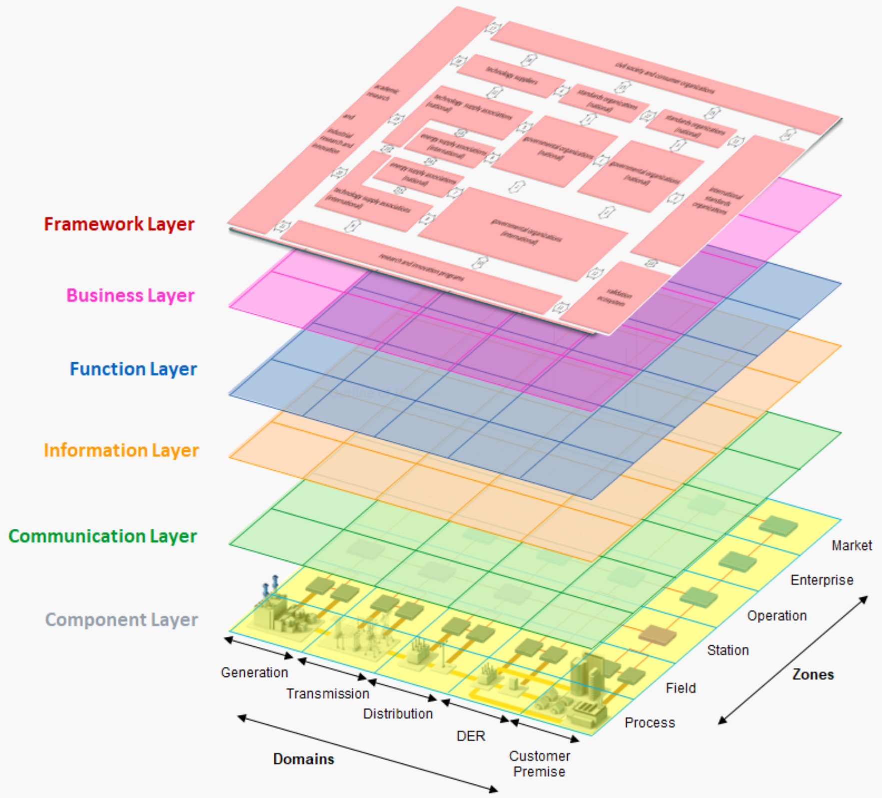
Table 2: Interfaces of roles: how to boost interoperability?

interface	topics to be defined, described and discussed	hurdles and deficiencies	measures and tools to foster interoperability
(0)	•	•	•
(1)	•	•	•
(2)	•	•	•
(3)	•	•	•
(4)	•	•	•
(5)	•	•	•
(6)	•	•	•
(7)	•	•	•
(8)	•	•	•
(9)	•	•	•
(10)	•	•	•
(11)	•	•	•
(12)	•	•	•
(13)	•	•	•

under discussion; to be completed in the second half of the int:net project

interface	topics to be defined, described and discussed	hurdles and deficiencies	measures and tools to foster interoperability
(14)	•	•	•
(15)	•	•	•
(16)	•	•	•
(17)	•	•	•
(18)	•	•	•
(19)	•	•	•
(20)	•	•	•
(21)	•	•	•
(22)	???		???
(23)	???		???

As depicted in Fig. 6, the interoperating entities can be considered to constitute SGAM Layer 6. This model needs further investigation and will be discussed in the second half of the int:net project.



source: B.A.U.M.

Fig. 6 SGAM plus: the entities constituting the 6th layer

2.3 SGAM and Holistic Interoperability: tubes in the cube

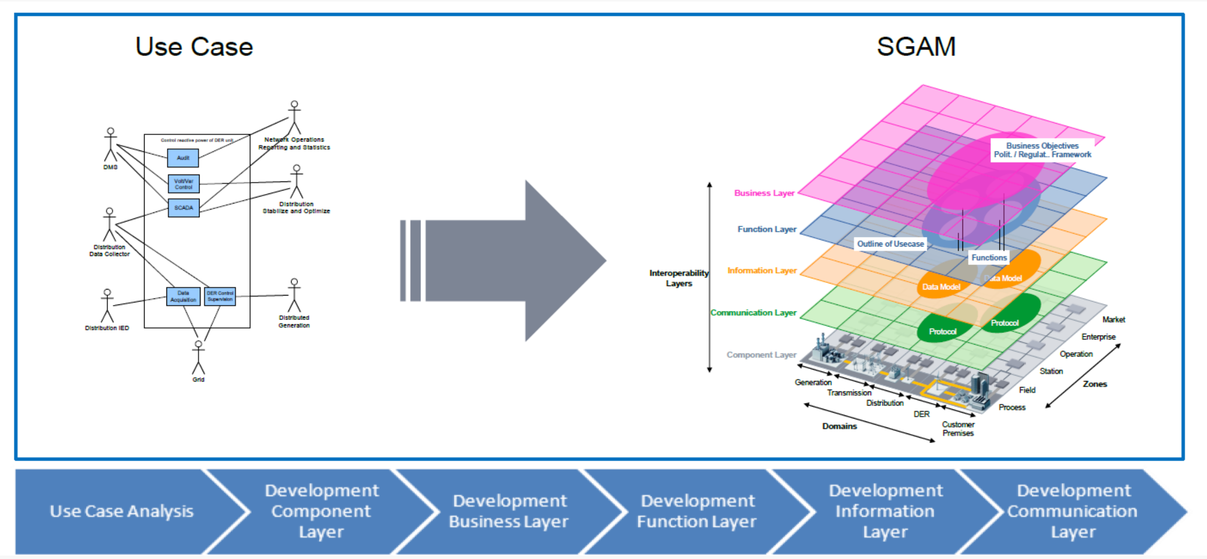
Interoperability in SGAM has often been misunderstood. It is not only about standardized datasets and protocol that allow communication between domains, zones or layers. Chapter 2.2 has outlined that collaboration in framework setting is definitely necessary to implement consistent and effective use cases. Moreover, also on the technical, functional and business layers a big variety of interfaces and interoperating needs to be agreed upon.

According to CEN-CENELEC and the mandate M/490, SGAM can serve the description of use cases with respect to standards in multiple dimensions:

- Mapping of use cases in order to validate the support by standards,
- Identifying gaps in respect to standards,
- Mapping of existing architectures into a general view,
- Developing smart grid architectures.

As outlined in Fig. 7, the development process for an SGAM description of a use case touches the layers in a specific sequence:

1. Component layer,
2. Business layer,
3. Function layer,
4. Information layer,
5. Communication layer.



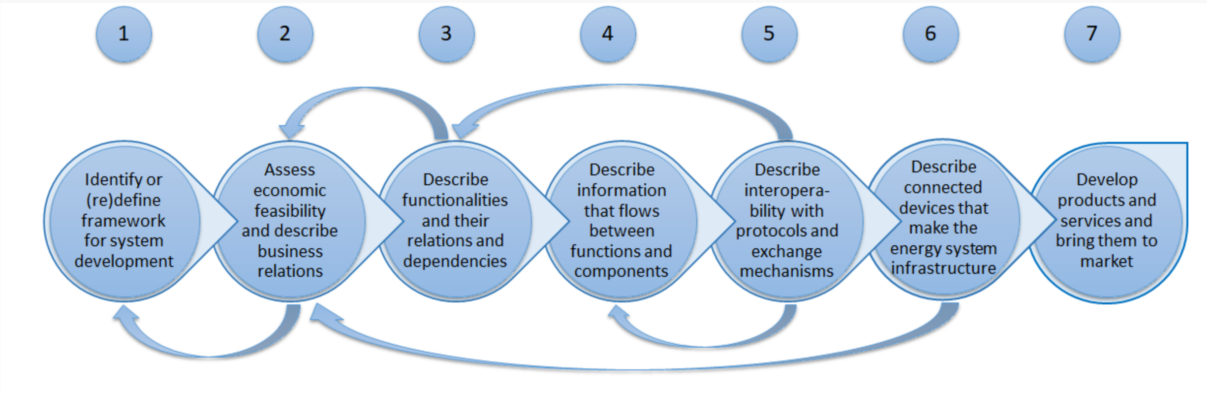
Source: CEN-CENELEC M/490.

Fig. 7 Use case mapping with SGAM

With the introduction of a framework layer (ref. chap. 2.2), the work process should rather be described as outlined in Fig. 8. It is worth noting that at various stages of development there might be reasons to set back and revisit previous steps. Reasons could be:

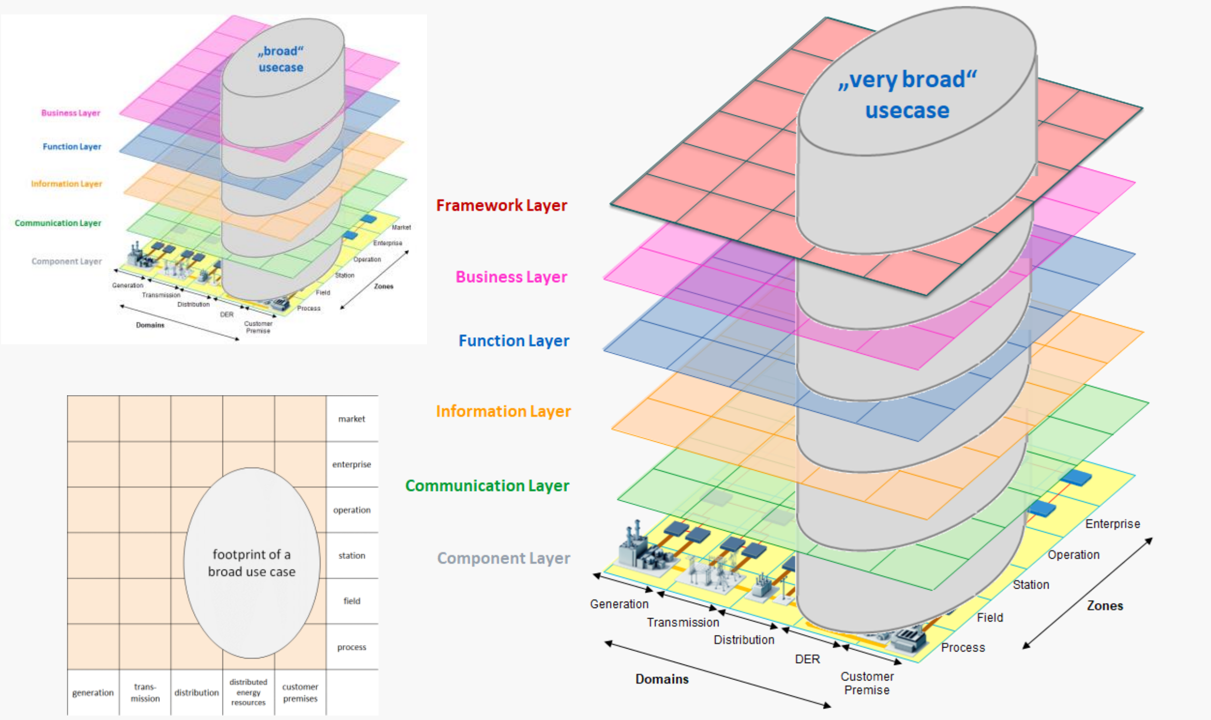
- It turns out that the goals that policy has set cannot be realized with a reasonable amount of investment. Or envisioned business cases cannot be implemented due to legal restrictions. An example would be Energy Communities for self-supply of power for EV charging or cooperatively owned heat-pumps.
- When developing a consistent set of functions (which should at the end be implemented with hardware or software on the component layer) it turns out that supportive functions (better: products or solutions) are needed which do not exist or can only be used at high prices.
- When describing protocols and exchange mechanisms it turns out that more functions are needed to ensure interoperability. An example would be a “translation function” for protocols or data sets in cases where existing solutions cannot adapt to a new communication standard.
- Before bringing a solution or product to market, it could turn out that meanwhile the prices for

the necessary components have drastically increased or the legal or regulatory framework does not allow to implement the envisioned business model. In such cases the business layer will have to be revisited to decide on changes in the business case. In a worst case it will be necessary to bring the case back to the framework layer with a request to amend the framework.



Source: B.A.U.M.

Fig. 8 Developing solutions by investigating interoperability on SGAM layers

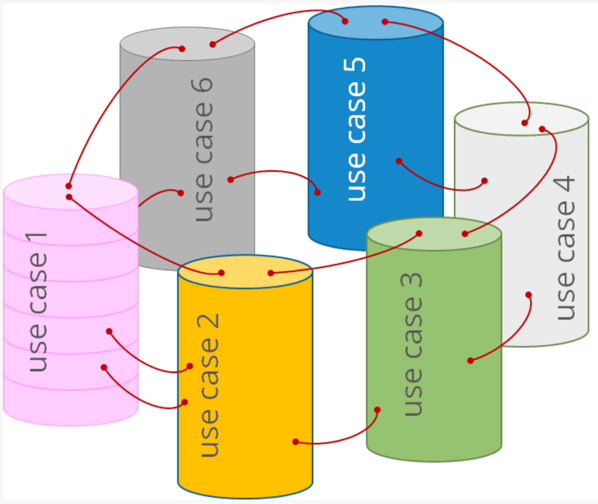


Source: B.A.U.M.

Fig. 9 Very broad use cases: the tube in the cube

With this development model in mind, it becomes very clear that for each use case it will be necessary to consider elements and their relations on all SGAM levels. Fig. 9 depicts this approach as a “tube in the cube”. When discussing interoperability “in a tube”, developers should follow some basic principles:

1. Clearly define the scope of the tube. Use cases should not be selected with too big scopes to not make development and descriptions un-manageable. One should rather describe sets of use cases that jointly make up a system (as depicted in Fig. 10). As a test, int:net has selected some “key use cases” which are described in chap. 2.4 and will be used to further discuss the int:net model of interoperability in “connected, very broad use cases”.



Source: B.A.U.M.

Fig. 10 Connected, very broad use cases

2. Cover all SGAM layers and mainly describe the relations between involved zones and domains. Consider what effects can be implied on neighboring levels up and down in the tube when interoperability shall be achieved on one level. Will it need more effort and time to implement specific functions? How will costs and business cases be affected? Will new elements be needed in the framework (SGAM layer 6)?
3. Always start development and description of a use case by assessing the existing and expected framework. Seriously take into account the involved stakeholders – mainly on SGAM levels 6, 5 and 4, but also level 1 when the infrastructure to be deployed might create resistance, opposition or just anxieties.
4. For connected use cases (see Fig. 10) carefully assess the interfaces and consider tools designed for the “translation between the silos”. This could be of outstanding importance for layer 6 where multiple groups of framework setters work in completely different legal and regulatory frameworks and might be less experienced in collaboration and creation of interoperability with other domains.
5. <more principles to be added after the developments in int:net phase 2>

2.4 Key Use Cases of int:net

Wisely managing data will be key to the success of all domains, not the least the energy sector. The EC tries to foster this "wisdom" with various activities for the description and development of "data spaces". The cluster of energy data spaces projects includes int:net as well as the five Innovation Actions (IA) belonging to the Horizon-Europe call "Establish the grounds for a common European energy data space", namely ENERSHARE, OMEGA-X, DATA CELLAR, SYNERGIES, and EDDIE; this cluster has drafted a model to describe a Common European Energy Data Space (CEEDS) [3]. The rational behind this activity is that energy markets will not be working without full digitalisation and efficient data exchange environments.

Not the least with respect to the mentioned European attempts to better understand relevant dataspaces, the int:net consortium selected 5 "very broad key use cases" to check its methodologies. These very broad use cases (in the sense of chap. 2.3) have been selected so to allow for matching them with the CEEDS use cases in further steps of the int:net project.

The selected "int:net key use cases" are:

Key Use Case 1: Electric Vehicle Charging [4]

Key Use Case 2: Flexibility Management for Frequency Control [5]

Key Use Case 3: Energy Communities and Energy Sharing [6]

Key Use Case 4: Smart Meter Reading and Demand Side Management [7]

Key Use Case 5: RES Operation and Maintenance [8]

The broad use cases comprise multiple specific use cases as found throughout the "Analysis of relevant use cases" in int:net WP 1. Table 3 gives and overview using selected uses from WP 1, whereas further descriptions of the selected use cases will be developed throughout the second half-time of the int:net project. For the specific use cases whose descriptions are in line with SGAM, Table 3 indicates the interoperability layers that are reported in the corresponding documentation as well as the application priority layers (introduced by int:net WP); the current version of the table does not include the correspondences among the application priority layers and the use cases without a documentation based on SGAM. Moreover, the same table includes the information on the domains and zones covered by each key use case in SGAM (according to the presented concept of the tube), while every interoperability layer is addressed. Additionally, the correspondences among the key use cases and the application priority areas are indicated. In the version 2 of this document, Table 3 will be updated to include complete information related to every key use-case.

The "key use cases" will be used as the examples for testing int:net tools (such as the EMINENT maturity model) and the implementation of validation exercise (e.g. the Connectathons as described in chap.2.5).

[3] Note that there is also an EC funded project called CEEDS (Collective Experience of Empathic Data Systems) which tries to make the subconscious 'visible' by gauging our sensory and physiological reactions to the flow of Big Data. For the further discussion of the role of stakeholders in interoperability this project may be valuable, too.

[4] relates to CEEDS use-case 4: Electromobility: services roaming, load forecasting and schedule planning

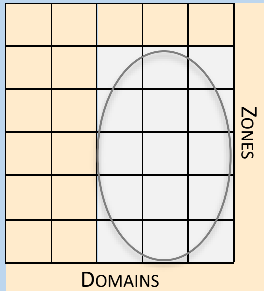
[5] relates to CEEDS use-case 3: TSO-DSO coordination for flexibility

[6] relates to CEEDS use-case 1: Collective self-consumption and optimized sharing for energy communities

[7] relates to CEEDS use-case 2: Residential home energy management integrating DER flexibility aggregation

[8] relates to CEEDS use-case 5: Renewables O&M optimization and grid integration

Table 3: Selected key broad use cases and underlying specific use cases

Project	UC ID No	Title	Covered SGAM layers and footprint					Application Priority Areas											
			business	function	information	communication	component	Network/ICT communications	Demand Side Management	Distribution Grid Management	Advanced Metering Infrastructure	Electric Vehicles	Cybersecurity	DER	Energy Management Systems	Energy trading	Microgrid	Ancillary services	Sector coupling (P2X)
		Key use case 1: **Electric Vehicle Charging** [9] [10] This use case is about technically integrating e-vehicle charging in the distribution and building grids. It implies "controlled charging" in the sense that charging processes can be controlled so to not de-stabilize the grids. This involves communicating between Charging Point Operators (CPOs) and negotiating schedules.						x	x			x		x	x			x	
Use cases with SGAM references																			
TwinErgy	HLUC03	Grid capacity enhancement utilizing e-mobility					x				x		x						
TwinErgy	PUC03.01	Booking a charge session					x												
TwinErgy	PUC03.02	Smart Charging to follow grid requests					x												
TwinErgy	PUC03.03	Smart Charging to maximize RES integration					x				x		x						
TwinErgy	PUC03.04	Smart Charging to minimize charge costs					x												
TwinErgy	PUC03.05	Smart Charging to minimize time of charge					x												
TwinErgy	PUC03.06	Grid management					x				x		x						

[9] For full description of use cases cf. "Analysis of relevant use cases" of int:net WP 1

[10] For depiction of footprint cf. Fig. 9

Table 3: Selected key broad use cases and underlying specific use cases

			Covered SGAM layers and footprint					Application Priority Areas											
Project	**UC ID No**	**Title**	business	function	information	communication	component	Network/ICT communications	Demand Side Management	Distribution Grid Management	Advanced Metering Infrastructure	Electric Vehicles	Cybersecurity	DER	Energy Management Systems	Energy trading	Microgrid	Ancillary services	Sector coupling (P2X)
Other use cases																			
MERLON	UC8	Services provision from local flexibility systems to the transmission system																	
XFLEX	Use Case 3.2	Electric vehicles modeling and forecasting																	
TDX Assist	WP2_UC04	Enabling new products for energy markets, facilitate market development																	
TDX Assist	WP2_UC07	Creating new operational paradigms for network connection																	
TDX Assist	WP2_UC08	Providing metering and service provision monitoring infrastructure for future Electric Vehicles (EV)																	
InteGrid	HLUC09	Home Energy Management																	
InteGrid	PUC01.11	Engage Consumers in Comfort-Oriented Demand Side Management in Smart Homes																	
InteGrid	PUC01.9	Collect Data and Schedule Optimization																	
InteGrid	PUC02.9	Automate Devices and Verify Activation																	
EUSysFlex	FI-AP1	Manage active power flexibility to support FCRn in the Finnish demo																	
ACCEPT	UC6	Day-ahead smart charging flexibility quantification via EV usage pattern profiling and forecasting																	
MAESHA	UC1	Frequency control																	
MAESHA	UC3	Minimization of the consumption peak																	
MAESHA	UC4	Maximization of the use of Renewable Energy Sources																	

Table 3: Selected key broad use cases and underlying specific use cases

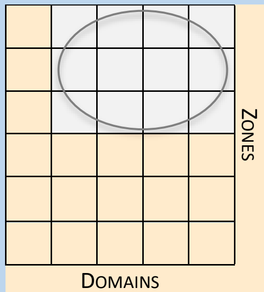
			Covered SGAM layers and footprint					Application Priority Areas											
Project	**UC ID No**	**Title**	business	function	information	communication	component	Network/ICT communications	Demand Side Management	Distribution Grid Management	Advanced Metering Infrastructure	Electric Vehicles	Cybersecurity	DER	Energy Management Systems	Energy trading	Microgrid	Ancillary services	Sector coupling (P2X)
		Key use case 2: **Flexibility Management for Frequency Control** This use case describes the market-based approaches to flexibility management. It is limited to the provision and trading of decentral flexibilities to stabilize grid frequency. In that sense it is a sub-set of the overall use case "coordination of flexibility" (as addressed in CEEDS use case 3).						x						x		x		x	
Use cases with SGAM references																			
MAESHA	UC1	Frequency control		x			x		x				x	x					
PLATONE	UC-GR-4	Frequency support by the distribution network	x	x					x										
Flexgrid	HLUC_03_UCS_02	TSO-DSO collaboration for coordinated management of aggregated FlexAssets and interaction between networks' and flexibility markets' operation	x						x										
EUSysFlex	FI-AP1	Manage active power flexibility to support FCRn in the Finnish demo					x		x				x						
Flexgrid	HLUC_01	FLEXGRID ATP offers advanced market clearing services to the Flexibility Market Operator (interaction between markets and networks' operation)							x		x		x						
Other use cases																			
TDX Assist	WP1_BUC7	Coordination of operational planning activities between TSO and DSO																	

Table 3: Selected key broad use cases and underlying specific use cases

			Covered SGAM layers and footprint					Application Priority Areas											
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TDX Assist	WP1_BUC1	Activation of DSO-connected resources for balancing purposes in market environment																	
TDX Assist	WP1_BUC3_4	Optimize active power management by the System Operator for congesting management purposes																	
TDX Assist	WP1_SUC01	Market pre-qualifcation																	
TDX Assist	WP1_SUC02	Maket offering																	
TDX Assist	WP1_SUC03	Maket services activation																	
TDX Assist	WP1_SUC10	Process and HV/MV substation use limit (Smax) request																	
TDX Assist	WP1_SUC11	Process a MV network reconfiguration request																	
TDX Assist	WP2_UC03	Activating different flexibility services at DSO level at different timeframes																	
TDX Assist	WP2_UC04	Enabling new products for energy markets, facilitate market development																	
TDX Assist	WP2_UC07	Creating new operational paradigms for network connection																	
TDX Assist	WP2_UC09	Managing electricity grid congestion																	
TDX Assist	WP2_UC10	Balancing supply and demand																	
InteGrid	HLUC02	Distributed monitoring and control of LV network using available flexibilities																	
InteGrid	HLUC01	Operational planning (from hours to week-ahead) of MV distribution network to pre-book available flexibility																	
InteGrid	HLUC10	Aggregate and communicate multi-period behind-the-meter flexibility from LV and MV consumers																	
InteGrid	HLUC07	Procure and manage regulated flexibilities from DER to optimize operation and costs																	

Table 3: Selected key broad use cases and underlying specific use cases

			Covered SGAM layers and footprint					Application Priority Areas											
Project	**UC ID No**	**Title**	business	function	information	communication	component	Network/ICT communications	Demand Side Management	Distribution Grid Management	Advanced Metering Infrastructure	Electric Vehicles	Cybersecurity	DER	Energy Management Systems	Energy trading	Microgrid	Ancillary services	Sector coupling (P2X)
InteGrid	HLUC11	Engage Consumers in Demand Side Management Programs																	
InteGrid	PUC02.11	Engage Consumers in Demand Side Management Programs Utilizing a Social Context																	
InteGrid	HLUC05	Manage the impact of flexibility activation from resources connected to the distribution network																	
InteGrid	HLUC08	Manage internal processes' flexibility to minimize energy costs according to market-driven mechanisms and system operators requests																	
InteGrid	HLUC12	Aggregate geographically distributed third-party (multi-client) resources to offer ancillary services to TSO (frequency) and DSO (non-frequency)																	
InteGrid	PUC01.1	Reserve distribution flexibility offers to solve constraints detected in operational planning and optimize MV network operation																	
InteGrid	PUC02.5	Post-activation selection of programs																	
InteGrid	PUC01.12	Commercial VPP for offering ancillary services to TSO																	
InteGrid	PUC02.2	Estimate the operating conditions of the LV network in real time																	
InteGrid	PUC02.10	Participation in Intraday and Ancillary Services Market																	
InteGrid	PUC02.12	Flexibility operator of technical VPP																	
InteGrid	PUC01.7	Technical pre-qualification procedure/requirements for the DSO																	
InteGrid	PUC01.5	Ex-ante evaluation of the flexibility programs by the traffic light system																	
EUSysFlex	SUC_05	Collect energy data																	
EUSysFlex	SUC_14	Manage sub-meter data																	

Table 3: Selected key broad use cases and underlying specific use cases

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EUSysFlex	FI-AP1	Manage active power flexibility to support FCRn in the Finnish demo																	
EUSysFlex	IT-RP	Manage reactive power flexibility to support voltage control and congestion management in the Italian demo																	
EUSysFlex	SUC_10	Manage flexibility activations																	
EUSysFlex	SUC_11	Manage flexibility activations_2																	
EUSysFlex	SUC_18	Verify and settle activated flexibilities																	
EUSysFlex	FI-RP	Manage reactive power flexibility to support voltage control in the Finnish demo																	
EUSysFlex	IT-AP	Manage active power flexibility to support mFRR/RR and congestion management in the Italian demo																	
EUSysFlex	DE-RP	Manage reactive power flexibility to support voltage control and congestion management in the German demo																	
EUSysFlex	PT VPP-AP1	Manage VPP active power flexibility to support aFRR in VPP Portuguese demo																	
EUSysFlex	PT VPP-AP2	Manage VPP active power flexibility to support mFRR/RR in VPP Portuguese demo																	
EUSysFlex	SUC_03	Authenticate data users																	
EUSysFlex	SUC_06	Erase and rectify personal data																	
EUSysFlex	SUC_08	Manage access permissions																	
EUSysFlex	SUC_09	Manage data logs																	
EUSysFlex	SUC_12	Manage flexiblity bids																	
EUSysFlex	SUC_13	Manage flexiblity bids_2																	
EUSysFlex	SUC_15	Predict flexibility availability																	
EUSysFlex	SUC_16	Provide list of suppliers and ESCOs																	

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			Covered SGAM layers and footprint					Application Priority Areas											
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EUSysFlex	SUC_17	Transfer energy data																	
EUSysFlex	SUC_01	Aggregated energy data																	
EUSysFlex	FI-AP2	Manage active power flexibility to support mFRR/RR in the Finnish demo																	
EUSysFlex	DE-AP	Manage active power flexibility to support congestion management and voltage control in the German demo																	
EUSysFlex	PT FxH-RP	Manage reactive power flexibility to support voltage control and congestion management in the FlexHub Portuguese demo																	
EUSysFlex	PT FxH-AP	Manage active power flexibility to support mFRR/RR and congestion management in the FlexHub Portuguese demo																	
EUSysFlex	SUC_04	Calculate flexiblity baseline																	
EUSysFlex	SUC_07	Exchange data between DERs and System Operators																	
ACCEPT	UC5	Intra-day district-level DER flexibility management for community self-balancing																	
ACCEPT	UC11	Retailer day-ahead optimal pricing configuration for aggregated portfolio balancing																	
ONENET	EACL-SL-01	Congestion management in distribution grids under market conditions																	
ONENET	NOCL-01	Northern flexibility market																	
ONENET	SOCL-CY-01	Active power flexibility																	
ONENET	WECL-ES-01	Long-term congestion management																	
ONENET	WECL-ES-02	Short-term congestion management																	
ONENET	WECL-FR-01	Improved monitoring of flexibility for congestion management																	

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ONENET	WECL-FR-02	Improved TSO-DSO information exchange for DER activation																	
ONENET	WECL-PT-01	Exchange of Information for Congestion Management – Short Term																	
ONENET	WECL-PT-02	Exchange of Information for Congestion Management – Long Term																	
ONENET	WECL-PT-03	Exchange of information for operational planning																	
ONENET	EACL-CZ-01	Nodal area congestion management																	
ONENET	EACL-HU-02	HV/MV transformer overload																	
ONENET	EACL-PL-01	Prequalification of resources provided by FSPs to support flexibility services in the Polish demonstration																	
ONENET	EACL-PL-02	Managing flexibility delivered by DER to provide balancing services to TSO																	
ONENET	EACL-PL-03	Event-driven Active Power Management for Congestion Management and voltage control by the DSO																	
ONENET	EACL-PL-04	Balancing Service Provider on the Flexibility Platform																	
INTERRFACE	BUC_5.1b	Congestion management “LV regulation Power quality” Business Use Case																	
INTERRFACE	BUC_5.1a	Congestion management “SO-Supplier”																	
INTERRFACE	BUC_5.1c	Congestion management “Local Energy Community” Business Use Case																	
INTERRFACE	BUC_5.2	Aggregated CM service to the TSO/DSO Fast balancing reserve to the TSO Non-frequency ancillary services to the TSO/DSO																	
INTERRFACE	BUC_6.2	Flexibility services for DSO congestion management and allowing more renewable connection without unreasonable DSO network investments (T6.2 Demo)																	

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INTERRFACE	BUC_5.3	mFRR demonstration: Single Flexibility Platform																	
INTERRFACE	BUC_5.3	aFRR demonstration: Single Flexibility Platform																	
INTERRFACE	BUC_5.3	FCR demonstration: Single Flexibility Platform																	
INTERRFACE	BUC_5.3	Congestion management operational demonstration: Single Flexibility Platform																	
INTERRFACE	BUC_5.3	Congestion management short-term demonstration: Single Flexibility Platform																	
INTERRFACE	BUC_5.3	Congestion management long-term demonstration: Single Flexibility Platform																	
INTERRFACE	BUC_7.1a	Regional inter-zonal provision of Balancing (FCR, aFRR, mFRR) services in South-East Europe																	
INTERRFACE	BUC_7.1b	Regional inter-zonal provision of Congestion Management services in SouthEast Europe																	
MAESHA	UC1	Frequency control																	
MAESHA	UC3	Minimization of the consumption peak																	
PLATONE	UC-GR-4	Frequency support by the distribution network																	
PLATONE	UC-IT-2	Congestion management																	
TwinErgy	HLUC03	Grid capacity enhancement utilizing e-mobility																	
TwinErgy	PUC03.03	Smart Charging to maximize RES integration (green electricity)																	
TwinErgy	PUC03.06	Grid management																	
XFLEX	Use Case 1.1	IntraPortfolio P2OptimalUse																	
XFLEX	Use Case 1.2	Ancillary Services participation - TSO level																	
XFLEX	Use Case 1.3	Ancillary Services participation – Grid operator level																	
XFLEX	Use Case 1.7	Real time congestion detection and management																	
XFLEX	Use Case 3.5	TSO - DSO cooperation schemes																	

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Flexgrid	HLUC_01_UCS_02	Market-based local congestion management using FLEXGRID ATP in distribution networks using output from AC-OPF model calculation as dynamic input for ATP																	
Flexgrid	HLUC_01_UCS_04	FLEXGRID ATP operates as a gateway to redirect local active power flexibility to TSO platforms (interaction with existing TSO balancing markets)																	
Flexgrid	HLUC_01	FLEXGRID ATP offers advanced market clearing services to the Flexibility Market Operator (interaction between markets' and networks' operation)																	
Flexgrid	HLUC_03	FLEXGRID ATP offers advanced flexibility demand management services to system operators																	
Flexgrid	HLUC_03_UCS_03	TSO deals with a frequency control problem either by aggregating flexibility from multiple FlexAssets or through a market-based mechanism																	
Flexgrid	HLUC_01_UCS_01	Distribution network aware Flexibility Market Clearing via FLEXGRID ATP																	
Flexgrid	HLUC_02	FLEXGRID ATP offers advanced flexibility supply management services to Energy Service Providers																	
Flexgrid	HLUC_04_UCS_03	ESP maximizes its profits by dynamically orchestrating distributed FlexAssets from its end users in order to optimally participate in several energy markets																	
GIFT	UC1	Congestion avoidance																	
iFLEX	HLUC-2	Manage flexibility requests or price signals at individual premises level;																	
iFLEX	HLUC-3	Manage flexibility requests or price signals at building level																	

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iFLEX	BUC-8	Offer flexibility through participation in explicit demand response programmes																	
CoordiNet	BUC ES-1	Congestion management- Common Market Model																	
CoordiNet	BUC ES-2	Balancing services for TSO – Central Market Model																	
CoordiNet	BUC GR-2a	Congestion Management – Multi-level Market Model																	
CoordiNet	BUC GR-2b	Congestion Management – Fragmented Market Model																	
CoordiNet	BUC SE-1a	Congestion management – Multi-level Market Model (in combination with BUC SE-3)																	
CoordiNet	BUC SE-1b	Congestion management - Distributed Market Model																	
CoordiNet	BUC SE-2	Balancing services for local DSO (in Gotland) – Local Market Model																	
CoordiNet	BUC SE-3	Balancing services for TSO – Multi-level Market Model (in combination with BUC SE-1a)																	
Platoon	HLUC P-2a- 01	Electricity Balance																	
Platoon	LLUC -P-2a-01	Balancing on regional level																	
Platoon	LLUC-P-2a-02	Balancing on country level																	
Platoon	LLUC- P-2a-03	Demand forecast on transmission level																	
Platoon	LLUC- P-2a-04	Wind generation forecasters																	
Platoon	LLUC -P-2a-05	Effects of Renewable Energy Sources on the Power System																	
Platoon	LLUC- P-2a-06	Research Data Management																	
MERLON	UC3	Explicit Demand Response through context-aware flexibility profiles																	
MERLON	UC8	Services provision from local flexibility systems to the transmission system																	

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MERLON	UC9	Participation of local flexibility sources in electricity energy markets																	
MERLON	UC1	Integration of battery storage systems in local energy systems																	
MERLON	UC2	Local distribution network management with battery storage solutions																	
MERLON	UC10	Flexibility Marketplace Establishment																	
Smart Grids UC	PARITY_UC-08	Congestion management by DSO through operation of LFM to increase DER penetration																	
Smart Grids UC	X-FLEX_UC2-5	State Estimation																	
Smart Grids UC	X-FLEX_UC2-7	Real time congestion detection and management																	

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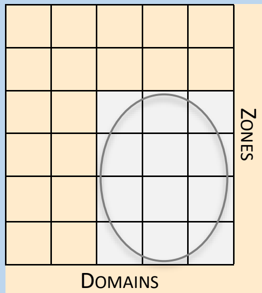
		Key use case 3: **Energy Communities and Energy Sharing** The scope of this use case is (only) the technical instantiation and operation of energy communities, aiming at the collective self-consumption and the optimization of energy sharing on a local level. It covers mechanisms to collect and share data, issue control signals and react to request from the grid.						x	x		x			x			x	x	
Use cases with SGAM references																			
GIFT	UC4	Procida LEC	x	x					x										
JRC	UC01	Load Management Based on Demand Response/Demand Side Management	x	x		x				x									
Integrid	HLUC09	Home Energy Management		x		x	x		x	x									
Integrid	PUC01.11	Engage Consumers in Comfort-Oriented Demand Side Management in Smart Homes		x		x	x		x	x	x								
PLATONE	UC-DE-1	Islanding	x		x	x			x										
ACCEPT	UC5	Intra-day district-level DER flexibility management for community self-balancing		x					x				x						
ACCEPT	UC2	Building self-consumption employing Virtual Thermal Energy Storage optimisation		x					x		x		x						

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ACCEPT	UC3	Consumer demand-side flexibility forecasting and optimisation taking into account comfort boundaries, activity patterns and possible requirements		x					x		x								
Other use cases																			
ACCEPT	UC5	Intra-day district-level DER flexibility management for community self-balancing																	
ACCEPT	UC2	Building self-consumption employing Virtual Thermal Energy Storage optimisation																	
ACCEPT	UC3	Consumer demand-side flexibility forecasting and optimisation taking into account comfort boundaries, activity patterns and possible requirements																	
ACCEPT	UC6	Day-ahead smart charging flexibility quantification via EV usage pattern profiling and forecasting																	
ACCEPT	UC7	Community-level P2P flexibility/ energy exchange based on locally produced renewable energy																	
ACCEPT	UC8	Participation in explicit Demand Response schemes																	
ACCEPT	UC10	Community flexibility bundling for local congestion management service																	
ACCEPT	UC12	Optimal scheduling and operation of heating generation for a cost-efficient district-level DER management																	
ACCEPT	UC13	Increase self-consumption at local community level																	
ACCEPT	BC1	Energy Community as Flexibility Aggregator																	
ACCEPT	BC2	Energy Community as an Energy Service Company (ESCO) offering energy management services																	
ACCEPT	UC1	Monitoring and Visualization of Metering & Sensor Energy Data in community buildings																	

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ACCEPT	UC4	Demand elasticity profiling-forecasting-aggregation and analysis in community level																	
ACCEPT	UC9	Participation in implicit Demand Response schemes																	
ACCEPT	UC11	Retailer day-ahead optimal pricing configuration for aggregated portfolio balancing																	
ACCEPT	UC14	Active Citizen and LEC Engagement																	
ACCEPT	BC3	Energy Community as an Energy Service Company (ESCO) facilitating P2P flexibility trading																	
ACCEPT	BC4	Energy Community as a Retailer																	
ACCEPT	BC5	Energy Community operation via P2P flexibility trading																	
ACCEPT	BC6	Heating-as-a-Service Provider																	
ACCEPT	BC7	Prosumer engagement																	
INTERRFACE	BUC_5.1c	Congestion management "LEC" Business Use Case																	
TwinErgy	PUC09.01	Explicit Demand Response Automation and display at a consumer and community level																	
TwinErgy	PUC09.02	Implicit DR Calculation and Communication to the end-user at both a community and consumer level																	
GIFT	UC1	Congestion avoidance																	
GIFT	UC4	Procida LEC																	
GIFT	UC2	Fish farms LEC																	
GIFT	UC3	Smart harstad LEC																	
iFLEX	BUC-3	Offer the flexibility of a multi-vector energy system (building community) to the energy markets																	
iFLEX	BUC-4	Optimal energy consumption for multi-vector energy system (building community) based on the behaviour of consumers and market price signals																	

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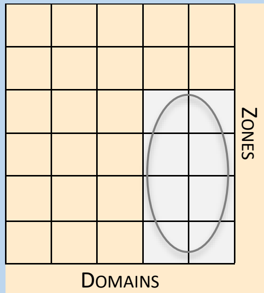
Project	UC ID No	Title	business	function	information	communication	component	Network/ICT communications	Demand Side Management	Distribution Grid Management	Advanced Metering Infrastructure	Electric Vehicles	Cybersecurity	DER	Energy Management Systems	Energy trading	Microgrid	Ancillary services	Sector coupling (P2X)
		Covered SGAM layers and footprint						**Application Priority Areas**											
		Key use case 4: **Smart Meter Reading and Demand Side Management** This broad use case covers the ICT needed to collect and administrate data from consumers and prosumers as well as controlling generation and consumption devices to serve the stability of the decentral systems. Interoperability aspects deal with aggregation and dis-aggregation of data – not the least to meet privacy and security needs.						x	x		x		x						
Use cases with SGAM references																			
EUSysFlex	SUC_05	Collect energy data				x			x				x						
EUSysFlex	SUC_14	Manage sub-meter data	x			x							x						
Other use cases																			
TDX Assist	WP2_UC06	Operation, roll-out and de-commission as well as governance of a smart metering infrastructure for third parties																	
TDX Assist	WP2_UC08	Providing metering and service provision monitoring infrastructure for future Electric Vehicles (EV)																	
TDX Assist	WP2_UC1	Acting as a data manager: Collecting, providing and processing raw data from DSO level (IED data, contracts data, metering data)																	

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TDX Assist	WP2_UC13	Making the necessary network design evolutions in consistency with appropriate functional improvement of Operational Planning (OP)																	
JRC	UC01	Load Management Based on Demand																	
InteGrid	HLUC02	Distributed monitoring and control of LV network using available flexibilities																	
InteGrid	HLUC01	Operational planning (from hours to week-ahead) of MV distribution network to pre-book available flexibility																	
InteGrid	HLUC09	Home Energy Management																	
InteGrid	HLUC07	Procure and manage regulated flexibilities from DER to optimize operation and costs																	
InteGrid	HLUC06	Provide data management and exchange between DSO and stakeholders																	
InteGrid	PUC02.11	Engage Consumers in Demand Side Management Programs Utilizing a Social Context																	
InteGrid	PUC01.11	Engage Consumers in Comfort-Oriented Demand Side Management in Smart Homes																	
InteGrid	PUC01.12	Commercial VPP for offering ancillary services to TSO																	
InteGrid	PUC01.3	Health monitoring and lifetime assessment of electrical energy storage systems																	
InteGrid	PUC02.2	Estimate the operating conditions of the LV network in real time																	
InteGrid	PUC01.9	Collect Data and Schedule Optimization																	
InteGrid	PUC02.12	Flexibility operator of technical VPP																	
InteGrid	HLUC03	Perform health diagnostics and preventive maintenance planning of distribution network assets																	
InteGrid	PUC02.9	Automate Devices and Verify Activation																	

Table 3: Selected key broad use cases and underlying specific use cases

			Covered SGAM layers and footprint					Application Priority Areas											
Project	**UC ID No**	**Title**	business	function	information	communication	component	Network/ICT communications	Demand Side Management	Distribution Grid Management	Advanced Metering Infrastructure	Electric Vehicles	Cybersecurity	DER	Energy Management Systems	Energy trading	Microgrid	Ancillary services	Sector coupling (P2X)
InteGrid	PUC02.1	Estimate the operating conditions of the MV network in real time																	
EUSysFlex	SUC_05	Collect energy data																	
EUSysFlex	SUC_14	Manage sub-meter data																	
ACCEPT	UC1	Monitoring and Visualization of Metering & Sensor Energy Data in community buildings																	
ONENET	WECL-FR-01	Improved monitoring of flexibility for congestion management																	
PLATONE	UC-GR-1	Functions of the State Estimation tool given conventional measurements																	
TwinErgy	PUC01.01	Increase the building observability - Data gathering from the home monitoring system																	
TwinErgy	PUC01.04	Control of the smart devices																	
TwinErgy	PUC08.02	Physiological parameter and comfort feedback monitoring																	
XFLEX	Use Case 2.9	Flex source monitoring and visualization																	
XFLEX	Use Case 2.10	Network real-time monitoring																	
iFLEX	BUC-6	Increase self-balancing through advanced monitoring and automation																	
iFLEX	PUC-7	Monitor my energy in real-time																	
iFLEX	PUC-3	Monitor my sustainability metrics																	
Platoon	LLUC P-3C- 01	Advanced EMS for Tertiary Buildings																	
Platoon	HLUC P-3b- 01	Building Energy Management System																	
Platoon	LLUC P-3b- 04	Monitor and analysis system of Data coming from energy meters of ROME Municipality buildings																	

Table 3: Selected key broad use cases and underlying specific use cases

			Covered SGAM layers and footprint					Application Priority Areas											
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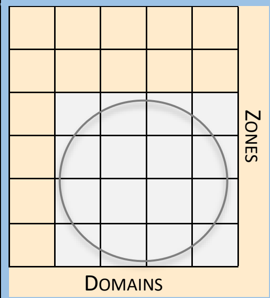
		Key use case 5: **RES Operation and Maintenance** This use case is about technical optimizing of the operation and maintenance of renewable energy assets. It contains data models and analytics to enable efficient monitoring and control of distributed devices. On the functional and business level it will be necessary to have cost effective services supported by intelligent data exchange and possibly AI support.							x					x					
Use cases with SGAM references																			
Other use cases																			
TwinErgy	HLUC02	RES generation in domestic and tertiary buildings																	
TwinErgy	PUC02.01	Dispatch of existing RES in domestic and tertiary buildings to minimise cost/carbon emissions																	
TwinErgy	PUC02.02	Optimal future energy storage to maximise RES production																	
TwinErgy	PUC02.03	Maximum future RES capacity according to the physical constraints (e.g. roof space, cable sizes) of the pilot site, as well as present/future V2G capacity as determined by the TwinEV module																	
TwinErgy	PUC02.06	Optimal domestic and tertiary demand response, based on RES, to minimise cost/carbon emissions																	

Table 3: Selected key broad use cases and underlying specific use cases

			Covered SGAM layers and footprint					Application Priority Areas											
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TwinErgy	PUC03.03	Smart Charging to maximize RES integration (green electricity)																	
TwinErgy	PUC05.01	Prediction of energy consumption and RES production																	
XFLEX	Use Case 2.6	RES modeling and forecasting																	
XFLEX	Use Case 2.12	RES scheduling control																	
Flexgrid	HLUC_02_UCS_01	ESP minimizes its OPEX by optimally scheduling the consumption of end users, production of RES and storage assets																	
Flexgrid	HLUC_02_UCS_02	ESP minimizes CAPEX by making optimal investments (i.e. optimal siting and sizing) on RES and FlexAssets																	
Flexgrid	HLUC_02_UCS_05	RESP optimizes the operation of its hybrid RES/storage assets in order to maximize their dispatchability rate and ensure their equal market participation																	
Platoon	LLUC P-2a- 07	Predictive maintenance in RES power plants																	
Smart Grids UC	CROSSBOW_HLU02 -UC02	RES generation forecast including scheduled maintenance																	
Smart Grids UC	EBALANCE-PLUS_UC5	Volt-VAr optimization with increasing RES generation																	

2.5 Checking broad interoperability: the int:net Connectathons

2.5.1 Connectathons in the health domain

In the context of interoperability, the healthcare industry is as a pioneer in the field of normative use of standards. The driving force here is the IHE initiative (IHE, http://www.ihe.net), which was founded in the USA in 1997 and is today a globally active non-profit organisation for the standardisation and standardisation of data exchange in healthcare – additionally formalised according to ISO TC 215.

An essential part of the approach of IHE to achieving interoperability is a suitable test environment. The open source tool “Gazelle” is a test platform for the interoperability of eHealth information systems developed by IHE Europe.

The IHE Connectathons are annual events that occur in the USA, Europe, and Asia. You can find more information about the 'IHE Conntectathon' interoperability test events in the health sector in the IHE-Europe Whitepaper on Connectathon [11] which explains in detail the concept and processes of a Connectathon. During these events, development teams from around 80 software manufacturers gather to test their prototypes over the span of a week, ensuring compliance with IHE profiles. This rigorous testing process involves thousands of individual tests, some of which are highly complex. Consequently, there is a considerable demand for robust test tools and effective test management.

A comprehensive list of testing tools used in these tests can be found at http://ihe.net/Testing_Tools/ . These tools have proven to be versatile, covering a wide spectrum of interoperability testing requirements.

2.5.2 Connectathons in the energy domain: first steps

In the Austrian R&D project “IES - Integrating the Energy System” [12] (FFG No. 853693), an innovative step was taken by addressing interoperability in the energy sector. This effort led to the development of a process chain and a test environment dedicated to interoperability testing within the energy sector.

The outcomes of the IES project demonstrated that the well-established and proven methodology, along with the extensive knowledge from the healthcare sector's IHE, could be successfully applied to another sector with reasonable effort. This transfer of expertise highlighted the potential for synergies, particularly in the creation of a versatile interoperability test platform.

As a result, the Austria Initiative has now published a white paper [13] outlining a sector-neutral interoperability process. This white paper encapsulates the entire IES methodology in a neutral and adaptable format, including the governance of the entire process chain, making it relevant for any digitalization challenge in any sector.

In general terms the implementation of a Connectathon follows 3 steps:

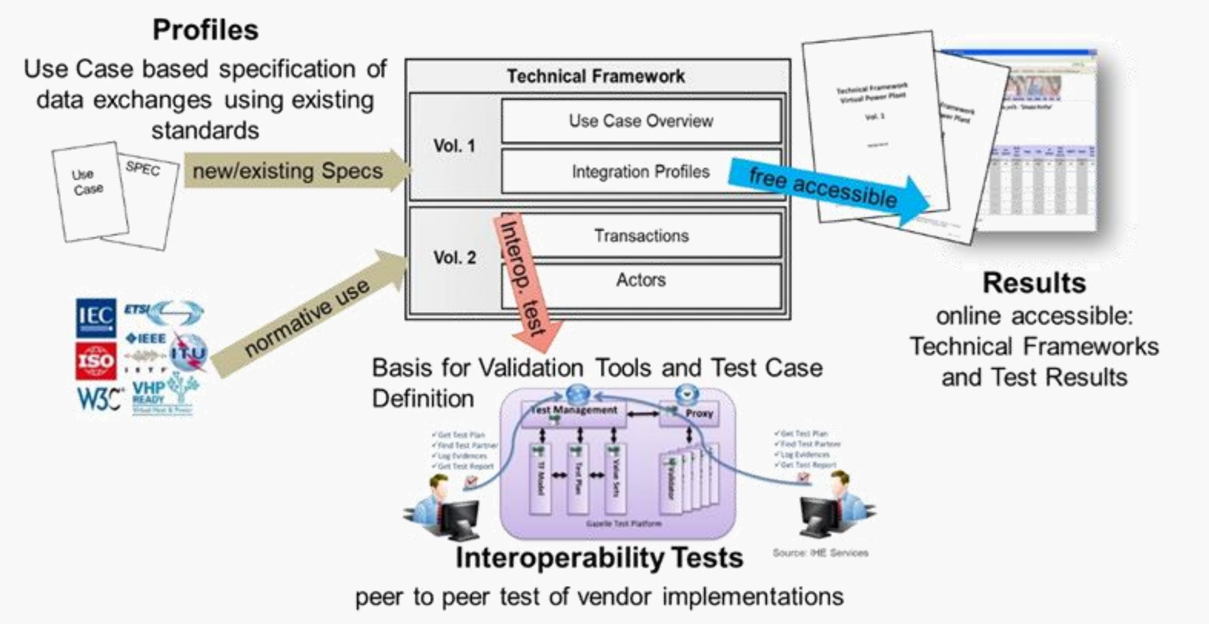
1. select and describe the use case to be tested
2. set up and describe data models and processes
3. prepare the Connectathon (including invitation of solution providers that want to test)
4. implement the 2-3 day event and document the results.

[11] WP_Connectathon_2020_V00.pdf (ihe-europe.net)
[12] IES Initiative - Smartgrids Austria
[13] WHITE PAPER FOR A SECTOR NEUTRAL INTEROPERABILITY PROCESS (Phaidra - o:5193) (fhstp.ac.at)

2.5.3 Specifying profiles and test cases

The Technical Framework is the centre of the approach to interoperability. Technical Frameworks are specifications with a defined structure. They are specified to the associated Use Case description. Released Technical Frameworks are public and available for download.

Technical Frameworks are organised in several volumes. While Volume 1 provides a high-level view of the supported Use Case, identifying actors and transactions or content, Volume 2 provides detailed technical descriptions of each transaction or content modules, used in the Integration Profiles. Furthermore, a specific Volume can define national or regional specifics to accommodate certain practices, that may require extensions to the baseline definitions in a domain.



source: White paper for a sector neutral interoperability process

Fig. 11 Technical Framework in the centre of the entire process

Detailed implementation and testing processes enable vendors to implement standards-based interoperability of their communication systems. Part of the approach to interoperability is the regular organisation of test events, i.e. Connectathons. There it is possible to carry out peer-to-peer interoperability testing with other vendors against the specifications.

Connectathons offer vendors the ideal environment to pre-test the interoperability of their systems. A broad applicability and acceptance of test systems ensures that the necessary interoperability is guaranteed in future systems. The low-entry-barriers for integration enable high cost-efficiency during IT infrastructure investments.

3 Working in the tube and on level 6

(working title)

This chapter will be added in the second version of the Whitebook. It will describe experiences with using the proposed models, means and measures and give more guidance, mainly for framework setters in the entities outlined in chap. 2.2.

Conclusion

The int:net project consortium strives to model and test interoperability of technical systems. In addition, it wants to tackle questions of governance in multiple scenarios. The three concepts "SGAM layer 6", "tube in the cube" and "Connectathon" show the way int:net wants to go. First reactions from the consortium and associated partners are positive and promising. Nonetheless, all the three concepts need further investigation throughout the second half of the int:net project. This first version of the Whitebook is meant to kick-off an expert discussion (mainly on the int:net platform https://www.intnet.eu/).

First feedback has unveiled that the model of "broad use cases" can help aligning the work of int:net (concentrating on interoperability) and the attempts to specify the necessary datasets to manage the future energy system.

The second version of the Whitebook will include exhaustive and detailed information on the use of the three presented concepts in the int:net activities.

4 List of Tables

5 List of Figures

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