

# “Navigating standardisation in R&I project proposals: strategies and insights for energy, mobility and building sectors”

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## Disclaimer

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## Glossary of terms (non-exhaustive list)

Abbreviation / Term	Description
AIOTI	Alliance for IoT and Edge Computing Innovation
API	Application Programming Interface
CEN	European Committee for Standardisation
CENELEC	European Committee for Electrotechnical Standardisation
CSA	Coordination and support action
C-SIGs	Cloud Select Industry Group
CWA	CEN Workshop Agreement
DTLF	Digital Transport and Logistics Forum
EC	European Commission
ECS	Electronic Components and Systems
EDC	Eclipse Data Space Connector
FOSS	Free and Open Source Software
GICTF	Global Inter-Cloud Technology Forum
HLF	High Level Forum
IEC	International Electrotechnical Commission
ISO	International Organization for Standardisation
ITU	International Telecommunication Union
JRC	Joint Research Centre of the European Commission
MaaS	Mobility as a Service
NSB	National Standardisation Body
OCC	Open Cloud Consortium
OFE	Open Forum Europe
OGF	Open Grid Forum
OMG	Object Management Group
ONF	Open Networking Foundation
PAS	Publicly Available Specification
SDOs	Standards Development Organizations
SNIA	Storage Networking Industry Associations
TCI	Technical Committee
TCI	TransContinuum Initiative
WG	Working Group

# 1 Introduction

The purpose of this report is to provide a summary of the key findings, take aways and recommendations from the workshop “**Accelerating standardisation in the nexus of mobility, buildings and energy**” that took place in Brussels on the 31<sup>st</sup> of January 2024. The workshop was organised by the European Commission, DG-CONNECT, Internet of Things Unit, the Alliance for IoT and Edge Computing Innovation (IOTI) and HSBooster EU funded project.

This event, as part of the European Commission’s strategy on Edge Computing in target sectors, brought together key stakeholders from strategic energy and mobility domains as well as experts from the policy and standardisation sectors. The workshop aimed at fostering collaboration among different sectors and ecosystems, exchanging ideas and driving consensus on current technological challenges and standardisation gaps.

This booklet and supportive guide have been designed to give thematic-oriented standardisation information on parties interested in developing standardisation deliverables or proposals.

## 1.1 Purpose of the Workshop and Key Take Aways

The main objective of the workshop was to provide specific recommendations and discuss about potential solutions to fostering the development of interoperable standards and the different mechanisms to accelerate this process. These recommendations are intended to support the implementation of the EU funding projects responding to the call for proposals: **HORIZON-CL4-2024-DATA-01-05 Platform Building, standardisation, and Up-scaling of the 'Cloud-Edge-IoT' Solutions (CSA)** which will support particularly the awarded proposals resulting from HORIZON-CL4-2024-DATA-03 targeting large scale-pilots in key sectors such as energy , e.g. charging of electric vehicles, grids, building automation and the use of the emerging Smart IoT platforms.

**In brief, the key takeaways from the workshop, especially with reference to standardisation topics, are listed below:**

- **Horizontal and Cross-Sector Standards are the key**  
Horizontal and cross-sector interoperability standards to enable seamless communication within different sectors and between different devices. There are challenges in terms of adopting common reference models (ontologies), interfaces, and APIs, whilst ensuring compliance with existing and upcoming regulations.
- **Fostering collaboration**  
Joint efforts and collaboration among different sectors and key stakeholders are essential. This involves open dialogues from policy-makers and regulators to industry (particularly innovative SMEs) and end-users. Given the variety of requirements, perspectives, and needs, it is imperative to align

sector-specific views and establish consensus, in order to identify optimal technical solutions that effectively address the diverse needs of stakeholders.

- **Early Engagement in standardisation activities is crucial**

Development of a strategic standardisation roadmap and an active engagement at an early stage in standardisation activities are crucial. There are fast-track mechanisms to accelerate this process, such as the CEN Workshop Agreements (CWAs) to contribute to the development of standards, leverage the planned pilots to test existing and emerging standards but also identify current gaps.

- **Global standards**

The benefits of integrating standards into research and innovation projects' overall aim is twofold: i) it facilitates the identification of emerging technologies where standardisation can contribute in their deployment and wide adoption of these technologies and ii) bringing research and innovation results for the development of new interoperable global standards and/or further developments of existing ones can facilitate market acceptance and wider adoption.

Compatibility based on open international standards is essential for global innovation where competition relies on the unique value that each solution adds on top of the standardisation layers.

## 1.2 Purpose of the document

The purpose of the following sections is to provide guidelines to engage in standardisation and an overview of the most relevant Standards Development Organizations (SDOs), de jure, de facto and open standardisation organisations of relevance for the target sectors addressed in the above-mentioned topics of the Horizon Europe Programme.

# 2 General Guidelines for Engagement in Standardisation

The focus of this chapter is to provide general guidelines on how R&I projects can effectively engage in standardisation at large, e.g. covering both formal and informal standards.

## 2.1 Introduction

In the last ten years, the European Standardisation System has taken outstanding initiatives to boost engagement in Standardisation, especially from the European scientific and research community, which is delivering state-of-the-art products, services, methods, innovations, and outcomes in general.

It is worthy to list the following initiatives that contributed not only positively but inspired the key stakeholders, as success stories, to proceed in the establishment of the current ones, which, in alignment with the NEW EU Standardisation Strategy, build the rise of the new geopolitics of standardisation and the geopolitics of next-generation standardisation. EU is the leader and the catalyst for such a change towards a sustainable, resilient, smart ecosystem given the rapid development of emerging technologies and their profound effect on society and the economy.

### 2.1.1 Strategic objectives

The strategic objective is to contribute to the development of robust and widely accepted standards in energy, mobility and building sectors sector. Effectively addressing the engagement in standardisation within the context of Research and Innovation (R&I) projects can be a strategic and beneficial approach, covering both formal and informal standards, as well as collaborative working agreements (in the form of CEN Workshop Agreements) and/or Project Liaisons and include the following actions:

- 1. Early involvement and explore informal standards:** start considering standardisation early in the R&I project life cycle. Early involvement can help shape standards that align with the projects goals and further allows the integration of standardisation considerations into the project's design and development phases.
- 2. Understand relevant standards:** gain a clear understanding of existing standards and related initiatives in the fields of the energy-mobility-building automation nexus. Identify relevant standardisation bodies and committees, both national and international.
- 3. Identify key stakeholders:** industry experts, SMEs, policy-makers, researchers, groups of coalitions or alliances, technology transfer bodies and representatives from standardisation bodies. Collaboration with these stakeholders can contribute to the development of effective standards.
- 4. Active participation/ contribute with technical expertise to standardisation committees:** actively participation in standardisation committees and working groups relating thereto in the fields of this study and collaboration with key stakeholders is essential. Provide technical expertise, share insights from experience gained in R&I projects, and contribute to the development of standards.
- 5. Promote interdisciplinary collaboration and participate in industry consortia:** Encourage collaboration between researchers, industry experts, and standardisation professionals. Interdisciplinary collaboration can lead to comprehensive standards that address a broader range of challenges. Foster a collaborative ecosystem and prevent vendor lock-in.
- 6. Best practices:** document our R&I processes, methodologies, and outcomes and share the best practices with standardisation bodies and with peers from the industry to be valorised as potential valuable inputs either for updating existing standards or the development of future standards. Informal networks can be valuable for staying informed about emerging standards.
- 7. Compliance and certification:** ensure that our R&I outcomes comply with requirements of existing standards -and when applicable- seek CE certification (CE markings indicate that a product complies with European Union regulations and directives regarding health, safety, and environmental protections), and conformity assessment schemes to enhance the reliability, credibility, and marketability of our innovation.

### 2.1.2 General European Overview

All sectors of the economy increasingly rely on digital technologies that change ever faster, frequently dramatically exceeding the pace of change in more traditional sectors and industries. The value of digital systems increasingly derives from cross-sector applications, data, and technology convergence. There are ever more bodies and organisations involved in standard or technical specifications setting around the world.

The increasing complexity resulting from a proliferation of standards, and the diversity of technical communities involved in standards setting could be synchronized with the speed of the emerging technologies under the appropriate governance model to the benefit of the citizens, customers, the global economy, and growth.

European work on standardisation cannot be viewed in isolation or silos. **The New EU Strategy on Standardisation (COM(2022) 31 final), the Code of Practice in Standardisation, and the Knowledge Valorisation**, among others, are some of the EU Policies that aim to reverse the obsolete norms of "doing business as usual".

More specifically, the **European Commission published on 25th October 2012 the Commission Communication on the development of European standardisation – Action for faster technological integration in Europe**, which regulates the European standardisation system and explains how to use European standards for products and services. [[Regulation \(EU\) 1025/2012](#)].

The Single Market is one of the greatest achievements of the European Union and standardisation is at its heart. Voluntary standards, driven by market needs, play a crucial role in the development of the Single Market, its advancement and deepening, enabling it to be future-proof for the benefit of businesses and citizens. The [Joint Initiative on Standardisation](#) reflected this crucial role. It has been a unique voluntary collaborative effort that started in 2016 under the NL-Presidency and that has brought a wide range of partners with an interest in standardisation around the table to help further modernise the European standardisation system and raise awareness of its benefits.

On 21 October 2021, the **European Committee of Standardisation (CEN)**, the **European Committee for Electrotechnical Standardisation (CENELEC)**, and the **Joint Research Centre of the European Commission (JRC)** renewed their cooperation agreement for a further five years. Through the agreement, the three organisations aim to enhance the exchange of knowledge and expertise between scientific research and European standardisation on several domains, including the ones this document is coping with.

Early 2023, EC established the **High-Level Forum on European Standardisation**, which aims to identify standardisation priorities in support of EU policies and legislation and discuss horizontal issues such as international leadership, [education and skills](#), and pre-normative challenges, in a multi-stakeholder setting. The parties of the HLF on European Standardisation agreed to contribute to the education of the new generation of European standardisation professionals and thus committed themselves to undertake relative actions. Due to the digitalisation and consequent challenges, a potential evaluation, update, and revision of the Regulation (EU) 1025/2012 is planned by the HLF for the next 2 years (source, HLF Annual activity report 2023).

On 1st March 2023, the European Commission published the COMMISSION RECOMMENDATION (EU) 2023/498, entitled **[Code of Practice on standardisation for researchers](#)**". The Code provides a set of recommendations to beneficiaries of public-funded research and innovation programmes on how to valorise project results through standardisation. It was developed with the contribution of experts from CEN and CENELEC Working Group 3 '**STAIR**' (where the acronym stands for 'Standardisation, Innovation and Research'). STAIR is the focal point within CEN and CENELEC for all matters related to integrating

standardisation with innovation and research (the joint strategic Working Group of STAIR was established in October 2008 and till nowadays play a significant role for the standardisation in the EU). The EaS (Education and Standardisation) action was established to enhance the education and skills on standards.

By publishing this paper, CEN and CENELEC continue on their commitment to enhancing the links between standardisation and research, as manifested in CEN CENELEC's **Strategy 2030**. More information on CEN and CENELEC's work on **Standards+Innovation** is available [here](#).

Furthermore, the European Commission has also recently released in 2nd of February 2024, the publication entitled "**The 2024 Annual Union Work Programme for European Standardisation**" (C(2024) 541), which outlines a number of actions to support the implementations of policy priorities, and divided into four main categories: (1) Resilience of European industry, (2) Digital transition, (3) Green transition, and (4) Internal market for products and services.

The following eight policy priorities were identified amongst the 72 actions identified in total:

1. Technologies for European high-performance computing and European quantum communication infrastructure (Action 7)
2. Recycling of permanent magnets (Action 1) and exploration, extraction, refining and recycling of critical raw materials (Action 2)
3. EU Trusted Data Framework (Action 10)
4. European Digital Identity framework (Action 8)
5. Ecodesign of air-to-air conditioning and heat pumps (Action 33)
6. Cybersecurity requirements (Action 6)
7. Hydrogen technologies and components (Action 16)
8. Electric vehicles charging infrastructure (Action 44).

### 2.1.3 Initiatives and Projects that support Standardisation

There are a variety of projects and initiatives that have supported standardisation activities along recent years. A brief historical overview is given below.

#### BRIDGIT 2

The funded project BRIDGIT2 (Bridge the Gap between Research, Innovation, and Standardisation Community). BRIDGIT2 was carried out between December 2017 and February 2020 by AFNOR (France), ASI (Austria), ASRO (Romania), BDS (Bulgaria), DS (Denmark), NEN (the Netherlands), NSAI (Ireland), UNE (Spain) and UNI (Italy) with the coordination of DIN (Germany) and support from CCMC. The draft from BRIDGIT2 was then processed by a group at the level of the CEN/CENELEC Technical Boards, the Secretariat of which was held by the Austrian Standards International (ASI).

Standards have a fundamental value in supporting and mainstreaming research and innovation. Yet, this value was very often misunderstood or underrated, also by policy-makers – with very serious consequences for the ability of innovation ecosystems to scale up. This issue was at the heart of a study published by Alfred Radauer, *Driving from the Fringe into Spotlight: the underrated role of standards and standardisation in RTDI policy and evaluation*. The CEN and CENELEC community, through its German



Member DIN and its Austrian members ASI and OVE, and the BRIDGIT 2 project contributed with first-hand expertise to the realisation of this important study.

## STANDARDS+INNOVATION

This initiative has delivered a platform to increase the impact of R&I Projects by integrating standardisation (2019). Since then, the very successful homonymous CEN CENELEC **awards** have also been established on an annual basis and acknowledge the valuable efforts in the following four categories, namely, project award, individual researcher/innovator, young researcher, and technical body officer.

## HSBOOSTER.EU

This EU-funded initiative provides Standardisation Support for Research & Innovation Projects. Any research project can apply for standardisation expert services to increase and valorise its results through standardisation. The HSBooster.eu tools, such as the Training Academy, the Helpdesk, the Orientation Tool, and the Success Stories, have a catalytic effect on the projects/consortia in terms of their successful enhancement of being familiar with standardisation processes and of gaining capacities to deal with standardisation challenges on the topics/fields they explore or within the scope of their respective competencies. In support of the EU Strategy on Standardisation, HSbooster.eu maintains and expands an open call for projects and for standardisation experts, who provide a well-structured standardisation-oriented consultancy services to the projects/consortia, under confidentiality.

## STANDICT.EU

This initiative contributes in “Building the expert network to reinforce Europe's role in global standards-setting”.

StandICT.eu 2026 builds on the success of the previous two editions [2020-23 & 2018-19 StandICT.eu initiatives], obtaining recognition of the “go-to” project on ICT Standards in Europe. StandICT.eu 2026's principal goal is to strengthen its global reach in the European ICT Standardisation Ecosystem by:

- Launching and managing a robust and efficient facility supporting individuals' activities in SDOs with € 2,925,000 funding earmarked over 36 months with 9 Open Calls;
- Managing the EUOS (EU Observatory for ICT Standardisation) and Technical Working Groups (TWGs) empowering contributions from ICT standardisation experts;
- Providing educational material on standardisation engaging with National Standardisation Bodies & PPPs through the Standards Education Group and the Standards Academy;
- Creating an engaging Forum on EU Strategy for ICT standards to address policy (FOREST), to keep momentum in policy discussions.

**The support services offered by HSbooster.eu and StandICT.eu are available for all interested parties (industry, SMEs, R&I Projects, Projects under CSA actions) and independent experts involved in standardisation activities.**

## SUPPORT TO STANDARDISATION ACTIVITIES PERFORMED BY CEN, CENELEC AND ETSI

Action grants (SMP-STAND-2023-ESOS-03-IBA) under the Standardisation strand of the Single Market Programme continue to support the standardisation activities of the three European ESOS: CEN, CENELEC and ETSI (Available budget: € 4,460,000; Deadline date 27 February 2024). The three pre-identified beneficiaries are invited to apply on the topics of their competence (i.e. Quantum Technologies, Digital Product Passport, among others).

Other campaigns of CEN and CENELEC and ETSI involve “Young professionals in standardization” (2022) and the “Training in Standardization” (2024).

## BRIDGE

BRIDGE is a European Commission initiative which brings together various Horizon 2020 and Horizon Europe projects **in the areas of smart grids, energy storage, islands, and digitalisation**. BRIDGE pursues a structured approach to address cross-cutting challenges encountered in the project demonstration phase. It started with 17 projects, now unites 98, and is set to continue expanding. One of BRIDGE working groups, the Data Management WG, is focused on the following aspects:

- Communication Infrastructure, embracing the technical and non-technical aspects of the communication infrastructure needed to exchange data and the related requirements, including issues faced by TSO and DSO
- Cybersecurity and Data Privacy, entailing data integrity, customer privacy and protection
- Data Handling, including the framework for data exchange and related roles and responsibilities, together with the technical issues supporting the exchange of data in a secure and interoperable manner, and the data analytics techniques for data processing

This WG has also published a report in 2022: “Contribution from BRIDGE projects to standardisation”, which provides an extensive analysis about the various types of data exchange platforms, standards and lessons learned.

Moreover, the BRIDGE standards users’ group is focused on;

- “Smart energy standards”, such as IEC CIM, IEC 62559, IEC 63097
- Establish liaisons with CEN/CLC/ETSO CG-SG and ENTSO-E CIM Expert Group.

### 2.1.4 Effective engagement of R&I projects in standardisation

Standards build trust, ensure reliability, comparability, compatibility and interoperability. It is important to understand which standards apply to R&I Project intended aim and to apply them. If this is not applicable, then the R&I Project can consider initiating the revision of an existing standard or the creation of a new one.

The European Standardisation Organisations (ESOs: CEN CENELEC ETSI), and in particular CEN CENELEC, **define specific types of standardisation deliverables** which are the European Standard (EN), the Technical Specification (TS), the Technical Report (TR), the CEN and/or CENELEC Guides, the Harmonization Document (HD) - CENELEC only and the CEN and/or CENELEC Workshop Agreement (CWA).

How the above types of standardisation deliverables are developed, is specified in the CEN CENELEC ETSI Internal Regulations and Guides, publicly available in the Standard Development Organizations (SDOs) websites and their Experts Areas (i.e. [European Standard](#) (EN); [Technical Specifications](#) (TS); [Technical Reports](#) (TR); CEN [Guides](#); [CWAs](#); **CEN CENELEC Guide 29 : CEN/CENELEC Workshop Agreements - A rapid way to standardisation** Edition 2, October 2020, etc.). All the CEN CENELEC Guides are available, [here](#)).

For R&I projects, beyond ESOs, there are **national contact points for R&D&I** to facilitate the interaction between the standardisation initiatives and the research projects (authorised services of National Standardisation Bodies-NSBs). For example, it can be proposed the development of a CEN Workshop

Agreement (CWA) as a fast-track standardization deliverable. Taking into account that many NSBs have their fast-track solutions, beyond a CWA, SDOs can suggest, i.e., ASI/ONR, AFNOR/Spec, DIN/Spec, BSI/Flex and PAS, UNI/PdR, UNE/Especificacion, and ISO/IWA. Other alternatives are the following: join a Technical Committee (TC), participation of project representatives through national mirror committees, or ask for a project liaison.

**CEN CENELEC Guide 23** ("**Research Consortium Bridge Addressing Research and Innovation in European Standardisation activities and deliverables**", Edition 3, October 2020), provides a general understanding of how standards and standardisation are addressed in R&I, while giving the context of how the interaction and engagement can take place. Three main types of interaction are described, the: a) direct participation of individual R&I actors in CEN/CENELEC Technical Bodies, b) the partnership of R&I projects with CEN/CENELEC Technical Bodies and c) the interaction with R&I projects funded under European Framework Programmes. According to the CEN CENELEC Guide 23, main R&I actors are basic and applied researchers in universities or research and technology organizations, innovators, start-ups or research, development, and innovation departments in industry, including Small and Medium Sized Enterprises (SME). When they engage in CEN-CENELEC standardisation activities, this can be done through **direct participation in national mirror committees or by linking their specific projects to European standardisation activities**.

Most of the European efforts in R&I are driven by the European Union's multiannual Framework Programmes for funding, such as Horizon 2020 (2014-2020) or Horizon Europe (2021-2027). They imply a heavy public investment from the Member States and seek a strong impact in industry, market, and society by addressing new technologies and innovative solutions to common challenges. European R&I projects typically are multinational, collaborative projects involving a consortium with partners from different types of organizations (research institutes, universities, SMEs, large industries, NGOs, etc.) established through an agreement with the European Commission. The project duration is usually between two and four years and in this time, the project consortium needs to develop and provide the agreed-on project deliverables. Many of the calls for European R&I projects in these programmes are requesting a contribution to standardisation (using existing standards or other standardisation deliverables such as TS and/or contributing to generate new ones) as an expected impact.

**There are different ways in which standardisation is addressed in such projects, for instance:**

- **Standardisation Roadmap:** In this project deliverable, the current status of standardisation in a specific area is outlined following an extensive analysis of a topic regarding standardisation. It includes future fields of activities and concrete recommendations.
- **Standardisation Strategy:** In this project deliverable, standardisation proposals in a specific area – not necessarily limited to the scope of one single CEN/CENELEC Technical Body – are usually summarized focusing on innovative and upcoming topics. This project deliverable is comparable to a Roadmap but less extensive.
- **Contribution to existing and/or initiating new standards or other standardisation deliverables:** A proposal for changes to existing standards and/or for creating new standards is either part of a Standardisation Roadmap, Standardisation Strategy, or a stand-alone project deliverable following an in-depth gap analysis during the project.

Interested parties and R&I Projects can be involved in standardisation as **Liaison Organisations** (the framework and the rules are described in the **CEN CENELEC Guide 25 "The concept of Cooperation with European Organizations and other stakeholders"** Edition 3, November 2021, Updated version, January 2023). The Guide specifies the framework of interaction and engagement for the choice of being a) Partner Organization; b) Liaison Organization; c) Associated Body; d) European Counsellor; e) European Institutional Stakeholder; f) Other Cooperating Organizations not covered by previous categories. The aforementioned Guide 25, describes the framework and occasions of entering into agreement for the above options, the organization status, the benefits and the obligations, the level of technical work, the conditions to become any of these types of Organizations, and the fees and the procedural aspects. The envisaged liaison between an existing CEN/CENELEC Technical Body and an EU funded project, **the liaison status is limited to the project duration**. The liaison organization is expected to provide quality, added-value expertise in a defined technical field relevant to CEN and/or CENELEC Technical Bodies and contributions through direct participation in meetings. Focused on ongoing work (drafting EN, TS, TR), proposals of new ones, or revising existing standardisation deliverables).

Last but not least, the **CEN CENELEC Guides 39:2022**, ("***The role of standards in support of Technology Transfer***", Edition 1, March 2022), is of equally importance and provides important info about how standards help innovation, how to contact the CEN and CENELEC members for such issues, about the Workshop Agreements, the Intellectual Property Rights and standardisation (how do they co-exist), the Patents and standards, the Standards Essential Patents (SEPs), the Licenses and the Copyright and standards, the Open source standards and the open access to publications.

**ISO (International Organization for Standardisation)** is an independent, non-governmental international organisation that develops and publishes standards for various industries and domains. ISO has published several standards that are relevant to R&D projects, among others the ISO 56000 series on Innovation Management, the ISO 21500 series Project Management standards, the ISO/IEC 27000 series on Information security management systems (ISMS,) including the most well-known ISO 9001 (quality management system standard that provides a framework for managing quality in R&D activities). It is designed to support organizations in managing the quality of R&D activities by providing a strategic framework for continuous improvement and meet customers' requirements.

There is an ongoing technical cooperation between CEN and ISO and CENELEC and IEC. CEN and ISO signed the Vienna Agreement in 1991, through the involvement of experts in TCs, EU and national experts. The aim is preventing duplication of effort and reducing time when preparing standards. As a result, new standards are jointly planned between CEN and ISO. Wherever appropriate priority is given to cooperation with ISO provided that international standards meet European legislative and market requirements and that non-European global players also implement these standards.

Similarly, CENELEC and IEC (International Electrotechnical Commission) has signed the Frankfurt Agreement with the same purpose.

In summary, these agreements aimed to provide a framework for an efficient use of resources and expertise available for standardisation work, preventing duplication and shorten the time for standardisation developments.

**R&I projects might check the already existing draft standards (enquiry stage) which are relevant for their projects, as these are open for comments. There is a list, publicly available which can be consulted here: [list of standards](#).**

Another way to engage with a relevant TC is to establish a liaison with an ISO Committee or Working Group (WG). If the proposal is accepted, although no voting rights are granted, the project can actively contribute to the ongoing discussions, provide recommendations and/or comments to current draft standards, participate in WG meetings, and submit relevant project technical reports.

The process is as follows, i.e. the application shall be submitted by the applicant organization to the **Secretariat of the correspondent Committee (ISO/CS)**:

- The organisation wishing to **create a liaison with ISO and/or IEC** shall send an application liaison form to the office of the CEO with copies to the committee officers and IEC SEC Technical Officer or ISO CS Technical Programme Manager ( The ISO application liaison form is available [here](#); The IEC application liaison form is available [here](#); All the details can be found here: [ISO Directives](#)).

#### 2.1.4.1 FORMAL AND INFORMAL STANDARDS, DE FACTO AND JURE STANDARDS

We often encounter the terms *formal* and informal standards or *de facto* and *de jure standards*. De facto standards, also known as “standards by practice,” are not formally sanctioned by any official standards organization. They emerge through widespread adoption and usage by the industry or user community. De facto standards often evolve organically as a result of the success, popularity, or dominance of a particular technology or approach. De jure standards, also known as “standards by law” are formally established and recognized by official standards organizations. These organizations, create and publish standards through rigorous processes that involve and bring together industry experts, researchers, and stakeholders to establish comprehensive standards that enhance interoperability, reliability, security, safety, and quality, in computer networking and modern technologies for example.

Formal / de jure Standard Development Organizations (SDOs) coordinate the development of compatibility standards that ensure technological progress and welfare through interoperability. Informal SDOs, which are self-organized and not mandated by law, co-exist with formal SDOs to develop compatibility standards in a substituting or complementing way ([Sabine Brunswicker, Jorge Rodriguez, Jonathan Douglas Wareham; ESADE Business School Research Paper No. 260, December 2014](#)).

According also to the “*Multi-mode standardisation: Acritical review and a research agenda*” which was issued in the Journal Research Policy Volume 46, Issue 8 ([Paul Moritz Wiegmann, Henk J. de Vries, Knut Blind; October 2017, pages 1370-1386](#)), there are three modes of standardisation: committee-based, market-based, and government-based. Due to the interconnected and interdependent world, we experience today, the trend for these three modes of standardisation is becoming increasingly mixed.

#### 2.1.4.2 VERTICAL STANDARDS VS HORIZONTAL STANDARDS: MOBILITY SHOWCASE

The first task within The **Digital Transport and Logistics Forum (DTLF)** expert group under **DG-MOVE** in 2017 was to prepare a “standardisation gaps analysis” in multi-modal transport networks where the lack of usage of available standards was identified. Now this activity was expanded as best practice across the transport industry members and continue as important activity within DTLG sub-group 2.

In exploring the dynamic between “vertical” and “horizontal” standards, we can draw a parallel to a widely known example: “email communication”. Email communication serves as a horizontal standard that transcends the diverse operating systems and hardware configurations of individual computers “vertical standards”, allowing seamless communication.

Second important achievement was within the ISO TC 204 working group, where the same approach can be applied across different WGs (335 published standards and 69 standards under development), leading

us to recognize the necessity for horizontal standards and improved collaboration between Working Groups (WGs). Examples of relative standards:

**ISO 23795-1: 2022: Intelligent Transport Systems.** Extracting trip data using nomadic and mobile devices for estimating CO2 emissions, Part 1: Fuel consumption determination for fleet management.

**ISO 14083:2023: "Greenhouse gases** — Quantification and reporting of greenhouse gas emissions arising from transport chain operations" and

**ISO 34503: 2023: "Road Vehicles — Test scenarios for automated driving systems** — Specification for operational design domain".

This approach could be extended to other ISO TCs and further among ISO, CEN, CENELEC, ETSI, ect. The goal is to establish horizontal standards that cut across various technical domains, facilitating better interoperability and coordination among different groups. This activity will continue contingent upon securing the necessary resources.

### 2.1.5 MAJOR INDUSTRY ASSOCIATIONS, CONSORTIA, AND ORGANIZATIONS FOCUSED ON EMERGING TECHNOLOGIES

There are many organisations focused and/or involved in topics such as Artificial intelligence, Internet of things, Cloud Computing, Edge computing, Quantum computing, Augmented reality, Robotics, 3D printing, 5G and 6G, Deep learning, etc. These organizations often lead collaborative efforts, set standards, and promote innovation in these fields. Examples of such organizations include:

**Industrial Internet Consortium (IIC):** The IIC focuses on accelerating the growth of the Industrial Internet of Things (IIoT) and fostering collaboration between industry, academia, and government.

**Edge Computing Consortium (ECC):** The ECC is a global industry organization dedicated to advancing edge computing technologies and applications. It aims to facilitate collaboration among industry players.

**OpenFog Consortium:** The OpenFog Consortium, which has merged with the Industrial Internet Consortium (IIC), worked on advancing fog and edge computing architectures. It aimed to create an open standard for computing in highly distributed systems.

**IoT Consortia and Alliances:** Various IoT consortia and alliances exist and they may include initiatives related to edge computing. Examples include the IoT Industry Council and the Industrial Internet Consortium (IIC).

Although we will refer to that type of standards and standardisation in more detail in the following Sections, it is worthy to introduce at this point, the **Alliance for IoT and Edge Computing Innovation AIOTI**, which is the multi-stakeholder platform for stimulating IoT and Edge Computing Innovation in Europe, bringing together small and large companies, academia, policy makers and end-users and representatives of society in an end-to-end approach. AIOTI work with partners in a global context. Strive to leverage, share and promote best practices in the IoT and Edge Computing ecosystems, be a one-stop point of information on all relevant aspects of IoT Innovation to its members while proactively addressing key issues and roadblocks for economic growth, acceptance and adoption of IoT and Edge Computing Innovation in society. AIOTI's contribution goes beyond technology and addresses horizontal elements across application domains, such as matchmaking and stimulating cooperation in IoT and Edge Computing ecosystems, creating joint research roadmaps, driving convergence of standards and interoperability and defining policies.

## 3 Information on Relevant Working Groups (WGs) and Technical Committees (TCs)

This section provides an overview of existing WGs/TCs and industrial associations relevant to the topics of the call under the Horizon Europe (HE) Programme.

### 3.1 Energy

On the level of technical standardisation and coordination of work, CEN & CENELEC (notably through the CEN-CENELEC-ETSI Coordination Group on Smart Energy Grids), IEEE and OASIS will foster their collaboration including identifying whether there are serious conflicts between their respective standardisation deliverables which may have a negative impact on interoperability and the market adoption of smart grid solutions. Energy Critical infrastructure systems are the backbone of modern economies, and their smooth functioning underpins societal security. The provision of affordable, sustainable, and uninterrupted services supports collective prosperous future and contributes to EU's security. Energy resilience in the era of terminal shocks and persistent digital threats is enhanced through standards and standardisation.

#### 3.1.1 CEN / CENELEC/ETSI Technical Committees (TCs) and Working Groups (WGs)

**CEN-CENELEC-ETSI: Coordination Group on Smart Energy Grids (CG-SEG)**. This group is focused on security and interoperability, follows up on new developments in the field of smart grids, and actively promotes the results of its work at European and international levels.

Below are listed a selected number and most representative of the CEN, CENELEC (CLC), and ETSI Technical Committees which are directly and indirectly linked to the “energy-oriented” areas and topics:

**CEN/TC 6 - Active Assisted Living (AAL)**: Addresses standards related to technologies that support older adults to live independently, including energy-efficient and smart living solutions.

**CEN/TC 57 - Power systems management and associated information exchange**: Focuses on standards related to power systems management, including information exchange and communication protocols.

**CEN/TC 164 - Water supply**: While primarily focused on water supply, this committee may address energy efficiency aspects related to water systems.

**CEN/TC 92** – the series on water meters for cold potable water and hot water;

**CEN/TC 176** – the series on heat meters

**CEN/TC 237** – the standard on ultrasonic domestic gas meters

**CEN/TC 294** deals with standardisation of communications interfaces for metering and submetering systems for Water, Fuel Gases, Heat and similar energies and fluids where the protocols are applied to the meters, sensors and actuators and systems used to provide metering services. Security features like confidentiality, authenticity and integrity are provided at the application and lower layers. Cooperation with CENELEC and ETSI, in relation to consistent protocol and use of spectrum, is an essential condition

for achieving interoperability between entities in systems. Excluded from this scope are areas, which are under the responsibility of CLC/TC 205 and CEN/TC 247.

**CLC/TC 57 - Power systems management** and associated information exchange: Aligns with CEN/TC 57 and focuses on electrotechnical standards related to power systems management and information exchange.

**CLC/TC 82 - Solar photovoltaic energy systems:** Addresses standards related to solar photovoltaic energy systems, covering various aspects of energy generation.

**CLC/TC 205 'Home and Building Electronic Systems (HBES):** Under the banner of CLC/TC 205, WG19 has been created, open, to relevant experts from other TCs e.g.:

- o CLC/TC 82 'Solar photovoltaic energy systems';
- o CLC/TC 69X 'Electrical systems for electric road vehicles';
- o CLC/SR 120 'Electrical Energy Storage (EES) Systems';
- o CLC/TC 57 'Power systems management and associated information exchange';
- o CLC/TC 13 'Electrical energy measurement and control'
- o CEN/TC294 'Communication systems for meters'.

**CLC/TC 38 'Instrument transformers'** will continue to maintain the EN 61689 series on Instrument transformers.

**CLC/TC 17AC 'High-voltage switchgear and control gear'** is responsible for the maintenance of the EN 62271 series on High-voltage switchgear and control gear.

**ETSI TC Smart Grid:** Focuses on standards for smart grids, addressing the integration of ICT technologies in energy distribution and management.

**ETSI TC ITS (Intelligent Transport Systems):** While primarily related to mobility, standards within this committee may also touch upon energy aspects in intelligent transport systems.

**ETSI TC Cyber:** Addresses cybersecurity aspects, including those related to critical infrastructure such as energy systems.

**ETSI SAREF4ENER:** Extension of SAREF reference ontology for the energy domain. It provides a reference ontology for home and building data interoperability. Similarly to CIM, SAREF4ENER provides a new interoperability framework using data exchange profiles. SAREF4ENER is published as an ETSI technical specification (ETSI TS 103 410-1)

### 3.1.2 ISO, IEC, ITU Technical Committees (TCs) and Working Groups (WGs)

Similarly, below are listed the most representative of the ISO, IEC and ITU Technical Committees which are directly and indirectly linked to the “energy-oriented” areas and topics:

**ISO/TC 204 - Intelligent transport systems:** Addresses standards related to intelligent transport systems, including energy aspects of transportation.

**ISO/TC 257 - Energy management:** Focuses on standards related to energy management systems, including energy efficiency and sustainability.

**ISO/TC 180 - Solar energy:** Concentrates on standards related to solar energy technologies and applications.

**ISO/TC 85 - Nuclear energy:** Focuses on standards related to nuclear energy, covering various aspects such as safety, nuclear reactors, and nuclear fuel.



**IEC/TC 4 - Hydraulic turbines:** Addresses standards related to hydraulic turbines used for energy generation.

**IEC/TC 8 - Systems aspects for electrical energy supply:** Focuses on systems aspects related to the electrical energy supply, including grid integration and stability.

- IEC/TC 8/SC 8A: Grid Integration of Large-capacity Renewable Energy (RE) Generation
- IEC/TC 8/SC 8B: Decentralized electrical energy systems

**IEC/TC 82 - Solar photovoltaic energy systems:** Concentrates on standards related to solar photovoltaic energy systems.

**IEC/TC 45 - Nuclear instrumentation:** Concentrates on standards related to nuclear instrumentation, which may include instrumentation for monitoring and control in nuclear energy systems.

**IEC/TC 13: Electrical Energy Measurement and Control** (including Smart Metering and demand side management))

**IEC/TC 17: High-voltage switchgear and control gear**

**IEC/TC 23: Electrical Accessories**

- IEC/TC 23/WG12: Home and Building Electronic Systems (HBES)
- IEC/TC 23/SC23 K: Electrical Energy Efficiency products

**IEC/TC 38: Instrument transformers**

**IEC/TC 64:** Electrical installations and protection against electric shock

**IEC/TC 65:** Industrial-process measurement, control and automation

**IEC/TC 69:** Electric Road vehicles and electric industrial trucks

**IEC/TC 88:** Wind energy generation systems

**IEC/TC 120:** Electrical Energy Storage (EES) Systems

**IEC/TC 121:** Switchgear and control gear and their assemblies for low voltage

**IEC/TC23/SC23K /WG3:** Customer Energy Management Systems is progressing work items on:

- IEC 63345 ED1: Energy Efficiency Systems - Simple External Consumer Display
- IEC 63402 ED1: Energy Efficiency Systems - Smart Grid - Customer Energy Management Systems - General Requirements and Architecture.

**IEC/TC 57 - Power systems management and associated information exchange:** Addresses standards related to power systems management, including communication protocols that could be relevant to smart grids.

Under TC 57, the **IEC 61970-301:2020+AMD1:2022; Energy management system application program interface (EMS-API) - Part 301: Common information model (CIM) base**. It is a set of open standards to represent power system components and facilitates the integration of network applications developed by different vendors.

**IEC** has several technical committees dealing with **smart grids and smart metering:**

**IEC SyC Smart Energy:** Standardisation in the field of Smart Energy to provide systems-level standardisation, coordination, and guidance in the areas of Smart Grid and Smart Energy, including interaction in the areas of Heat and Gas.

**IEC SyC Working Groups:**

- WG 2 IEC Smart Energy Development Plan
- WG 5 Methodology and Tools
- WG 6 Generic Smart Grid Requirements
- WG 8 Distributed energy trading infrastructure.

**IEC SyC Joint Working Groups:** JWG 3: IEC Smart Energy Roadmap linked to ISO/IEC JTC1/SC41

**ITU-T SG5 - Environment and circular economy:** Focuses on standards related to the environmental impact of ICT, which may include energy efficiency considerations.

**ITU-T SG15 - Transport, access, and home networks:** Works on standards related to transport networks, including energy-efficient network design.

**ITU-T SG20 - Internet of Things (IoT) and its applications including smart cities and communities:** Addresses standards for IoT applications, including those related to smart energy management.

## 3.2 Mobility and Electric Charging Vehicles

CEN/CENELEC and ETSI have been working together on a basic set of standards for Cooperative Intelligence Transport Systems (C-ITS) since 2014 on the so-called 'Release 1 specifications'. Work is currently underway in both CEN/CENELEC and ETSI to develop the next package of standards (Release 2). CEN and ETSI are working, in consultation with main stakeholders (such as ASECAP and C2C CC), to find an appropriate solution to ensure non-detrimental interference from ITS-G5 and 3GPP-based direct communication systems on to CEN DSRC technology at 5.8 GHz.

Many initiatives are advancing software-defined vehicle platforms for the vehicle of the future, which will be electric, autonomous, connected and servitised.

### 3.2.1 CEN / CENELEC/ETSI Technical Committees (TCs) and Working Groups (WGs)

Below are listed the most representative of the CEN, CENELEC (CLC), and ETSI Technical Committees which are directly and indirectly linked to the "mobility and electric charging vehicles-oriented" areas and topics:

**CEN/TC 69 - Electric vehicle road traffic:** Focuses on standardisation related to electric vehicles, including safety, communication protocols, and charging infrastructure.

**CEN/TC 301 - Electric vehicle and infrastructure deployment:** Addresses standards for the deployment of electric vehicles and the associated infrastructure, covering charging stations and interoperability.

**CEN/TC 278** develop standards in the field of **telematics** to be applied to **road traffic and transport**, including those elements that need technical harmonization for intermodal operation in the case of other means of transport. It shall support: vehicle, container, swap body and goods wagon identification; communication between vehicles and road infrastructure; communication between vehicles; vehicle man machine interfacing as far as telematics is concerned; traffic and parking management; user fee collection; public transport management; user information.

**CEN/TC 278/WG8:** DATEX data exchange standards. DATEX II is a standardised e-language for traffic and travel data exchange between traffic control centres, traffic information centres and service providers. Further standardisation activities address new domains like energy infrastructure and traffic regulations, in particular for Urban Vehicle Access Regulations.

**CEN/TC 278 WG17** has been created specifically to address standardisation requirements for Urban ITS, initially focusing on the priority areas identified in Mandate/546 but not limited only to these aspects. WG17 is not only a standards development group but provides a cross cutting workspace to liaise with other SDOs.

**CLC/TC 9X - Electrical and electronic applications for railways:** Focuses on electrotechnical standards for railway applications, including signalling and control systems.

**CLC/TC 69X** - Electromobility: Focuses on electrotechnical standards for electric vehicles, including charging infrastructure, safety, and communication protocols.

**CLC/TC 69B** - Electric vehicle conductive charging system: Specialized in standards related to conductive charging systems for electric vehicles.

**CLC/TC 205** - Home and Building Electronic Systems (HBES): While primarily focused on home and building systems, it may also cover aspects related to smart mobility within the built environment.

**CEN-CENELEC Workshop on “Innovative solutions for user centric charging infrastructure for electric vehicles”** was launched last year (July 2023). There was a public consultation to provide comments until the 9th of February 2024. Workshop secretary is UNE. Referenced documents of the CWA can be found here: a) [Guidelines for operators to implement advanced smart charging and management strategies](#); b) [Charging stations of the future — Stations models considering users’ expectations](#).

**ETSI TC ITS (Intelligent Transport Systems)**: Addresses standards for intelligent transport systems, covering communication between vehicles, infrastructure, and other components for enhanced mobility. While primarily focused on intelligent transport systems, this committee may include standards related to communication between electric vehicles and charging infrastructure.

ETSI TC ITS has made separation between access layers (potentially with examples ETSI ITS-G5, 3GPP LTE-V2X PC5 etc.) and upper layer protocols. Considering the continuous improvements of access technologies, e.g. LTE-V2X PC5, NR-V2X PC5, IEEE 802.110p, and IEEE 802.11bd, is important that this independence is maintained in future standardisation.

**ETSI TC SmartBAN (Smart Body Area Networks)**: Focuses on standards for communication networks for body-worn devices, which may include aspects related to connectivity in electric vehicle applications.

**ETSI SAREF4AUTO** (under development): Extension of SAREF reference ontology for the automotive domain. The technical specifications can be found in the following link: [ETSI TS 103 410-7 V1.1.1 \(2020-07\): "SmartM2M; Extension to SAREF; Part 7: Automotive Domain"](#). The main purpose is to connect SAREF with existing ontologies such as W3C SOSA, GeoSPARQL, and other standardisation initiatives and ontologies in the Automotive domain, e.g. ETSI TC ITS for V2V, the DATEX II standard for information exchange between traffic management centres, the SENSORIS data model (<https://sensor-is.org/>) for exchanging data between vehicles and cloud services, etc.

### 3.2.2 ISO, IEC, ITU Technical Committees (TCs) and Working Groups (WGs)

In like manner, the most representative of the ISO, IEC, and ITU Technical Committees which are directly and indirectly linked to the “mobility and electric charging vehicles-oriented” areas and topics, are as follows:

**ISO/TC 204 - Intelligent transport systems**: Focuses on standards related to intelligent transport systems (ITS), including communication between vehicles, infrastructure, and traffic management as well as the coordination of the overall ISO work programme in this field including the schedule standards development, taking into account the work of existing international standardisation bodies.

**WG17: Nomadic Devices in ITS Systems include 2 sWGs-17.1 and 17.2.**

Define the infrastructure-supported location-based services to provide safety messages for improving road safety to AV, Non-AV, and VRU to be applicable in localized urban roadway sections, such as un-signalized intersection, T-intersection, roundabouts, weaving areas, Dynamic Dilemma Zone.

The goal is also to improve the road safety of VRUs by expanding the use of the nomadic device based on V2X communication. Finally, a new concept of the roadside ITS station is needed: **future smartRSU**.

**Under development: ISO 17739-1 (X) development: Intelligent transport systems (ITS)** — Nomadic device – Roadside infrastructure supported location-based services for urban connected automated mobility – Part 1: General information and use case definition and further to start to draft as potential the new proposal of 17748-4 (just started): Intelligent transport systems — Energy-guided green ITS services on nomadic and mobile devices for smart city mobility applications.

Within the TC groups, it has been undertaken an audit of existing standards, leading the TC to recognize the necessity for horizontal standards and improved collaboration between Working Groups (WGs):

- ISO/TC 204/WG 14: Vehicle/roadway warning and control systems
- ISO/TC 204/WG 16: Communications
- ISO/TC 204/WG 17: Nomadic Devices in ITS Systems
- ISO/TC 204/WG 18: Cooperative systems
- ISO/TC 204/WG 19: Mobility integration
- ISO/TC 204/WG 20: Big Data and Artificial Intelligence supporting ITS

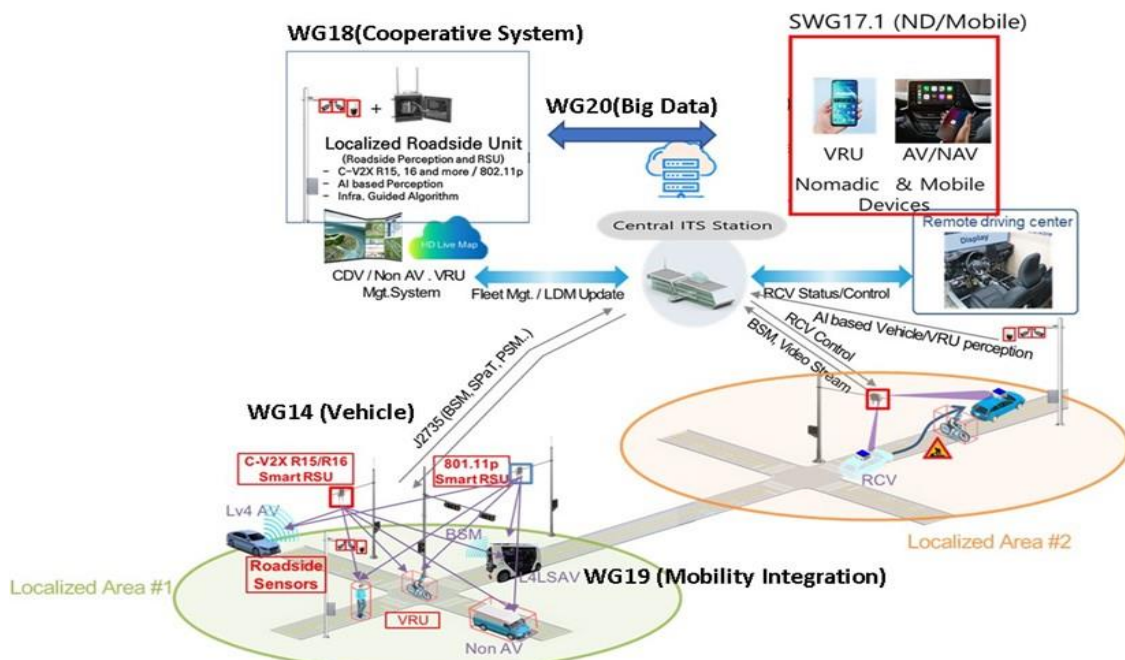


Figure 1: Analysis of interdependencies ISO/TC 204 WGs

In exploring the dynamic between "vertical" and horizontal standards, it has been drawn a parallel to a widely known example: email communication. Email communication serves as a horizontal standard that transcends the diverse operating systems and hardware configurations of individual computers, allowing seamless communication.

This TC group's effort aligns with the mission of key industrial associations that support the respective WGs and TCs. These associations play a crucial role in shaping standards and fostering collaboration within their industries (automotive, sensors, telecom). As we propose a similar approach to foster collaboration among different WGs, the aim is to leverage the expertise and influence of these industrial associations. If successful, this model could be extended to other ISO TCs, ensuring a broader industry-

wide impact. By aligning with and involving industrial associations, the aim is to create horizontal standards that not only benefit the TC 204 group but also contribute to broader industry advancements. This collaborative approach maximizes the impact of our standards initiatives, fostering interoperability and coordination across various technical domains.

**ISO/TC 22 - Road vehicles:** Addresses standards related to various aspects of road vehicles, including safety, environmental performance, and vehicle-to-vehicle communication.

**ISO/TC 23/SC 37 - Electric vehicle systems and components:** Focuses on standards for electric vehicles, including charging systems and components.

**ISO/TC 69 - Applications of statistical methods:** Addresses standards related to statistical methods, which may include aspects relevant to electric vehicle charging data analysis and performance evaluation.

**ISO/IEC JTC1 SC 37** is responsible for the standardisation of generic biometric technologies pertaining to human beings to support interoperability and data interchange among applications and systems.

**IEC/TC 9 - Electrical equipment and systems for railways:** Focuses on electrotechnical standards for electrical equipment and systems used in railways, which may include mobility aspects.

**IEC/TC 69 - Electric road vehicles and electric industrial trucks:** Concentrates on standards related to electric road vehicles and industrial trucks, contributing to standards for electric mobility.

**IEC/TC 23 - Electrical accessories:** May contribute to standards for electrical accessories, including those used in electric vehicle charging.

**Standards developed and in development in support of e-mobility include:**

- ISO 15118 Road vehicles - Vehicle to grid communication interface
- IEC 62840 Electric vehicle battery swap system
- IEC 61851 Electrical systems for electric road vehicles and electric industrial trucks
- IEC 62196 Plugs, socket-outlets, vehicle connectors and vehicle inlets - Conductive charging of electric vehicle
- IEC 63110 Protocol for the management of EVs charging and discharging infrastructures
- IEC 63119 Information exchange for electric vehicle charging roaming service
- IEC 61850 Exchange of information with distributed energy resources
- IEC 62351 series guarantees the security of data exchanged with the IEC 61850 protocols.

**ITU-T SG12 - Performance, QoS, and QoE:** Works on standards related to performance, quality of service (QoS), and quality of experience (QoE) in telecommunication networks, which may have implications for mobility services, in telecommunication networks, which could be relevant to charging communication protocols.

**ITU-T SG16 - Multimedia coding, systems, and applications:** Addresses standards related to multimedia coding, systems, and applications, which may include communication standards for mobile multimedia services.

**ITU-T SG5 - Environment and circular economy:** Focuses on standards related to the environmental impact of ICT, which may include aspects of electric vehicle charging infrastructure.

ITU is also actively involved in “AI for road safety”, in collaboration with the **UN Secretary-General's Special Envoy for Road Safety** and the **UN Envoy on Technology**, as well as other UN sister agencies. The focus of “AI for Road Safety” will be to harness the value of AI in enhancing the safe system approach to road safety, especially in low- and middle- income countries, where most of the road fatalities and injuries occur. We will explore the role of AI in the following areas: road safety data and regulatory frameworks; safer vehicles; road infrastructure; and post-crash response.

**ITU-T SG13** approved Recommendation ITU-T Y.4407/Y.2281 “Framework of networked vehicle services and applications using NGN” and is working on QoS requirements for train communication network supported by IMT-2020 (**Y.IMT2020-qos-req-tcn**) as well as on deployment of data platform for ITS in developing countries (**Supp-Y.TDP-Gen**).

**ITU-T SG20** approved Recommendation ITU-T Y.4211 “Accessibility requirements for smart public transportation services”. ITU-T SG20 is working on draft Recommendation ITU-T Y.4809 (Y.IoT-ITS-ID) “Unified IoT Identifiers for intelligent transport systems” and draft Recommendation ITU-T Y.dt-ITS “Requirements and capability framework of digital twin for intelligent transport system”.

**ITU-R Working Party (WP) 5A** is responsible for ITS studies in the Radiocommunication Sector and contributed to the World Radiocommunication Conference (WRC-19) on AI 1.12 “to consider possible global or regional harmonized frequency bands” (Resolution 237 (WRC-15)). See WRC-19 final acts.

### 3.3 Building Sector – Building Automation

The European Union (EU)'s construction products market alone is worth approximately €500 billion. Such a huge business needs to keep an open internal market for construction products consistent with national regulations under continuous technological evolution. The construction sector consists of more than 80 Technical Committees from CEN and CENELEC, dealing with the wide range of construction products, such as concrete, cement, wood, steel, gypsum, aggregates, glass, plastic, insulation materials, masonry, pipes, sanitaryware appliances, roof and wall coverings, building automation etc. The digital transformation of the built environment involves the digitalization of business processes, business data and strategic information. For this transformation to be successful it needs to consider technical, organizational, informational, or human aspects. Due to the number of multidisciplinary actors, this digitalization also needs to include a structured collaborative environment.

**Building Information Modelling (BIM)** is one of the main technologies that can be applied in all steps of the lifecycle of construction and existence of the assets. The adoption of BIM process in buildings allows us to simulate the impact of each decision made in the built environment. Other different technologies emerge reaching the full potential of BIM and promising to revolutionise different parts of the value chain, such as robotics, drones, printing, automated robots, sensors and IoT. Procurement (Directive 2014/24/EU)49, promotes the use of BIM in construction project. The introduction of common standards and operating methods using BIM would enhance the ecosystem.

A great and recent initiative deals with current building automation challenges is the **Smart Readiness Indicator (SRI)** calculation which is an auditing process aiming at assessing the automation and control aspects of building. It requires a structured chronological sequence and corresponding obligations in

terms of scope, aims and thoroughness. The SRI assessment requires inspection both of physical and operational aspects of building technical systems, including automation and control of building services. The CWA to develop is related to the SMART SQUARE project (2024, funded by European Commission and CINEA: <https://www.smartsquare-project.eu>) to adopt the audit procedures described in the EN 16247:2022 energy audit standard, with the aim to deliver a novel SRI audit procedure.

Other activities related to standardization under the H2020, are a) the DigiPLACE (Digital PLAtform for Construction in Europe) and the b) BIM4EEB (BIM based fast toolkit for Efficient rEnovation of residential Building).

Last but not least, a very helpful and insightful report for the parties would like to be involved in building automation standardization, entitled "***Landscape report on energy and flexibility data models and interoperability across the sectors of energy, mobility and buildings***", and published in 2023, is available [here](#). Standard solutions are instrumental to enable data exchange across today's information silos to boost grid flexibility and integration of renewables.

### 3.3.1 CEN / CENELEC/ETSI Technical Committees (TCs) and Working Groups (WGs)

Below are listed the most representative of the CEN, CENELEC (CLC), and ETSI Technical Committees which are directly and indirectly linked to the "Building-building automation" areas and topics:

**CEN/TC 156 - Ventilation for buildings:** Deals with standards related to ventilation systems in buildings.

**CEN/TC 169 - Heat pumps and air conditioning units:** While primarily focused on heat pumps and air conditioning, this committee may address standards relevant to building automation systems.

**CEN/TC 247 - Building Automation, Controls, and Building Management:** Focuses on standards related to building automation and controls, covering aspects such as communication protocols, interoperability, and energy efficiency.

**CEN/TC 294 - Heating systems and water-based cooling systems in buildings:** Addresses standards related to heating and cooling systems in buildings.

**CEN/TC 371 - Project Committee on Smart and Sustainable Cities and Communities:** Relevant to the building sector, this committee focuses on developing standards for smart and sustainable cities, including building automation and construction.

**CEN/TC 442 "Building Information Modelling (BIM)"** is about standardisation in the field of structured semantic life-cycle information for the built environment. CEN/TC442 collaborate with ISO/TC10/SC8 and ISO/TC 59/SC 13 (ISO committee responsible for BIM standardisation) to align Business Plans and Work Programmes with regard to the BIM. CEN/TC442 develops standards that support implementation of EU strategies for green, resilient, and digital construction ecosystem. List of standards and technical reports from CEN/TC442 grouped in use case categories, Data model – schema and format.

More information can be found following this link [here](#).

**CLC/TC 205 'Home and Building Electronic Systems (HBES)** is exploring the need for standardizing BIM attributes within its scope and in coordination with CEN/TC 442 (which has a coordinating role for BIM), **CEN/TC 247 'Building automation, controls and building management'**, and CEN/TC 169 'Light and Lighting'.

**CLC/TC 205 - Home and Building Electronic Systems (HBES):** Concentrates on standards related to electronic systems in homes and buildings, including building automation.

**CLC/TC 205/WG 5 - Home and Building Interoperability:** Works on standards related to interoperability aspects within home and building electronic systems.

**CLC/TC 23H - Power electronics for electrical transmission and distribution systems:** Addresses standards related to power electronics in electrical systems, which is relevant to the energy sector.

**ETSI TC SmartBAN (Smart Body Area Networks):** Focuses on standards for communication networks for body-worn devices, which may include applications related to building automation. Deals with standards related to communication networks for body-worn devices, which may be relevant to mobility and healthcare applications.

**ETSI TC M2M (Machine to Machine):** Addresses standards for machine-to-machine communication, which is relevant to the connectivity of devices in building automation. Focuses on standards for machine-to-machine communication, which has implications for IoT in various sectors, including energy and mobility.

**ETSI TC Smart Grid:** Deals with standards for smart grids, addressing the intersection of energy and ICT technologies.

**ETSI TC CYBER (Cybersecurity):** Works on standards related to cybersecurity, including aspects that may be applicable to securing communication in building automation systems.

### 3.3.2 ISO, IEC, ITU Technical Committees (TCs) and Working Groups (WGs)

Likewise, below are listed the most representative of the ISO, IEC, and ITU Technical Committees which are directly and indirectly linked to the "Building-building automation" areas and topics:

**ISO/TC 205 - Building environment design:** Focuses on standards related to building environment design, including aspects that may intersect with building automation.

Under this TC 205, the **ISO 52120-1:2021 Energy performance of buildings**. This standard is focusing on building automation, controls and building management. The ISO/DIS 16484-4: Building automation and controls systems (BACS), is under development and provides specifications for control applications and function blocks for solar protection, HVAC, lighting, among others.

**ISO/IEC JTC 1/SC 6 - Telecommunications and information exchange between systems:** Works on standards for telecommunication and information exchange, including protocols that may be relevant to building automation systems.

**ISO ISO/TC 59/SC 13 "Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM)"** is charged by TC 59 "Buildings and civil engineering works" to focus on international standardisation of information through the whole life cycle of buildings and infrastructure across the built environment to enable interoperability of information, to deliver a structured set of standards, specifications and reports to define, describe, exchange, monitor, record and securely handle information, semantics and processes, with links to geospatial and other related built environment information and to enable object-related digital information exchange.

**IEC/TC 57 - Power systems management and associated information exchange:** While primarily focused on power systems, it may address standards related to information exchange, including aspects of building automation.



**IEC/TC 65 - Industrial-process measurement, control, and automation:** Focuses on standards related to industrial process measurement, control, and automation, which may include building automation systems.

**ITU-T SG15 - Transport, access, and home networks:** Works on standards related to transport, access, and home networks, which may encompass technologies used in building automation.

**ITU-T SG20 - Internet of Things (IoT) and its applications including smart cities and communities:** Addresses standards for the Internet of Things (IoT), including applications such as smart cities, which can include building automation.

### 3.4 Smart and Sustainable Cities, Security and Resilience and Risk Management

Given that Energy, Mobility and Building as sectors are exist in the framework of Societies and Cities, is considered relevant to include and take into account also the technical bodies and standards focused to the Smart and Sustainable Cities, Security and Resilience and Risk Management, as provided below:

#### SMART CITIES

The Commission has created the European Innovation Partnership on Smart Cities and Communities (EIP SCC) which has established a smart cities stakeholder platform, with ESO participation, and a high-level group advising the Commission. The high-level group released in early 2014 a strategic implementation plan (SIP) setting out a joint vision, a common target and proposals for implementation, which contain standardisation aspects. The EIP-SCC has not prolonged its mandate. However, the initiative's stakeholder platform is continuing as Smart Cities Marketplace on the EUROPA domain.

It is important to ensure the cooperation between the different initiatives that bring together cities with the work of the SDOs, in particular for the definition of (high) level requirements and feedback about their implementation. Example initiatives are:

- The (EIP-SCC) memorandum of understanding (MoU) on urban platforms (18/09/2017)
- List of signatories of the EIP-SCC MoU on urban platforms (18/09/2017)
- The Open & Agile Smart Cities (OASC) initiative and the actual implementation of technical specifications through Living-in.eu.
- Urban Agenda for the EU and the recently adopted New Leipzig Charter
- Smart Cities Marketplace.

Within the Smart Cities Marketplace, the Action Cluster on Integrated Infrastructures and Processes, an initiative of 110 cities and 93 industry partners, created, among other deliverables, a reference architecture and design principles for an open urban platform, which became a standard of DIN and is moving towards a standard in the international SDOs. Complementing their work, the European project SynchroniCity developed the **Minimal Interoperability Mechanisms (MIMs)** consistent with the Smart Cities & Communities guidelines and comprised of commonly agreed industry standards and best practice and tested their validity on a large scale (more than 50 implementations), now overseen by the Open & Agile Smart Cities network.

Digital Twins meet the agreement from the EU standardisation strategy, COM (2022) 31, whereby: EU Member States, EU standardisation bodies and EU industries do not effectively coordinate and share

resources in support of international standardisation processes and principles of the World Trade Organization (WTO), such as openness, transparency and consensus.

The "**United for smart sustainable cities**" (**U4SSC**) initiative coordinated by ITU, UNECE and UN-Habitat and supported by 13 other UN agencies and programmes to advocate for public policy to emphasize the importance of ICT in enabling the transition to smart sustainable cities (see the ITU section below).

### 3.4.1 CEN / CENELEC/ETSI Technical Committees (TCs) and Working Groups (WGs)

Below are listed the most representative of the CEN, CENELEC (CLC), and ETSI Technical Committees which are directly and indirectly linked to the "Smart and Sustainable Cities, Security and Resilience and Risk Management-oriented" areas and topics:

**CEN/TC 465 'Sustainable and Smart Cities and Communities'** has been created by CEN in October 2019. The TC is intended to address specific European needs through a consistent approach with the activities of ISO/TC 268 'Sustainable Cities and Communities'.

**CEN/TC 391- Societal and Citizen Security.** The main objective of CEN/TC 391 is to elaborate a family of European standards, standard-like documents in the Societal and Citizen Security sector including aspects of prevention, response, mitigation, continuity and recovery before, during and after a destabilising or disruptive event.

**CLC/TC 205 - Home and Building Electronic Systems (HBES):** Concentrates on standards related to electronic systems in homes and buildings, which may include aspects of smart and sustainable buildings in smart cities.

**ETSI TC SmartBAN** (Smart Body Area Networks): Focuses on standards for communication networks for body-worn devices, which may include applications related to smart and sustainable cities.

**ETSI TC M2M** (Machine to Machine): Addresses standards for machine-to-machine communication, which is relevant to the connectivity of devices in smart city applications.

**ETSI: Context Information Management (NGSI-LD):** ETSI ISG CIM specifies protocols (NGSI-LD API) running 'on top' of IoT platforms and allowing exchange of data together with its context, this includes what is described by the data, what was measured, when, where, by what, the time of validity, ownership, and others. This is extending the interoperability of applications, supporting smart cities (and other areas such as Smart Agriculture and Smart Manufacturing) to integrate their existing services and enable new third-party services.

### 3.4.2 ISO, IEC, ITU Technical Committees (TCs) and Working Groups (WGs)

Below are listed the most representative of the ISO, IEC, and ITU Technical Committees which are directly and indirectly linked to the "Smart and Sustainable Cities, Security and Resilience and Risk Management-oriented" areas and topics:

**ISO/TC 268 - Sustainable cities and communities:** Focuses on developing standards for sustainable and resilient cities, covering areas such as infrastructure, environment, and societal aspects.

**ISO/TC 262** - Risk management: Focuses on standards related to risk management, providing principles, guidelines, and frameworks applicable to various industries and sectors.

**ISO/TC 292** - Security and resilience: Concentrates on standards related to security and resilience, covering a wide range of topics such as risk management, societal security, and resilience planning. Addresses standards related to societal security, including emergency management and business continuity.

**ISO/TC 307** - Blockchain and electronic distributed ledger technologies: Addresses standards related to blockchain technologies, which may have applications in smart city systems.

**ISO/IEC JTC 1/SC 27** - IT Security techniques: Focuses on standards related to information security, including cybersecurity management systems, cryptography, and security controls.

**IEC/TC 57 - Power systems management and associated information exchange:** Develops standards related to power systems management, including communication protocols for smart grid applications within smart cities.

**IEC/TC 82 - Solar photovoltaic energy systems:** Concentrates on standards related to solar photovoltaic energy systems, which play a role in sustainable energy solutions for smart cities.

**IEC/TC 57** - Power systems management and associated information exchange: Develops standards related to power systems management, including cybersecurity for power systems.

**IEC/TC 65** - Industrial-process measurement, control, and automation: Focuses on standards related to industrial-process measurement, control, and automation, including security considerations.

**IEC/TC 56** - Dependability: Addresses standards related to dependability, including risk assessment and management in the design and operation of systems.

**ITU-T SG20 - Internet of Things (IoT)** and its applications including smart cities and communities: Addresses standards for IoT applications, including those specific to smart cities and communities.

**ITU-T SG5 - Environment and circular economy:** Works on standards related to the environmental impact of ICT, including considerations for smart city technologies.

**ITU-T FG DPM (Focus Group on Data Processing and Management to support IoT and Smart Cities & Communities):** Focuses on data processing and management to support IoT, smart cities, and communities.

**ITU-T SG17** - Security: Addresses standards related to information security, including network and information security, telebiometrics, and identity management.

**ITU-T SG20** - Internet of Things (IoT) and its applications including smart cities and communities: Works on standards for IoT applications, including security considerations for IoT devices and networks.

**ITU-T SG15** - Transport, access, and home networks: Focuses on standards related to transport networks, including security aspects.

**ITU-T SG17** - Security: While primarily focused on information security, SG17 also addresses risk management aspects related to cybersecurity.

**U4SSC** is a United Nations initiative coordinated by ITU, UNECE and UN-Habitat and supported by 14 other UN agencies and programmes, to help cities and communities become smarter and more sustainable. U4SSC is currently working on several thematic groups including (but not limited to) city platform, Lessons Learned From Building Urban Economic Resilience at City Level During and After COVID-19, Compendium of Practices on Innovative Financing for Smart Sustainable Cities Projects, guiding principles for artificial intelligence in cities, procurement guidelines for SSC, Enabling People-Centred Cities through Digital

Transformation and etc, to support the transition to smart sustainable cities in view of the Sustainable Development Goals (SDGs). More info here: <https://u4ssc.itu.int/>

## 3.5 DIGITAL CROSS SECTORIAL APPROACH

The **EU Rolling Plan for ICT Standardisation** provides a unique bridge between EU policies and standardisation activities concerning information and communication technologies (ICT). This helps to increase the convergence of standards makers' efforts towards achieving EU policy goals. It also details the requirements for ICT standardisation, translates them into actions, and provides a follow-up mechanism for the actions. The Rolling Plan 2023 ([Rolling Plan 2023 | Joinup \(europa.eu\)](#)) identifies around 260 actions grouped into 39 technological or application domains under four thematic areas: key enablers, societal challenges, innovation for the single market and sustainable growth. Moreover, it gives a particular prominence to three horizontal “foundational topics” under section 3.0, including updated chapters on data economy, cybersecurity and e-privacy. These are all technology areas for standardisation that go right across the spectrum of standards-making, and may need to be referenced by many, even most, specific activities. Their challenges arise at every step of digitalisation and policy makers need to be more aware that ICT standardisation is the tool to tackle them.

### 3.5.1 Relevant Technical Committees (TCs), Working Groups (WGs), industrial associations and open-source communities (Cloud and edge computing)

When it comes to Cloud Security, **CEN-CLC/JTC 13 'Cybersecurity and Data protection' mirrors the activities of ISO/IEC JTC 1 SC 38 'Cloud Computing and distributed platforms'**, and considers in this respect the potential adoption of International Standards as European Standards, where market relevant. CEN-CLC/JTC 13's scope covers the development of standards for cybersecurity and data protection covering all aspects of the evolving information society. This includes notably: Management systems, frameworks, methodologies; Data protection and privacy; Services and products evaluation standards suitable for security assessment for large companies and small and medium enterprises (SMEs); Competence requirements for cybersecurity and data protection; Security requirements, services, techniques and guidelines for ICT systems, services, networks and devices, including smart objects and distributed computing devices.

In 2021, CEN-CLC/JTC 13 started developing the following relevant deliverables:

- prCEN/CLC/TS XXX 'Multi-layered approach for a set of information security requirements for information/cyber security controls for Cloud Services'
- prCEN/CLC/TS XXX 'Requirements for Conformity Assessment Bodies certifying Cloud Services'

Moreover, last year, it launched a **CEN Workshop on “Trusted Data Transaction”**, Secretariat AFNOR. This workshop was proposed with the aim of developing a CWA on terminology, concepts, and mechanisms for common elements to form a foundational understanding on which trusted data transactions can be based independent of any architectural choices or technical implementation.

This workshop arises from the need to secure cross-border and cross-industry data flows, within and across data spaces or data ecosystems, in full compliance with regulatory requirements. As technologies such as artificial intelligence (AI) and internet of things (IoT) continue to evolve and spread, the importance of data exchange, data sharing and data flows will only become more significant to build data-driven use cases and generate value. The document submitted to public enquiry is the part 1 of the CWA focusing on terminology and concepts. It will be followed by a part 2 focusing on Trustworthiness characteristics of data transactions. The CWA is now ready for public consultation.

## ETSI

**ISG NFV (Network Functions Virtualization):** <https://www.etsi.org/committee/NFV> adapts standard IT virtualization technologies, consolidating heterogeneous network infrastructures based on disparate, ad hoc equipment types onto industry standard servers, switches and storage. ISG NFV develops the NFV architectural framework to make more efficient the integration of edge computing and NFV.

GS NFV-EVE 011 documents the set of criteria to help characterize cloud-native VNFs.

GS NFV-IFA 029 documents enhancements of the NFV architecture for providing “PaaS”-type capabilities and supporting virtualized network functions (VNFs) which follow “cloud-native” design principles.

### **Specifications and reports on container infrastructure management:**

- GS NFV-IFA040 "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Requirements for service interfaces and object model for OS container management and orchestration specification"
- GS NFV-IFA036 " Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Specification of requirements for the management and orchestration of container cluster nodes"
- GR NFV-IFA038 "Network Functions Virtualisation (NFV) Release 4; Architectural Framework; Report on network connectivity for container based VNF"
- GS NFV-SEC023 " Network Functions Virtualisation (NFV) Release 4; Security; Container Security Specification"
- GS NFV-SOL 018 "Network Functions Virtualisation (NFV) Release 4; Protocols and Data Models; Profiling specification of protocol and data model solutions for OS Container management and orchestration"

### **Specifications and reports on multi-site / multi-domain deployments**

- GS NFV-IFA 032 " Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Interface and Information Model Specification for Multi-Site Connectivity Services"
- GS NFV-IFA 030 "Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Multiple Administrative Domain Aspect Interfaces Specification"
- GR NFV-SOL 017 "Network Functions Virtualisation (NFV) Release 3 Protocols and Data Models Report on protocol and data model solutions for Multi-site Connectivity Services"

Within the framework of NFV Release 5, ISG NFV develops a report on methods and metrics for evaluating the reliability of cloud-native VNFs.

**ISG MEC (Multi-access Edge Computing):** <https://www.etsi.org/committee/MEC> offers to application developers and content providers cloud-computing capabilities and an IT service environment at the edge of the network. ISG MEC is developing a set of standardised Application Programming Interfaces (APIs) to enable MEC services. To application developers and content providers, the access network offers a service environment with ultra-low latency and high bandwidth and direct access to real-time network information that can be used by applications and services to offer context-related services.

Relevant ISG MEC documents:

- The group led the publication of a **White Paper on “MEC security: Status of standards support and future evolutions”** written by several authors participating in ETSI ISG MEC, ETSI ISG NFV SEC and ETSI TC CYBER. The work identified aspects of security where the nature of edge computing leaves typical industry approaches to cloud security insufficient.
- Following on from the white paper, ISG MEC started a study on MEC Security (ETSI GR MEC041).
- Also, multi-MEC and MEC-Cloud environments can be relevant in this context. In the domain of Cloud Federation, ETSI ISG MEC published a study **ETSI GR MEC 035**.

As a follow-up of the previous study (MEC 035), the group started the related normative work (ETSI GS MEC 040) to standardize MEC Federation Enablement APIs. The work is done in alignment with GSMA OPG and 3GPP SA6.

**ISG IPE (IPv6 Enhanced Innovation):** <https://www.etsi.org/committee/1424-ipe> has published a report "IPv6 based Data Centers, Network and Cloud Integration".

**ISG NIN (Non-IP Networking):** is investigating communications and networking protocols to provide the scale, security, mobility, and ease of deployment required for a connected society. It is developing a forwarding plane standard that, while still supporting traditional Internet protocols, will also natively support new forms of routing, with a clean interface between the forwarding plane and the control and management planes. Thus, when accessing a service that might be provided at the edge or centrally, a client no longer needs to discover an IP address which identifies an interface to the equipment that provides the service, but can identify the service, content, etc., directly.

**ISG ETI (Encrypted Traffic Integration):** is exploring means to ensure the smooth integration of encrypted traffic to the operation of networks. The concern is that with an over enthusiastic approach to encryption the data required to manage the network effectively is hidden from management points (e.g. routers, switches, control planes). The intent of the work of the ISG is captured in the published problem statement (**ETSI GR ETI 001**) and is being addressed in ongoing work that endorses the Zero Trust Architecture wherein network elements have to attest to their function in the network before managing it.

**ISG ZSM (Zero Touch Management):** <https://www.etsi.org/committee/ZSM>. Provides a framework which enables the management of the network and services without human involvement. The automation of operation will ease the management of the edge-cloud continuum, and the enforcement of security and privacy policies.

**ISG F5G (Fixed 5G):** completed two releases of Use Cases, with a large percentage of them referring to the use of cloud services. Dedicated interfaces to cloud services are defined in F5G Architecture (**ETSI GS F5G 004V1.1.1**) and the E2E management (in final revision before publication as ETSI GS F5G 006) provides indications about how the F5G network should handle requests for Cloud based service.

### **ETSI: IoT Semantic Interoperability**

The **SAREF** family of standards enable interoperability between solutions from different providers and among various activity sectors in the Internet of Things (IoT).

SAREF (Smart Applications REference ontology) allows connected devices to exchange semantic information in many applications' domains, as there are several extensions already developed for Energy, Smart Grids, and Automotive domains.

**OSM (Open-Source MANO):** <http://osm.etsi.org/> developing an open-source Management and Orchestration (MANO) software stack aligned with ETSI NFV.

**ISG MEC (Multi-access Edge Computing):** <https://www.etsi.org/committee/MEC> offers to application developers and content providers cloud-computing capabilities and an IT service environment at the edge of the network. ISG MEC is developing a set of standardised Application Programming Interfaces (APIs) to enable MEC services. To application developers and content providers, the access network offers a service environment with ultra-low latency and high bandwidth and direct access to real-time network information that can be used by applications and services to offer context-related services.

### **List of relevant documents from ISG MEC:**

- The group led the publication of a **White Paper on "MEC security: Status of standards support and future evolutions"** written by several authors participating in ETSI ISG MEC, ETSI ISG NFV SEC and ETSI TC CYBER. The work identified aspects of security where the nature of edge computing leaves typical industry approaches to cloud security insufficient.

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- Also, multi-MEC and MEC-Cloud environments can be relevant in this context. In the domain of Cloud Federation, ETSI ISG MEC published a study **ETSI GR MEC 035**.

As a follow-up of the previous study (MEC 035), the group started the related normative work (ETSI GS MEC 040) to standardize MEC Federation Enablement APIs. The work is done in alignment with GSMA OPG and 3GPP SA6.

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## ISO/IEC

**ISO/IEC JTC 1/SC 27** Information security, cybersecurity and privacy protection

**ISO/IEC 27017** — Code of practice for information security controls based on ISO/IEC 27002 for cloud services

**ISO/IEC 27018** — Code of practice for personally identifiable information (PII) protection in public cloud acting as PII processors

**ISO/IEC 27036-4** — Information security for supplier relationships — Part 4: Guidelines for security of cloud services

**ISO/IEC JTC 1/SC 38 -- Cloud computing and distributed platforms.** It covers the different aspects of standardisation in the areas of Cloud Computing and Distributed Platforms including:

- Foundational concepts and technologies,
- Operational issues, and
- Interactions among Cloud Computing systems and with other distributed systems
- Below is a non-exhaustive list of relevant ISO standards.

The list below provides an overview of relevant standards under this SC 38 (non-exhaustive list):

**ISO/IEC 19941:2017**, titled "Information technology -- Cloud computing -- Interoperability and portability," provides guidelines and requirements for achieving interoperability and portability in cloud computing environments.

**ISO/IEC TS 5928:2023**- "Information technology — Cloud computing and distributed platforms — Taxonomy for digital platforms"

**ISO/IEC TR 23186:2018** - "Information technology — Cloud computing — Framework of trust for processing of multi-sourced data"

**ISO/IEC 23751:2022**- "Information technology — Cloud computing and distributed platforms — Data sharing agreement (DSA) framework"

**ISO/IEC 19086-3:2017** - " Information technology - Cloud computing -- Service-level agreement (SLA) framework- Part 3: Core conformance requirements".

**There are 7 standards and/or projects under the direct responsibility of ISO/IEC JTC 1/SC 38, which are under development:**

- ISO/IEC DIS 5140: Information technology — Cloud computing — Concepts for multi-cloud and the use of multiple cloud services
- ISO/IEC AWI TS 7339: Cloud computing and distributed platforms — Cloud computing — Platform capabilities type and Platform as a Service (PaaS)

- ISO/IEC AWI TR 10822-1: Cloud computing — Multi-cloud management — Part 1: Overview and use cases
- ISO/IEC AWI TS 10866: Information technology — Cloud computing and distributed platforms — Framework and concepts for organizational autonomy and digital sovereignty
- ISO/IEC AWI 11034: Information technology — Cloud computing — Trustworthiness in cloud computing
- ISO/IEC AWI 19274: Information technology — Cloud computing and distributed platforms — Networking in cloud computing and edge computing
- ISO/IEC AWI 19941: Information technology — Cloud computing and distributed platforms — Interoperability and portability
- ISO/IEC AWI 20151: Information technology — Cloud computing and distributed platforms — Dataspace concepts and characteristics.

## ITU-T

**ITU-T SG13** leads ITU's work on standards for future networks and **5G** and is the primary SG working on cloud computing and data handling. It approved 29 Recommendations and 2 Supplements and has 26 ongoing work items covering different aspects of cloud computing (e.g. terminology, overview, reference architecture, functional requirements for technologies supporting XaaS and inter-cloud computing, edge cloud for FMSC, and performance management framework in inter-cloud and data storage federation). Relevant URLs:

- Y.Sup49 to ITU-T Y.3500-series (11/2018) - Cloud computing standardisation roadmap, including deliverables of various SDOs: <https://www.itu.int/rec/T-REC-Y.Sup49/en> .
- Flipbook "Cloud computing: From paradigm to operation" with a collection of many ITU-T outputs on cloud computing: <https://www.itu.int/en/publications/Documents/tsb/2020-Cloud-computing-From-paradigm-to-operation/index.html>

In the domain of **Big Data for Cloud**, ITU-T related work is listed in the Big Data chapter of this Rolling Plan. More info: <https://www.itu.int/en/ITU-T/studygroups/2017-2020/13>

**ITU-T SG11 work on cloud and edge computing** with regard to signalling, monitoring and interoperability testing. SG11 developed 7 Recommendations which cover monitoring of cloud computing, signalling requirements of intelligent edge computing, interoperability testing of cloud computing and testing requirements for virtual switches (ITU-T Q.3914, ITU-T Q.4040-Q.4059-series, ITU-T Q.5001).

**The ITU-T Q.Supplement 65 "Cloud computing interoperability activities"**, provides the summary information for cloud computing interoperability activities of existing standards development organizations (SDOs) and the groups, forums and open sources developing the specifications that have the potential to utilize cloud computing interoperability testing tools. The ongoing work items of SG11 focus on signalling requirements for interfaces of edge-aided energy management agent at intelligent edge computing, protocols for microservices based intelligent edge computing and data management interfaces for intelligent edge computing-based smart agriculture service. More info: <https://itu.int/go/tsg11>

**ITU-T SG20** develops standards for the **Internet of Things (IoT), smart cities, and communities**. It also studies aspects related to edge computing for the Internet of Things (IoT) which allows IoT deployments to be enhanced through data processing closer to the end device. ITU-T SG20 has approved the following Recommendations:

- Recommendation ITU-T Y.4122 "Requirements and capability framework of edge computing-enabled gateway in the IoT"
- Recommendation ITU-T Y.4208 "IoT requirements for support of edge computing"



**ITU-T SG20** is currently working on draft Recommendation “Framework of decentralized service by using DLT and edge computing technologies for IoT devices” (Y.IoT-DES-fr). More info: <https://itu.int/go/tsg20>

**ITU-T SG17** works on **cloud computing security**. It has approved four Recommendations:

- ITU-T X.1603 “Data security requirements for the monitoring service of cloud computing”,
- ITU-T X.1604 “Security requirements of network as a service (NaaS) in cloud computing”
- ITU-T X.1605 “Security requirements of public infrastructure as a service (IaaS) in cloud computing”
- ITU-T X.1606 “Security requirements for communication as a service application environment”. .SG17 has is working on Security guidelines for container, distributed cloud, multi-cloud, edge cloud and Security requirements of cloud-based platform under low latency and high reliability application scenarios, network security situational awareness platform for cloud computing, etc.

More details here: <https://www.itu.int/en/ITU-T/studygroups/2017-2020/17>

## **IEEE ((INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS)**

### **Cloud computing:**

IEEE 2302-2021: IEEE Standard for Intercloud Interoperability and Federation (SIIF), providing a model that allows a range of deployment topologies and governance, and can be applied to many application domains using different implementation approaches.

### **Fog/Edge Computing:**

Work is going on in IEEE P1934.1 "Nomenclature and Taxonomy for Distributing Computing, Communications and Networking along the Things-to-Cloud Continuum" and IEEE P1935 "Standard for Edge/Fog Manageability and Orchestration".

More recently IEEE SA initiated a new family of standards on cloud-edge collaborative framework through its work on IEEE P2805.1 on “Self-Management Protocols for Edge Computing Node”, IEEE P2805.2 on “Data Acquisition, Filtering and Buffering Protocols for Edge Computing Node”, IEEE P2805.3 on “Cloud-Edge Collaboration Protocols for Machine Learning”, and the IEEE P2961 on “Guide for an Architectural Framework and Application for Collaborative Edge computing”.

With increased usage of cloud computing, cybersecurity is a core consideration. IEEE SA has initiated a pre-standards Industry Connections program to focus on “Cybersecurity of Agile Cloud Computing”.

More information is available at <https://ieeesa.io/eu-rolling-plan>

## **IETF (INTERNET ENGINEERING TASK FORCE)**

The IETF has multiple groups working on standards for virtualization techniques, including techniques used in cloud computing and data centres.

The **Layer 2 Virtual Private Networks (L2VPN) Working Group** produced specifications defining and specifying solutions for supporting provider-provisioned Layer-2 Virtual Private Networks (L2VPNs). They also addressed requirements driven by cloud computing services and data centres as they apply to Layer-2 VPN services. The **L2VPN Service Model (L2SM) Working Group** is tasked to create a data model that describes an L2VPN service.

The **Layer 3 Virtual Private Networks (L3VPN) Working Group** was responsible for defining, specifying and extending solutions for supporting provider-provisioned Layer-3 (routed) Virtual Private Networks (L3VPNs). These solutions provide IPv4, IPv6, and MPLS services including multicast.

The **Layer Three Virtual Private Network Service Model (L3SM) Working Group** was tasked to create a YANG data model that describes an L3VPN service (an L3VPN service model) that can be used for communication between customers and network operators, and to provide input to automated control and configuration applications.

The **Network Virtualization Overlays (NVO3) Working Group** develops a set of protocols and extensions that enable network virtualization within a datacentre environment that assumes an IP-based underlay. An NVO3 solution provides layer 2 and/or layer 3 services for virtual networks enabling multi-tenancy and workload mobility, addressing management and security issues.

The **System for Cross-domain Identity Management (SCIM) Working Group** worked on standardising methods for creating, reading, searching, modifying, and deleting user identities and identity-related objects across administrative domains, with the goal of simplifying common tasks related to user identity management in services and applications.

The **Computing in the Network Research Group (coinrg)** of the IRTF explores existing research and fosters investigation of “Compute In the Network” and resultant impacts to the data plane. The goal is to investigate how to harness and to benefit from this emerging disruption to the Internet architecture to improve network and application performance as well as user experience.

<https://trac.ietf.org/trac/iab/wiki/Multi-Stake-Holder-Platform#Cloud>

### **FRAUNHOFER INSTITUTE AND OFE**

The Fraunhofer Institute and Open Forum Europe (OFE) have been carrying out a study on behalf of the European Commission, entitled “The impact of Open-Source Software and Hardware on technological independence, competitiveness and innovation in the EU economy”. The study is in latest stages of being published (foreseen September 2021). The analysis estimates a cost-benefit ratio of above 1:4 and predicts that an increase of 10% of OSS contributions would annually generate an additional 0.4% to 0.6% GDP as well as more than 600 additional ICT start-ups in the EU. Case studies reveal that by procuring OSS instead of proprietary software, the public sector could reduce the total cost of ownership, avoid vendor lock-in and thus increase its digital autonomy. The study also contains policy recommendations including the promotion OSS in addition to standardisation as a further channel of knowledge and technology transfer, e.g., as an explicit dissemination channel for Horizon Europe projects.

### **OPEN GRID FORUM (OGF)**

OGF is a leading standards development organization operating in the areas of grid, cloud and related forms of advanced distributed computing. The OGF community pursues these topics through an open process for development, creation and promotion of relevant specifications and use-cases. More details, here <http://www.ogf.org/>

### **RISC-V (INTERNATIONAL NON-PROFIT ORGANIZATION FOR THE OPEN STANDARD RISC-V INSTRUCTION SET ARCHITECTURE (ISA) AND RELATED SPECIFICATIONS)**

RISC-V has approximately 4.000 members across 70 countries that contribute to define RISC-V open specifications as well as convene and govern related technical, industry, domain, and special interest groups. RISC-V combines a modular technical approach with an open, royalty-free ISA — meaning that anyone, anywhere can benefit from the IP contributed and produced by RISC-V. As a non-profit, RISC-V does not maintain any commercial interest in products or services. As an open standard, anyone may leverage RISC-V as a building block in their open or proprietary solutions and services.

RISC-V, the open standard instruction set architecture (ISA), is enabling a range of new applications and research in areas such as automotive, high-performance compute, space, and more, to define the future of computing in Europe. RISC-V addresses the following technical topics: Automotive; Cloud computing; Compilation and code optimization; Embedded systems, IoT, and edge computing; Hardware/software co-design; High-performance computing; Open EDA tools; Open-source hardware and open silicon; Operating system and software ecosystem; RISC-V related educational activities; RISC-V ISA extensions; Systems-on-chip, including processor cores, accelerators, and peripherals; Security and functional safety; Verification; Any other topic related to RISC-V and open hardware.

Specifications can be found in the following link: **[Specifications – RISC-V International \(riscv.org\)](https://riscv.org/specifications/)**

### **OBJECT MANAGEMENT GROUP (OMG )**

The OMG's focus is always on modelling, and the first specific cloud-related specification efforts have only just begun, focusing on modelling deployment of applications & services on the clouds for portability,

interoperability & reuse. <http://www.omg.org/> Hosted by the OMG is the Cloud Standards Customer Council, which has produced a series of customer-oriented white papers on diverse topics related to cloud computing, all of which are publicly accessible at: <http://www.cloud-council.org/resource-hub.htm>

### **OneM2M**

The oneM2M architecture is based on distributed computing capabilities, data management and storage, and it supports interworking with non-oneM2M entities and integrates with communication infrastructures. The oneM2M system operates in the cloud when the data are centralized. At the same time, separate oneM2M based cloud services may be federated as an alternative to the direct integration of dedicated data bases. The oneM2M standards also address edge related technologies for Automotive and Industry 4.0 domains. In 2018 oneM2M started a dedicated work item on Edge and Fog Computing (WI-0080). Different solutions have been developed, such as Edge/Fog offloading, dynamic service management, common service description /service-awareness, loosely/tightly coupled Edge/Fog Computing. The study of those solutions resulted in related normative work that contains advanced features and enhancements for oneM2M specifications TS-0001, TS-0004 and TS-0026. Specific studies are available as technical reports as well as all specifications being made publicly accessible at: <https://onem2m.org/technical/published-specifications>. Related guidelines are also provided in ETSI TR 103 527 V1.1.1 (2018-07) SmartM2M; Virtualized IoT Architectures with Cloud Back-ends.

### **OASIS (OASIS (NON-PROFIT STANDARDISATION BODY))**

OASIS Open offers projects—including open-source projects—a path to standardisation and de jure approval for reference in international policy and procurement.

#### **Relevant Technical Committees (TCs):**

The **Topology and Orchestration Specification for Cloud Applications (TOSCA)** TC works to enhance the portability of cloud applications (vendor neutral) and services across their entire lifecycle. TOSCA enables the interoperable description of application and infrastructure cloud services, and the operational behaviour of these services (e.g. deploy, patch, shutdown) independent of the supplier creating the service, and any particular cloud provider or hosting technology. TOSCA is at the top of the list of “most used standards projects” in **the Cloudwatch2 study**. The OASIS TOSCA TC and ETSI NFV ISG cooperate to align their Network Functions Virtualisation (NFV) service models and specifications.

TOSCA TC has also a workgroup focused on IoT/Edge/Fog to explore the opportunities of application within these domains.

The **Cloud Application Management for Platforms (CAMP) TC** advances an interoperable protocol that cloud implementers can use to package and deploy their applications. CAMP defines interfaces for self-service provisioning, monitoring, and control. Common CAMP use cases include: moving on-premise applications to the cloud (private or public) or redeploying applications across cloud platforms from multiple vendors.

This TC was closed by OASIS TC Administration in 2021 and is no longer active, however its work remains publicly accessible and linked to the TC website.

The **OASIS Open Data Protocol (Odata)** TC works to simplify the querying and sharing of data across disparate applications and multiple stakeholders for re-use in the enterprise, Cloud, and mobile devices. A REST-based protocol, OData builds on HTTP and JSON using URIs to address and access data feed resources. OASIS OData standards have been approved as ISO/IEC 20802-1:2016 and ISO/IEC 20802-2:2016.

The goal of the **OASIS Virtual I/O Device (VIRTIO) TC** is to simplify virtual devices, making them more extensible and more recognizable. It ensures that virtual environments and guests have a straightforward, efficient, standard, and extensible mechanism for virtual devices. Guest can use similar standard PCI drivers and discovery mechanisms for PCI devices of the VIRTIO family as for physical PCI devices.

## OPEN FORUM EUROPE (OFE)

OFE was carried out a study on behalf of the European Commission, entitled “Standards and Open Source: bringing them together”. The aim of this study was to analyse and make practical progress on the collaboration models between SDOs and cloud open-source software development initiatives, and to develop a roadmap of actions to improve the integration of open-source communities in the standard setting process.

<https://ec.europa.eu/digital-single-market/en/news/standards-and-open-source-bringing-them-together>

## OTHER ACTIVITIES RELATED TO DIGITAL STANDARDISATION

### BSI (BRITISH STANDARDS INSTITUTION)

Cloud Computing Compliance Controls Catalogue (C5). The C5 defines a baseline for cloud security, divided into thematic sections (e.g. organisation of information security, physical security), using mostly recognised security standards. C5 outlines prerequisites for a conformity assessment using international standards (ISAE 3000, ISAE 3402), adding cloud specific requirements, especially for transparency.

### W3C (WORLD WIDE WEB CONSORTIUM)

It is an international stakeholder community which develops standards to support organizations to build a web based on the principles of accessibility, internationalization, privacy and security.

#### **Relevant groups:**

#### **Verifiable Credentials Working Group (VC WG)**

The mission of the Verifiable Credentials Working Group is to maintain the Verifiable Credentials Data Model specification and related Working Group Notes. This specification provides a mechanism to express credentials on the Web in a way that is cryptographically secure, privacy respecting, and machine-verifiable ([Verifiable Credentials | Working Groups | Discover W3C groups | W3C](#)).

#### **W3C DECENTRALIZED IDENTIFIER Working Group**

The goal of the Decentralized Identifier Working Group is to standardize the Decentralized Identifiers (DID) URI scheme, the data model and the syntax of DID documents. It provides the requirements for DID method specifications. Decentralized identifiers (DIDs) are a new type of identifier that enables verifiable, decentralized digital identity. ([Decentralized Identifier | Working Groups | Discover W3C groups | W3C](#)).

### OPENID FOUNDATION

It is a non-profit open standards foundation which develops identity standards that are secure, interoperable and privacy-preserving. Moreover, the foundation also provides support to the members to understand the links with other standards like FIDO (The “FIDO Alliance” is an open industry association which aims at reducing the reliance on passwords. It develops standards for authentication and device attestation. or W3C VCs.

The **EAP OpenID Connect WG** (Enhanced Authentication Profile): The aim of this WG is to develop a security and privacy profile of the OpenID Connect specs with strong authentication specs which allows the users to authenticate to OpenID providers. The outcome will enable the use of IETF Token Binding specs.

### C-SIGS (CLOUD SELECT INDUSTRY GROUP)

The cloud selects industry groups as a contribution from Europe to the global cloud standardisation community.

- **Cloud Select Industry Group on Code of Conduct:** the European Commission has been working with industry to finalise a code of conduct for cloud computing providers. The code of conduct supports a uniform application of data protection rules by cloud service providers. The Code of

Conduct for Protection of Personal Data in cloud services has been published in June 2016. Strong relationship with ISO/IEC 27018 standard.

- **Cloud Select Industry Group on Service Level Agreements:** the goal of this subgroup is to work towards the development of standardisation guidelines for SLAs for cloud services. Work was submitted to ISO/IEC SC38 committee as input to the work on the 19086 standards.
- **Cloud Select Industry Group on Certification Schemes:** the **Digital Single Market Strategy 2015 (DSM)** committed the European Commission to delivering a European Cloud Initiative, including certification.

### GLOBAL INTER-CLOUD TECHNOLOGY FORUM (GICTF)

The GICTF is promoting standardisation of network protocols and the interfaces through which cloud systems inter-work with each other, to promote international interworking of cloud systems, to enable global provision of highly reliable, secure and high-quality cloud services, and to contribute to the development Japan's ICT industry and to the strengthening of its international competitiveness. [http://www.gictf.jp/index\\_e.html](http://www.gictf.jp/index_e.html).

### THE OPEN CLOUD CONSORTIUM OCC

The OCC supports the development of standards for cloud computing and frameworks for interoperating between clouds; develops benchmarks for cloud computing; and supports reference implementations for cloud computing, preferably open-source reference implementations. The OCC has a particular focus in large data clouds. It has developed the MalStone Benchmark for large data clouds and is working on a reference model for large data clouds. <https://www.occ-data.org/>

### TM FORUM

The primary objective of TM Forum's Cloud Services Initiative is to help the industry overcome these barriers and assist in the growth of a vibrant commercial marketplace for cloud-based services. The centrepiece of this initiative is an ecosystem of major buyers and sellers who will collaborate to define a range of common approaches, processes, metrics and other key service enablers. <https://www.tmforum.org/ioe/>

### STORAGE NETWORKING INDUSTRY ASSOCIATION (SNIA)

SNIA is the Cloud Work Group exists to create a common understanding among buyers and suppliers of how enterprises of all sizes and scales of operation can include cloud computing technology in a safe and secure way in their architectures to realise its significant cost, scalability and agility benefits. It includes some of the industry's leading cloud providers and end-user organisations, collaborating on standard models and frameworks aimed at eliminating vendor lock-in for enterprises looking to benefit from cloud products and services. <http://www.snia.org/cloud>

## OTHER RELATIVE STANDARDISATION INITIATIVES, ASSOCIATIONS AND ALLIANCES FOR DIGITAL ASPECTS

As highlighted above, beyond the formal European and International SDOs for which the relevant to the Energy, Mobility and Building sectors Technical Committees, identified and listed below, we should refer to the relevant European alliances, partnerships and initiatives involved in the ICT, IoT and the Cloud to Edge informal standardisation.

Several European alliances, partnerships and initiatives are focused on the edge to cloud continuum, covering different parts of the value chain, adopting different technologies and with different objectives. The following list illustrates the positioning of European alliances, partnerships, and initiatives in the edge-to-cloud continuum. Many relationships between these initiatives are already in place and synergies are

often already established because they are sharing the same experts, they jointly participate in events, or they commonly define strategic agendas and their adoption, among other things. The coordination and alignment of these alliances, partnerships, and initiatives is important to reduce the overlapping and make them constructive/productive, optimise the use of resources and avoid fragmentation.

### **HiPEAC (HIGH-PERFORMANCE AND EMBEDDED ARCHITECTURE AND COMPILATION)**

It is a European network that focuses on advancing the fields of high-performance computing (HPC), embedded systems, and their related technologies. From a liaison perspective a coordination group has been setup including HiPEAC, EUCEI (OpenContinuum and Unlock CEI), SNSS, KDT and ETP4HPC. The objectives include coordination, alignment, joint event organisation and participation, roadmaps and strategic agendas alignment, etc.

### **FIWARE FOUNDATION**

It is an Independent non-profit association which aims at bringing open standards and open-source solutions to create interoperable smart solutions avoiding lock-in scenarios. The foundation provides a set of standardised APIs, software components, and frameworks for building and deploying smart applications and services in various domains, such as smart cities, smart agrifood, smart energy, smart industry and smart water. Fiware NGSI is the API exported by a FIWARE Context Broker, used for the integration of platform components within a “Powered by FIWARE” platform and by applications to update or consume context information. FIWARE NGSI API specifications have evolved over time, initially matching NGSI-v2 specifications, now aligning with the ETSI NGSI-LD standard. The FIWARE Community plays an active role in the evolution of ETSI NGSI-LD specifications which were based on NGSIv2 and commits to deliver compatible open-source implementations of the specs.

### **ECLIPSE FOUNDATION**

It is a global community, vendor-neutral governance for open-source projects and innovation.

#### **Relevant Working Groups:**

**The Eclipse Cloud DevTools WG:** it provides a vendor-neutral ecosystem of open-source projects to accelerate the adoption of Cloud Integrated Development Environments (IDE) and container-based workspace management through the adoption of standards, engagement with third party developer tool providers.

**The Eclipse Dataspace WG:** this WG was established very recently with the aim to promote open-source solutions to enable interoperable dataspace and foster the creation and adoption of trusted data sharing ecosystems. The WG has a strong focus on developing standards.

**The Eclipse IoT WG:** this WG is focusing on the development of open-source implementations of IoT standards and protocols, frameworks and services used by IoT solutions and tools for IoT developers for commercial-grade IoT

**The Eclipse OpenMobility interest group:** it is focusing on the evolution and adoption of mobility modelling and simulation of the mobility patterns of both vehicles and people by creating digital twins, optimizing traffic systems and evaluating concepts such as Mobility as a Service (MaaS).

Other relevant initiatives within the Eclipse Foundation are linked to the **Eclipse Data Space Components (EDC)** project which provides a framework (concept, architecture, code) with functional and non-functional specifications from Gaia-X AISBL and IDSA Dataspace protocol, for data spaces by leveraging the existing APIs and ensuring interoperability.

The Eclipse “Tractus-X™” project is the official open-source project in **Catena-X ecosystem** (more in page 40), under the umbrella of the Eclipse Foundation. It supports the development of services and applications for Catena-X. In particular, Tractus-X supports Catena-X in the following areas:

- The **Catena-X Automotive Network e.V.** is responsible for standardisation, certifications, and governance of the Catena-X ecosystem and is managing the Eclipse Tractus-X project. Association members can participate in WGs to actively shape the Catena-X ecosystem.
- The **development environment** is responsible for the development of the initial reference implementations of the core and enabling services. The reference implementations are managed in the Tractus-X repositories, that contain, among other things, source code, technical documentation, and deployment instructions.
- In the **operating environment**, the open-source reference implementations can be freely used, modified, and operated by providers - (e.g., marketplace), enablement service provider (e.g., Eclipse Dataspace Connector), and business application provider (e.g., traceability applications). Tractus-X provides reference implementations of core and enabling services to accelerate the development of interoperable and innovative applications and the on-boarding to the Catena-X ecosystem. Reference implementations are free and open-source software (FOSS) components, which are managed in the associated Eclipse Tractus-X project. Other reference implementations (e.g., DAPS) used by the Catena-X ecosystem but developed by other projects such as Gaia-X or IDSA can also be found in the Eclipse Tractus-X project.

### [THE TRANSCONTINUUM INITIATIVE \(TCI\)](#)

Is a European initiative trying to cover the entire edge-to-cloud continuum, promoted by the ETP4HPC and intended to elaborate a vision of the characteristics of the infrastructure required for the convergence of data and compute capabilities in many leading edge industrial and scientific use case scenarios. TCI covers a wide spectrum of activities and objectives in the edge-to-cloud continuum.

### [THE KEY DIGITAL TECHNOLOGIES \(KDT\) JOINT UNDERTAKING](#)

It is a European initiative that aims to accelerate the development and deployment of key digital technologies in Europe. In 2023, it will be extended and evolved in the Chips JU, as part of the European Chips Act. This initiative provides all the basic and advanced building blocks, i.e. electronic components and systems (ECS), enabling the edge-to-cloud continuum, from the edge, to the IoT, to the cloud interfacing, and providing enabling technologies for connectivity. The KDT Joint Undertaking supports collaborative research and innovation projects in key digital technologies, including but not limited to semiconductor manufacturing, nano and microelectronics, chips, embedded software, edge AI, high-performance embedded computing, connectivity, cybersecurity, etc.

### [GAIA-X](#)

It is a European initiative aimed at developing a secure, controlled, federated, privacy-preserving and transparent data infrastructure to foster data sovereignty and promote the exchange and sharing of data in a trusted manner. Gaia-X promotes the principles of data sovereignty, giving individuals and organisations control over their data and determining with whom and how it is shared.

The association goal is to create de-facto standards fully aligned with EU values by developing a set of policies, rules, specifications and a verification framework. It is based on three main pillars: i) Compliance: for a common digital governance based on European values; ii) Federation: enables interoperable & portable (Cross-) Sector data-sets and services and iii) Data exchange: A mean to perform data exchange

and anchor data contract negotiation results into the infrastructure. Each pillar has one or more artefacts in the form of specifications, software and labels.

### **CATENA-X**

It is a European automotive industry initiative that aims to establish a secure, trusted, and transparent data ecosystem for the automotive value chain of the future. It brings together various stakeholders, including automotive manufacturers, suppliers, and technology providers, with the goal of enabling efficient data exchange and collaboration within the industry. The initiative promotes the use of open standards, APIs, and secure communication protocols to ensure interoperability and seamless integration of systems, data spaces and their sources. The initiative also considers the integration of advanced technologies such as blockchain, artificial intelligence, and machine learning to enhance data security, traceability, and analytics capabilities.

### **SIMPL (EU INITIATIVE BY DIGITAL EUROPE PROGRAMME)**

It is an initiative funded by the Europe Digital Programme, the aim is the development of smart middleware that will enable cloud-to-edge federations and support all major data initiatives funded by the European Commission, such as common European data spaces. Simpl has been procured through two framework contracts, October 2023. SIMPL has the following objectives:

- Anchored to specific use cases, from sectoral data spaces, AI-on-demand (AI4EU) and the European Open Science Cloud. Ensure data sets and their infrastructures can be seamlessly interconnected and made interoperable.
- Smart and modular, to allow the replacement or addition of components without affecting the system.
- Open source (without any proprietary claims) and simple deployment.
- Green, scalable and elastic, by allowing a monitoring of its environmental performance, and the addition of new users without affecting performance.
- Secure and interoperable, where trust, confidence and compliance with regulations are built into the system. Creation of a layer that enables data to flow across multiple providers and Member States.

### **Smart Networks and Services Joint Undertaking (SNS JU)**

In order to understand how crucial is for Europe, to develop emerging technologies and standardise devices, systems, methods etc, it is worthy to mention the investment on the **Smart Networks and Services Joint Undertaking (SNS JU)**. Europe scales up 6G research investments and selects 35 new projects worth €250 million. The Smart Networks and Services Joint Undertaking (SNS JU) selected its first portfolio (2022) of 35 research, innovation, and trial projects to enable the evolution of 5G ecosystems and promote 6G research in Europe. With a combined funding for this new portfolio of around €250 million under Horizon Europe, the aim is to build a first-class European supply chain for advanced 5G systems and build Europe's 6G technology capacities. One of the two main missions of the SNS JU is to fostering Europe's technology sovereignty in 6G by implementing the related Research and Innovation (R&I) programme leading to conception and standardisation around 2025.



## **THE ALLIANCE FOR INTERNET OF THINGS INNOVATION (AIOTI)**

It is a European initiative that brings together industry stakeholders, research institutions, and government bodies to foster the development and deployment of Internet of Things (IoT) technologies and, recently, of edge computing. The AIOTI members include a wide range of stakeholders, such as industry representatives, research organisations, standardisation bodies, and public sector entities. AIOTI's primary purpose is to **accelerate the adoption of IoT technologies** and foster innovation in Europe by creating a collaborative ecosystem, addressing the technical challenges in the IoT domain, including interoperability, security, privacy, and scalability. The initiative focuses also on societal and policy aspects of IoT, including ethical considerations, social acceptance, and standardisation/regulatory frameworks.

**AIOTI** established a horizontal Working Group on Standardisation, which on December 2023, published a homonymous report (Release 2.0), which aimed to briefly present the EU funded projects focusing on IoT and edge computing, which can -among other- be used to provide input to IoT and edge computing standardisation gap analysis activities. That report provides landscape visualizations of ongoing and completed projects on the IoT and Edge computing that are funded by the EU. For each of these EU funded completed and ongoing projects, two groups of landscape visualisations are realised, based on 1) Technology and Marketing Dimensions and 2) vertical industry domains.

**The AIOTI horizontal Working Group on Standardisation**, is engaged to deal with the challenges of three main domains, a) the High-level Architectures & Digital Twins, the b) Landscape-Gaps-Continuum IoT relation to 5G and the c) Security & Privacy. AI, Data, Cybersecurity and Testbeds are also including. The Report could be extremely helpful to the relevant formal European Technical Committees and their Working Groups and informal deal with the standardisation on the energy, mobility and building sectors from the CloudEdgeIoT point of view. The report is available [here](#).

Other [publicly available](#) deliverables under the Standardisation AIOTI priority, are the following ones: IoT & Edge Landscape Report; Gap Analysis Report; IoT Impact Beyond 5G Report; Computing Continuum Report; Ontology Landscape Report; Guidance on integration of IoT/Edge in Data Spaces; Landscape of EU funded projects.

## **EU CLOUD EDGE IOT - THE EUROPEAN CLOUD, EDGE & IOT CONTINUUM**

The European Cloud, Edge & IoT continuum aims to unlock the potential of these transformative technologies by understanding the supply and demand value chains in Europe. This initiative is funded by the EU (Grant Agreement No.: 101070030; Call: HORIZON-CL4-2021-DATA-01; Topic: HORIZON-CL4-2021-DATA-01-07; Type of action: HORIZON-CSA).

The EU Cloud Edge IoT, on June 2023, issued a report entitled "D1.1 TOWARD A STRATEGY FOR EUROPEAN DIGITAL AUTONOMY THROUGH OPEN SOURCE, STANDARD AND ALLIANCES", in order to raise, among others, awareness on good practises for open source and open standards. Consolidate the coordination between open source and open standard approaches. In the Chapter 3 of the aforementioned report, is described the Standardisation towards a computing continuum ecosystem in terms of four dimensions such as the architecture level, the trustworthiness, the interoperability, the open source level and the strategic approach. Standards of interest that can be composed with a computing continuum are listed for every dimension. More details in the next Section 3 [here](#).

## 3.6 Specific Recommendations on Key Topics

Identification of gaps and/or needs for new or existing standards, is a highly recommended task for R&I Projects in order to deliver specific recommendations and suggestions with added value to the EC regulatory framework, SDOs and the European and International Standardisation Organizations. Moreover, adopting and implementing standards from the early design & development stages of products/services can have a significant impact for the sustainability of the project outcomes by ensuring compatibility and interoperability with existing technologies and processes, thus also facilitating a wider adoption and market acceptance.

**Interested parties in submitting proposals and draft sections about standardisation under the framework of the HORIZON-CL4-2024-DATA-01-05 Platform Building, standardisation and Up-scaling of the 'Cloud-Edge-IoT' Solutions (CSA), can make use of the guidelines and list of initial standards identified in previous sections of this document, in order to identify and match their needs with**

- a) the current prioritisation of the relevant SDOs and their TCs/WGs as well as Industrial associations and open-source communities (as this prioritisation is illustrated to their Business Plans and annual Work Programs, i.e. [Work Programme 2024 \(cencenelec.eu\)](https://www.cencenelec.eu))
- b) the standardisation targeted priorities of the AUWPS 2024
- c) the gaps identified and/or the recommendations pointed out by alliances such as the EUCloudEdgeIoT, AIOTI, ICT Rolling Plan
- d) the supportive actions such as the **StandICT.eu** and the **HSBooster.eu**.

Through Horizon is helped to achieve the European Union's competitive edge and sustainability through targeted research, innovation, and strategic deployment while integrating the physical and digital worlds. Pro-actively monitoring of global technology trends and understanding of their geopolitical impacts, enhances the competitiveness of proposals and future synergies.

**Below some examples of Initiatives that provided relevant recommendations and/or suggestions to tackle the challenges related to the call topic:**

### EUCloudEdgeIoT

EUCloudEdgeIoT has identified several approaches and provides recommendations for overall digitalization in Europe through open source, standards and Alliances. The main points are summarised below:

- fostering the development of building blocks that serve mainstream computing continuum architectures
  - trustworthiness level: fostering the development of building blocks that serve mainstream trustworthiness approaches
  - interoperability level: fostering the development of applications and building blocks that serve mainstream APIs and interoperability points
  - open-source level: fostering the development of open-source communities on the continuum
- More information can be found in the deliverable: "D1.1 TOWARD A STRATEGY FOR EUROPEAN DIGITAL AUTONOMY THROUGH OPEN SOURCE, STANDARD AND ALLIANCES" as part of the EUCloudEdgeIoT repository.

## ERTICO AND FENIX2.0 RECOMMENDATIONS FOR CROSS BORDER DATA SHARING RELATED TO MOBILITY

1. **Establish a unified framework:** develop/create a unified framework for mobility standards that addresses diverse aspects of mobility, including infrastructure, communication protocols, and vehicle specifications.
2. **Standardisation for autonomous vehicles:** create industry-wide standards for autonomous vehicle technologies, including communication protocols, safety features, precise positioning based on GNSS/GALILEO and testing procedures to ensure safe and reliable autonomous mobility.
3. **Data interoperability:** Establish common data semantic model, data formats, communication protocols, and interfaces to ensure seamless data exchange between different components of the mobility ecosystem, such as vehicles, traffic management systems, and navigation services.
4. **Cybersecurity standards:** start with the priorities, develop and implement robust cybersecurity standards to safeguard connected vehicles, smart infrastructure, and mobility platforms against cyber threats.
5. **Regulatory collaboration:** engage with governmental agencies to align mobility standards with regulations, ensuring that standards support and comply with regulatory requirements for safety, emissions, and performance.
6. **Open standards for connectivity:** Advocate for and adopt open standards for vehicle-to-everything (V2X) communication, enabling interoperability between different manufacturers and service providers in the connected mobility landscape.
7. **Focus on horizontal standards:** launch dedicated initiatives within the SDOs TCs group for the creation of horizontal standards that can be universally applied across diverse technical domains
8. **Scalability and future proofing:** Develop standards that can adapt to evolving technologies and accommodate future innovations in areas such as electric vehicles, alternative fuels, and mobility-as-a-service (MaaS).
9. **Testing and certification protocols:** Define standardised testing procedures and certification requirements to validate the compliance of mobility technologies and services with established standards
10. **Global alignment:** Collaborate with international standardisation bodies and organizations to ensure that mobility standards align with global practices, facilitating cross-border interoperability and market access.

## Recommendations for Interoperability on Energy based on the ICT Rolling Plan for Smart Grids and Smart Metering

1. Follow up on the development of the **EU Task Force for Smart Grids** which is composed of industry energy and telco industry, consumer associations, public authorities, standards org that cooperates with the **coordination group on smart grids (CG-SG)** linked to **CEN/CENELEC** to develop new standards or update existing ones, the group is **focused on interoperable and open data architectures** based on international standards. The outcomes will serve as inputs for the **EU directive and implementing acts**. In terms of **cybersecurity**, the group also provides guidance on how to reinforce the implementation of the NIS directive to increase **cybersecurity** awareness and preparedness in the energy sector. The respective reports from this latest strand of work, as well as earlier deliverables from other activities of the Task Force are available on the smart grids task force dedicated webpage (**CIRCA BC**), which is a collaborative platform that gives access to all task-force documents, via the platform library”.

2. Use of the large-scale pilots to test and identify new specifications to further extend the **SAREF4ENER** ontology as well as the main SAREF ontology (including interoperability profiles). **Security** and **cyber-security** aspects should be investigated
3. **Engage in ETSI and CEN/CENELEC WGs** to provide feedback and recommendations to add new specifications to SAREF4ENER standard. The outcomes of the pilots could also support the current initiatives in Data Spaces and upcoming deployment actions, such as INT:ENT (Energy), GREAT (Green Deal) and DS4SSCC (Smart and Sustainable Cities and Communities), where the latter has identified an initial set of Minimum Interoperable Mechanisms (MIMs) based on the Living-in EU initiative.
4. **Engage with relevant SDOs, Industrial associations and open-source communities:** to explore data exchange interoperability – between grid, buildings and mobility sectors, similarly for EVs-chargers based on demand, storage and grid services, e.g. ETSI for radio technology- wireless for home automation, smart metering and energy control.  
**OASIS** - open-source projects, has a TC on energy interoperation which defines the interaction between smart grids and their end nodes, including vehicles, smart buildings, etc by developing data and communication models to enable interoperability and exchange of signal for dynamic pricing, emergencies. OASIS TOSCA TC (Topology and orchestration specification for cloud applications).  
**KNX non-profit organization** – mainly composed of manufacturers and offers a standard for smart home and building automation. It provides a secure IoT technology that can integrate a wider range of products in just one tool (heating, ventilation, A/C, alarms, household appliances, audio/video, building control access, lighting, etc).
5. **Ensure compliance with EU regulation:** engage with regulatory bodies and keep up on the latest regulatory requirements, both sector- specific, e.g. smart meters regulation and horizontal aspects such as Data Act, AI Act and GDPR, due to the sensitivity of personal and commercial data to manage for future energy services and AI applications.

## 4 Next Steps and Solutions Based on Standard Maturity

This section provides general guidance on what actions to take in the proposal stage to elaborate a strategic standardisation plan, based on the maturity and current state of development of the standards.

**The step-by-step approach is presented below:**

### EARLY-STAGE STANDARDISATION:

- a) **need assessment:** identify key areas requiring standardisation within target ecosystems, e.g. mobility, energy, building automation.
- b) **formation of working groups:** focus on communication protocols, data formats, data semantics, safety and security standards.
- c) **collaboration with stakeholders:** included manufacturers, technology providers, policymakers, consumers associations.

### INTERMEDIATE STAGE STANDARDISATION:

- a) **foundational framework development:** outlines key principles and guidelines for mobility, energy, building automation standards.

- b) interoperability testing programs:** ensure early compatibility between different specific sector solutions and across sectors, e.g. mobility and energy
- c) global alignment with international SDOs:** emerge standards with global practices.

#### ADVANCED STAGE STANDARDISATION:

- a) expand standardisation efforts :** cover a wide range of aspects. For mobility, e.g. connected vehicles, autonomous systems and sustainable transportation. For energy, e.g. smart meters, smart charging data sharing platforms, smart grids, integration of new renewable energy sources in a more decentralized approach, trustworthy AI models to build on top to provide new services, e.g. predictive maintenance.
- b) regulatory integration:** work with regulatory bodies to integrate developed standards into regulatory frameworks for widespread adoption.
- c) industry certification programs:** validate compliance with established standards, providing a mark of quality for consumers.

#### MATURE STAGE STANDARDISATION:

- a) innovation in standards:** anticipate and address future specific domain trends and disruptions.
- b) continuous improvement:** regular views and updates to address emerging challenges and technologies.
- c) public awareness campaigns:** inform consumers about the benefits of standardised mobility or energy solutions and build trust in the industry.
- d) education and training:** ensure that industry professionals are well-versed in the latest standards and best practices.

#### CROSS-CUTTING SOLUTIONS:

- a) digital platforms for collaboration:** dissemination of standards, fostering real-time communication among stakeholders
- b) open-source initiatives:** support open-source initiatives in mobility and energy, promote collaboration and transparency.
- c) data governance framework:** address privacy and security concerns related to mobility or energy data, ensuring responsible and ethical use.
- d) circular economy standards:** supporting circular economy principles in the design, manufacturing, and disposal of related products.
- e) smart infrastructure integration:** integrate standards for smart infrastructure. In mobility, enable seamless communication between vehicles and urban systems for efficient traffic management. In energy, develop common low power interoperable communication components, and standardised communication protocols and data formats for seamless integration, reliability, exchange of data and interoperability of IoT devices in energy systems and facilitation of real-time monitoring and control of energy systems.
- f) resilience and security standards:** enhance standards to address cybersecurity threats and resilience measures, ensuring the robustness against potential disruptions and the protection of sensitive data cyber-attacks.
- g) ecosystem collaboration:** foster collaboration with adjacent ecosystems (e.g., telecommunications) to create holistic standards that support integrated and sustainable solutions.

## 5 Appendix: Bibliography and Reference documents

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