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STANDARDS ANALYSIS
ICT SECTOR
LUXEMBOURG

ILNAS
Institut luxembourgeois de la normalisation, de l'accréditation, de la sécurité et qualité des produits et services

ANEC
AGENCE POUR LA NORMALISATION ET L'ÉCONOMIE DE LA CONNAISSANCE

Executive summary

In 2012 the "*Institut Luxembourgeois de la Normalisation, de l'Accréditation, de la Sécurité et qualité des produits et services*" (ILNAS) initiated an analysis of European and international standards in the Information and Communication Technology (ICT) sector. The aim of this analysis is to develop an information and exchange network for ICT standardization knowledge in the Grand Duchy of Luxembourg. Since 2013, this analysis has been carried out in the frame of the implementation of the "Luxembourg's policy on ICT technical standardization" (which was last updated in 2015)[1].

The ICT sector is already an active sector at the national standardization level with 65 national delegates currently registered by ILNAS[2]. These delegates are involved in standardization technical committees to participate actively and follow closely the work performed at international level and have the task of ensuring that the views and positions of Luxembourg are understood and known by the technical committees. ILNAS is convinced that this sector could be even more active, especially since some ICT subsectors do not yet benefit from a sufficient representation of national delegates (e.g.: Internet of Things, Cloud Computing, Big Data, Smart Cities). Thus, the purposes of this analysis are firstly, to provide useful information to national stakeholders regarding standardization activities in the field of ICT and secondly, to involve them into an integrated and innovative approach of standardization.

Conducted in several steps, this survey is basically built on a standards watch that allows the identification of standardization technical committees related to the ICT sector at the European and international level. Moreover, detailed information concerning the most interesting formal and non-formal standardization technical committees is provided in the present report. It also provides pathways for the national economic development by identifying niche opportunities and recent or emerging topics from a standardization point of view. Lastly, the connections between the ICT sector and other economic sectors active in the Grand Duchy of Luxembourg are pointed out.

Conceived as a practical tool, this report is evolving and should be used to quickly identify issues and interests for the national stakeholders of the ICT sector. Published for the first time in November 2012, the present report constitutes the sixth version of this analysis which will continue to be updated according to national market needs.

[1] http://www.portail-qualite.public.lu/fr/publications/normes-normalisation/orientations-strategiques/politique-luxembourgeoise-pour-la-normalisation-technique-des-TIC-2015-2020/Policy-on-ICT-technical-standardization-_2015-2020_.pdf

[2] National register of standardization delegates (June 2016)

Preface

The "*Institut Luxembourgeois de la Normalisation, de l'Accréditation, de la Sécurité et qualité des produits et services*" (ILNAS) is an administration under the supervision of the Minister of the Economy in Luxembourg. It was created on the basis of the law of May 20, 2008 (which has been repealed by the law of July 4, 2014, regarding the reorganization of ILNAS) and started its activities on June 1, 2008. For reasons of complementarity, effectiveness and transparency as well as for purposes of administrative simplification, ILNAS is in charge of several administrative and technical legal missions that were previously the responsibility of different public structures. These assignments have been strengthened and new tasks have since been assigned to ILNAS corresponding to a network of skills for competitiveness and consumer protection.

Through its Digital Trust department, ILNAS carries out different legal missions in the field of Information and Communication Technology (ICT). In addition, ILNAS commissioned the Economic Interest Grouping "*Agence pour la Normalisation et l'Économie de la Connaissance*" (ANEC GIE) to organize an information and exchange network dedicated to ICT standardization knowledge. Essentially, this particularly consists in following the relevant technical committees in the ICT field, including the joint standardization committee ISO/IEC JTC 1 of the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). This mission aims to achieve excellence in the ICT sector and additionally, to support the national (digital) economy in order to remain competitive and effective.

To promote standardization in Luxembourg, a national standardization strategy, approved by the Minister of the Economy, had been drawn up by ILNAS in June 2010 for the decade 2010-2020. This national strategy, directly related to the Horizon 2020 strategy of the European Union, has been updated in January 2014 with the "Luxembourg Standardization Strategy 2014-2020"[3], which is more in line with the needs of the national market and the priorities identified after three years of active promotion of technical standardization in Luxembourg. The new position can be summarized by the motto: "Technical standardization as a service".

To meet the new priorities, the strategy is based on the three following pillars in which the ICT sector is now one of the cornerstones:

1. Information and Communication Technologies (ICT)

Given the dynamism and the vital importance of the ICT sector for the national market:

- Continued support and development of the standardization field dedicated to ICT (also in terms of education and *ad hoc* promotion) according to the "Luxembourg's policy on ICT technical standardization", published in 2013 with latest update in 2015[4];
- Detection of niche opportunities for national economic developments.

[3] http://www.portail-qualite.public.lu/fr/publications/normes-normalisation/orientations-strategiques/strategie-normative-2014-2020/luxembourg-standardization-strategy-2014-2020.pdf

[4] http://www.portail-qualite.public.lu/fr/publications/normes-normalisation/orientations-strategiques/politique-luxembourgeoise-pour-la-normalisation-technique-des-TIC-2015-2020/Policy-on-ICT-technical-standardization-_2015-2020_.pdf

2. National influence and compliance with legal attributions

In order to increase the influence of Luxembourg:

- Strengthen the influence of the Grand-Duchy of Luxembourg within European and international standards organizations;
- Active support in respecting legal attributions in terms of European standardization;
- Detection of opportunities for the national economic market.

3. Products and services

- Support through products and services [5] in the field of standardization (diagnostic, awareness/training sessions, targeted watch, sector-based analysis, etc.), mainly upon requests of the national market.

Moreover, as mentioned in the national standardization strategy, the "Luxembourg's policy on ICT technical standardization 2015-2020" aims to strengthen the national ICT sector in its involvement in standardization activities through three leading projects:

- Developing the interest and the involvement of the national market;
- Promoting and reinforcing the participation of the national market;
- Supporting and strengthening the Education about Standardization and research activities related to standardization.

Since October 2010, ILNAS has been supported by ANEC GIE in implementing the national standardization strategy. The role of ANEC GIE is to support the development of standardization and metrology activities at the national level and particularly to promote the benefits of participating in standardization.

Its mission is to raise awareness, deliver trainings and monitor the developments in the fields of standardization and metrology. ANEC GIE also has assignments in applied research in order to support the competitiveness of companies in Luxembourg. Thus, ILNAS, with the support of ANEC GIE, can effectively contribute to the economic diversification policy pursued by the Government in niches for economic developments.

In this context, ILNAS commissioned ANEC GIE, through the "Luxembourg's policy on ICT technical standardization", to carry out an analysis of European and international standards of the ICT sector, which is presented in this document. Indeed, in line with the priorities set by the Government of the Grand Duchy of Luxembourg, this sector has long been identified as a carrier for the national economy.

[5] http://www.portail-qualite.public.lu/fr/normes-normalisation/produits-et-services/index.html
Training catalogue: http://www.portail-qualite.public.lu/fr/publications/normes-normalisation/information-sensibilisation/catalogue-formation-2016/Catalogue_de_formation_2016_WEB.pdf

Table of Contents

1. INTRODUCTION

The sector of Information and Communication Technologies (ICT) is a keystone of the worldwide economy. It provides pervasive support to all other sectors of activity. As systems become more and more intricate, the growth of the ICT sector is now driven by the ability of its component parts to interoperate ("to talk to each other"). Standards can allow this interoperability between different products from different manufacturers. Thus, economic growth of and through ICT is tied to the related standardization activities.

The ICT sector is an active sector at the national standardization level composed by 65 national delegates, which are national experts registered and involved in a standardization committee. Conducted by ILNAS, several activities have been set up[6] in order to develop education about ICT standardization to national stakeholders, and strengthen their participation in related technical committees[7]. To reach these objectives, ILNAS, in collaboration with the University of Luxembourg, launched a pilot project related to a university certificate *Smart ICT for Business Innovation* to provide standards-based knowledge on the main emerging and current Smart ICT domains at a national level. The course, spanning two semesters, was successfully completed in 2016.

Initiated by ILNAS in 2012, this analysis of European and international standards is based on several years of experience in ICT standardization and contributes directly to raise awareness, interest and to educate national stakeholders about ICT standardization. This is the sixth version of the report, which will continue to be updated on a regular basis according to market interests. The main value of this document lies in the focus on ICT technical committees and the detection of niche opportunities for economic development at the national level. The purpose is to inform national stakeholders of the ICT sector about the main standardization activities and to offer them guidance for a potential future involvement in the standardization process.

Achieving this objective will support the ICT sector in terms of competitiveness, visibility and performance, while improving the international recognition of the Grand Duchy of Luxembourg in the standardization community.

This analysis of European and international ICT standards has been realized in several steps:

- Execution of a watch on technical standardization committees and related standards (both published and under development), at the European and international levels;
- Identification of national stakeholders and potential interests;
- Identification of most relevant *fora* and *consortia* related to the ICT sector and technical committees relying on ICT as a supporting sector;
- Preparation of a final report of analysis and opportunities.

The report is organized as follows. After introductory chapters dedicated to standardization in general (**Chapter 2**) and the context of the ICT sector (**Chapter 3**), the method applied for the standards analysis is described in **Chapter 4**.

Chapter 5 then presents the main results of the standards analysis. This chapter offers an overview of the different subsectors and the technical committees identified for the ICT sector. Then, the main advantages for stakeholders to take part in the standardization process are highlighted. Based on

[6] http://www.portail-qualite.public.lu/fr/publications/normes-normalisation/orientations-strategiques/politique-luxembourgeoise-pour-la-normalisation-technique-des-TIC-2015-2020/Policy-on-ICT-technical-standardization-_2015-2020_.pdf

[7] Note: In this report, the term "standardization technical committee" is generic and covers "technical committees", "subcommittees", "working groups", etc.

these results, **Chapter 6** presents opportunities related to standardization for national stakeholders, providing a general perspective about all the benefits of standardization.

Based on the results of the standards watch, **Chapter 7** is dedicated to a detailed presentation of each Standards Developing Organization (SDO) at European and international level. Thus, this chapter describes the formal standards bodies developing *de jure* (or formal) standards, as well as other technical committees analyzed through investigation of non-formal standards organizations (ICT *fora/consortia* developing *de facto* standards). It is organized by subsector (i.e., Cloud Computing, Data Center, Telecommunications, etc.), providing a prompt access to someone looking for a specific technical committee.

To complete the standards analysis, **Chapter 8** presents the pilot project related to a university certificate "*Smart ICT for Business Innovation*" and describes more deeply the standards landscape of selected Smart ICT domains (Cloud Computing, Big Data, Internet of Things, Green ICT and Smart Cities) that are part of this innovative diploma. To go further, **Chapter 9** analyzes the prospective and innovative role of standardization through the analysis performed by the ISO/IEC JTC 1 Special Working Group on Planning, and **Chapter 10** describes some standardization activities for recent or emerging technologies, which could have the potential to significantly and deeply change our economy and society: additive manufacturing (3D printing), intelligent transport systems, unmanned aircraft systems (drones) and robotics. **Chapter 11** highlights ICT as a sector that supports other economic sectors through standards. Technical committees that have drawn such a link are identified.

Finally, the **Conclusion** chapter provides a summary of the document and reiterates the commitment of ILNAS and ANEC GIE to assist national entities with their involvement in standardization.

2. STANDARDS AND STANDARDIZATION

2.1. DEFINITIONS

❖ ILNAS:

This acronym designates the "*Institut Luxembourgeois de la Normalisation, de l'Accréditation, de la Sécurité et qualité des produits et services*". ILNAS is an administration under the authority of the Minister of the Economy. It was created by the amended law of May 20, 2008, and began its activities on June 1, 2008. Since August 1, 2014, the law on the reorganization of ILNAS, dated July 4, 2014, constitutes the new legal basis of the administration.

❖ OLN:

This acronym designates the "*Organisme luxembourgeois de normalisation*". OLN is an ILNAS department, which fulfills the ILNAS missions as the national standards body, according to the law of July 4, 2014. It is a member of the European and international standardization organizations.

❖ ANEC GIE:

This acronym designates the Interest Economic Grouping *"Agence pour la Normalisation et l'Economie de la Connaissance".* ANEC GIE was created in October 2010 by ILNAS,"*Chambre de Commerce*", "*Chambre des Métiers*" and STATEC. It is divided into 3 departments: Standardization, Knowledge-based Economy and Metrology. The role of the standardization department of ANEC GIE is to implement the national standardization strategy established by ILNAS in order to support the development of standardization activities at national level and to promote the benefits of participating in the standardization process.

❖ STANDARDIZATION:

Standardization corresponds to the definition of voluntary technical or quality specifications with which current or future products, production processes or services may comply. Standardization is organized by and for the stakeholders concerned based on national representation (CEN, CENELEC, ISO and IEC) and direct participation (ETSI and ITU-T), and is founded on the principles recognized by the World Trade Organization (WTO) in the field of standardization, namely coherence, transparency, openness, consensus, voluntary application, independence from special interests and efficiency. In accordance with these founding principles, it is important that all relevant interested parties, including public authorities and small and medium-sized enterprises, are appropriately involved in the national, European and international standardization process[8].

❖ STANDARD:

A standard is a "*document established by consensus and approved by a recognized body that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context*"[9].

They have a national, regional or international concern. Standards are created by bringing together all interested parties, such as manufacturers, consumers and regulators of a particular material, product, process or service. All parties benefit from standardization. Several categories of standards exist: core standards, standards of analysis and testing, standards of specifications, methodological standards, etc.

[8] Based on: Regulation (EU) N°1025/2012 of the Parliament and of the Council

[9] ISO/IEC Guide 2:2004, ISO/IEC Guide 2:2004, *Standardization and Related Activities -- General Vocabulary* (definition 3.2)

❖ STANDARDS BODY:

A standards body can be defined as a standardizing organization recognized at national, regional or international level whose main function is the preparation, approval or adoption of standards available to the public. In this report, a distinction has been made between formal standards bodies (e.g. CEN or ISO) and non-formal standards bodies (e.g. W3C or IEEE).

❖ STANDARDIZATION TECHNICAL COMMITTEE:

A standardization technical committee is a technical decision-making body with a precise title, scope and work program, within European and/or international standardization organizations, essentially to manage the preparation of deliverables as standards in accordance with an agreed upon business plan[10].

❖ NATIONAL MIRROR COMMITTEE:

A national mirror committee is a national structure to European or international technical committees ensuring, for example, the formulation of coherent national positions as a first round of consensus finding.

[10] Based on the information available on the CEN website/BOSS.

2.2. STANDARDIZATION OBJECTIVES AND PRINCIPLES

As stated in the Regulation (EU) N°1025/2012 on European standardization, and according to the World Trade Organization (WTO)[11], standardization is based on founding principles, which are observed by the formal standards bodies for the development of international standards:

- **Transparency**:

All essential information regarding current work programs, as well as on proposals for standards, guides and recommendations under consideration and on the final results should be made easily accessible to all interested parties.

- **Openness**:

Membership of an international standards body should be open on a non-discriminatory basis to relevant bodies.

- **Impartiality and Consensus**:

All relevant bodies should be provided with meaningful opportunities to contribute to the elaboration of an international standard so that the standard development process will not give privilege to, or favor the interests of, a particular supplier, country or region. Consensus procedures should be established that seek to take into account the views of all parties concerned and to reconcile any conflicting arguments.

- **Effectiveness and Relevance**:

International standards need to be relevant and to effectively respond to regulatory and market needs, as well as scientific and technological developments in various countries. They should not distort the global market, have adverse effects on fair competition, or stifle innovation and technological development. In addition, they should not give preference to the characteristics or requirements of specific countries or regions when different needs or interests exist in other countries or regions. Whenever possible, international standards should be performance based rather than based on design or descriptive characteristics.

- **Coherence**:

In order to avoid the development of conflicting international standards, it is important that international standards bodies avoid duplication of, or overlap with, the work of other international standards bodies. In this respect, cooperation and coordination with other relevant international bodies is essential.

- **Development dimension**:

Constraints on developing countries, in particular, to effectively participate in standards development, should be taken into consideration in the standards development process. Tangible ways of facilitating developing countries participation in international standards development should be sought.

Standardization is an efficient economical tool offering the possibility to pursue various objectives, such as:

- Management of the diversity;
- Convenience of use;
- Performance, quality and reliability;
- Health and safety;
- Compatibility;
- Interchangeability;
- Security;
- Environmental protection;
- Product protection;
- Mutual understanding;
- Economic performance;
- Trade;
- Etc.

[11] Source: Second triennial review of the operation and implementation of the agreement on technical barriers to trade – Annex 4: Decision of the committee on principles for the development of international standards, guides and recommendations

2.3. STANDARDIZATION LANDSCAPE

In Europe, the three recognized European Standardization Organizations (ESO) are[12]:

- European Committee for Standardization (**CEN**);
- European Committee for Electrotechnical Standardization (**CENELEC**);
- European Telecommunications Standards Institute (**ETSI**).

At the international level, the three recognized standardization organizations are:

- International Organization for Standardization (**ISO**);
- International Electrotechnical Commission (**IEC**);
- International Telecommunication Union's Telecommunication Standardization Sector (**ITU-T**).

The standardization frame allows cooperation between standards organizations at the same level, or at different levels but on the same topics:

- CENELEC and IEC are specialized in electrotechnical standards;
- ETSI and ITU-T are focused on telecommunications standards;
- CEN and ISO are in charge of the standards in other sectors.

Table 1 presents the main characteristics of the European and international standards bodies.

Table 1: Characteristics of European and International Standardization Organizations[13]

European and International Standardization Bodies		Date of Creation	Number of Members	Number of Published Standards
ISO	International Organization for Standardization	1946	162	20493
IEC	International Electrotechnical Commission	1906	83	6895
ITU-T	International Telecommunication Union's Telecommunication Standardization Sector	1865	270[14]	5022
CEN	European Committee for Standardization	1961	33	15985
CENELEC	European Committee for Electrotechnical Standardization	1973	33	6937
ETSI	European Telecommunications Standards Institute	1988	782[14] (66 countries)	38508

[12] Regulation (EU) No 1025/2012 of The European Parliament And of The Council : http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:316:0012:0033:EN:PDF

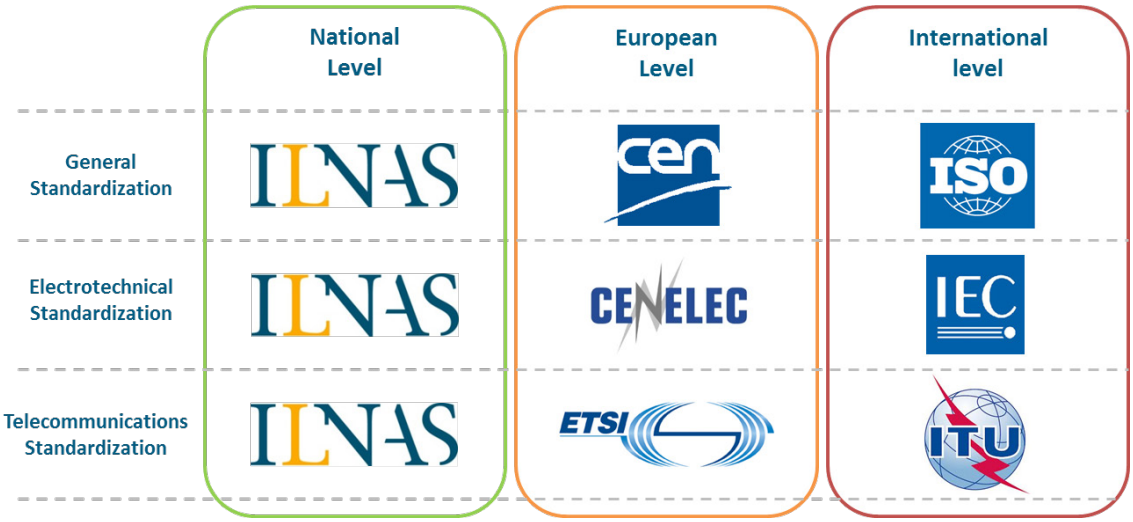
[13] Source: Websites of organizations - March 2016

[14] ETSI and ITU-T have a specific way of working compared to the other recognized organizations, as they work through the direct participation of industry stakeholders

From a national perspective, one or several standards bodies protect national interests within the European and international standardization organizations. In Luxembourg, ILNAS – the only official national standards body – is member of the European and international standardization organizations CEN, CENELEC, ISO, IEC and ETSI.

Several bridges exist between the national, European and international standardization organizations in order to facilitate the collaboration and coordination of the standardization work on the different fields (Figure 1).

Figure 1: Interactions between the Standardization Organizations



A strong collaboration exists between the European and international standardization organizations. In this context, and in order to ensure transparency in the work and avoid the duplication of standards, in 1991 ISO and CEN signed the Vienna Agreement[15], which is based on the following guiding principles:

- Primacy of international standards and implementation of ISO Standards at European level (EN ISO);
- Work at European level (CEN), if there is no interest at international level (ISO);
- Standardization documents should be approved between the two organizations.

Similarly, the Dresden Agreement[16] was concluded in 1996 between IEC and CENELEC with the aim of developing intensive consultations in the electrotechnical field. This agreement is based on the following guiding principles:

- Development of all new standardization projects by IEC (as much as possible);
- Work at European level (CENELEC), if there is no interest at international level (IEC);
- Ballots for documents made in parallel at IEC and CENELEC.

Under both agreements, approximately 31% of all European standards ratified by CEN, as well as about 71% of those ratified by CENELEC, are now technically equivalent or identical to ISO or IEC standards[17]; in that respect, the European and international organizations do not duplicate work.

[15] Agreement on technical co-operation between ISO and CEN (Vienna Agreement)
[16] IEC-CENELEC Agreement on Common planning of new work and parallel voting (Dresden Agreement)
[17] CEN-CENELEC Quarterly Statistical Pack – 2015 Q4

Finally, ITU-T and ETSI have agreed on a Memorandum of Understanding (MoU) in 2012[18] (replacing the former MoU signed in 2000) that paves the way for European regional standards, developed by ETSI, to be recognized internationally.

Agreements also exist between the standards organizations to facilitate their cooperation. ISO and IEC have the possibility to sign conventions to create Joint Technical Committees (JTC) or Joint Project Committees (JPC) when the area of work is overlapping the two organizations. It is to avoid the creation of duplicative or incompatible standards. In this frame, two joint committees have already been created: ISO/IEC JTC 1 "Information Technology" and ISO/IEC JPC 2 "Energy efficiency and renewable energy sources - Common terminology".

ISO, IEC and ITU have also established the World Standards Cooperation (WSC) in 2001, a high level collaboration system intending to strengthen and advance the voluntary consensus-based international standards system and to resolve issues related to the technical cooperation between the three organizations[19]. Similarly, the cooperation between CEN and CENELEC aims to create a European standardization system that is open, flexible and dynamic.

[18] Memorandum of understanding between ETSI and ITU

[19] http://www.worldstandardscooperation.org/

2.4. STANDARDS DEVELOPMENT

Developing a standard is characterized by four main steps:

- Proposal: following an identified need, a party proposes a preliminary draft;
- Study and preparation: a working group studies the draft and prepares the standard draft;
- Public inquiry and approval: the standard draft goes into public consultation and is subject to approval;
- Publication: the ratified standard is published by the standards body.

At each stage, a validation of all participating members of the standardization technical committee is required. This is done automatically through a vote; however, the rules of the vote differ between the European and international level as outlined in Table 2 below.

Table 2: Voting rules at European and international level

Organization	Members	Method of adopting standards	Integration into the collections of national standards
International ISO and IEC	National bodies from countries members of ISO (162) and IEC (83)	1 country = 1 voice	Voluntary
European CEN and CENELEC	National bodies complying with membership criteria of CEN and CENELEC[20] (33)	Weighted Vote	Required: countries must eliminate conflicting provisions from their collections

At the European level, the weighted vote is defined by the "CEN/CENELEC Internal Regulations - Part 2, Common rules for standardization work"[21], which fixes the distribution of the voices for the CEN/CENELEC national members as showed in Table 3.

Table 3: Weightings allocated to the CEN/CENELEC national members

Country	Weighting of votes
Germany, France, Italy, United Kingdom, Turkey	**29**
Spain, Poland	**27**
Romania	**14**
Netherlands	**13**
Belgium, Greece, Hungary, Portugal, Czech Republic	**12**
Austria, Bulgaria, Sweden, Switzerland	**10**
Croatia, Denmark, Finland, Ireland, Lithuania, Norway, Slovakia	**7**
Cyprus, Estonia, Latvia, Luxembourg, Slovenia, Former Yugoslav Republic of Macedonia	**4**
Iceland, Malta	**3**

[20] CEN-CENELEC Guide 20 "Guide on membership criteria of CEN & CENELEC"
[21] Source: Internal regulation CEN/CENELEC – Part 2 – Annex D

Another particularity at the European level is that the European standards approved shall be implemented identically in both technical content and presentation, with no restrictions for application by each national member. This implies enforcing the new standard through publication and withdrawing all conflicting standards already in place at national level, on average, in six months. The new European standard then takes the status of national standard.

In the Grand Duchy of Luxembourg, the list of new national standards is regularly published by ILNAS in the "*Mémorial A*"[22].

[22] http://www.legilux.public.lu/leg/a/index.php

3. CONTEXT OF THE ICT SECTOR

3.1. DEFINITION AND ISSUES OF THE ICT SECTOR

ICT (also commonly called Information Technology or IT) is defined by ISO/IEC JTC 1 as follows: "*ICT includes the specification, design and development, integration and interoperability of systems, tools and applications dealing with the capture, representation, accessibility, processing, security, transfer, interchange, presentation, management, organization, storage and retrieval of information, and their related cultural, linguistic adaptability and societal aspects*"[23].

Regarding current trends and the future of ICT at a global level, this sector remains promising. Dynamism in the ICT base technologies is driving innovation processes. Some companies will redesign their operating models to exploit the advantage of digital technologies. The ability to create digitally based business models could allow to lower the barrier to pursue new and innovative ventures for entrepreneurs.

In terms of economy impact, Research & Development investment in the ICT sector is still very important, for example global Software and Hardware activities have increased by 12.8% and 6.7% respectively in 2014.[24]. Moreover, the coming trends show that the sector is still innovating with the development of technologies such as Information of Everything, Cloud Computing, Internet of Things, Smart Machines, 3D printing, etc.[25]

At the European level, the ICT sector has been directly responsible for 4.5% of GVA[26] (Gross Value Added), with a market value of EUR 529 billion in 2013[27], but it contributes far more to the overall productivity growth. This is due to the high levels of dynamism and innovation inherent in this sector, but also due to the enabler role this sector plays, in changing how other sectors do business. At the same time, the social impact of ICT has become significant. This is supported by European statistics of 2015, with 83% (Luxembourg: 97%) of households having a broadband connection [28], 76% (Luxembourg: 97%) of individuals using the Internet on a regular basis [29] of which 57% (Luxembourg: 80%) used a mobile device to connect to the Internet away from home or work[30].

In 2010, the European Commission published "A Digital Agenda for Europe"[31]. The overall aim of the Digital Agenda is to deliver sustainable economic and social benefits from a digital single market based on fast/ultra-fast Internet and interoperable applications. The Digital Agenda for Europe is one of the seven flagship initiatives of the Europe 2020 Strategy[32], set out to reboot Europe's economy and help Europe's citizens and businesses to get the most out of digital technologies.

According to the European Commission[33], digital technologies have enormous potential to benefit daily lives and tackle social challenges. The Digital Agenda focuses on ICT capabilities to reduce

[23] ISO/IEC JTC 1, Information technology - Business Plan 2014
[24] http://iri.jrc.ec.europa.eu/scoreboard15.html
[25] http://www.gartner.com/newsroom/id/3143521
[26] Gross value added is the value of output less the value of intermediate consumption; it is a measure of the contribution to GDP made by an individual producer, industry or sector (source: OECD)
[27] http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace10_c&lang=en (source: Eurostat)
[28] http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=isoc_ci_in_h&lang=en (source : Eurostat)
[29] http://ec.europa.eu/eurostat/tgm/table.do?tab=table&language=en&pcode=tin00091 (source : Eurostat)
[30] http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=isoc_cimobi_dev&lang=en (source : Eurostat)
[31] http://ec.europa.eu/information_society/digital-agenda/index_en.htm
[32] http://ec.europa.eu/europe2020/index_en.htm
[33] http://ec.europa.eu/digital-agenda/en/digital-society

energy consumption, support ageing citizens' lives, revolutionizes health services and deliver better public services. ICT can also drive the digitization of Europe's cultural heritage forward by providing online access to all. Currently, ICT plays a crucial role in[34]:

- Advanced research to uncover radically new technological possibilities and ICT contributions to research and innovation;
- Research and innovation activities on generic technologies either driven by industrial roadmaps or through a bottom up approach;
- Multi-disciplinary application-driven research and innovation leveraging ICT to tackle societal challenges.

To conclude, Europe must master both the development and use of ICT to generate sustainable economic and social benefits.

Finally, at the national level, ICT is considered as a key economic sector. Within the National Government Program[35], having a developed ICT sector is a cornerstone, especially to support other economic sectors: eco-technologies (e.g. Smart Grid, IT management), logistics (e.g. e-commerce), biotechnologies (e.g. Archiving, Data Management), industrial and financial sector (e.g. Cloud Computing). Indeed, the ICT sector is already a competitive sector at national level which represents more than 1,700 companies or 4.58% of the total employment[36]. Moreover, the ICT sector has contributed to 6.2% of GVA in Luxembourg in 2013[37]. In April 2015, Luxembourg was awarded 9th overall ranking in the Global Information Technology[38] Report published by the World Economic Forum. Through the national policy pursued in the recent years, Luxembourg has built a branding of "European Trusted Information Center" that the Government intends to consolidate and expand.

The next section is focused on the standards context of the ICT sector and details in particular the different lead projects established by ILNAS in order to develop ICT standardization in Luxembourg.

[34] https://ec.europa.eu/programmes/horizon2020/sites/horizon2020/files/ICT%20in%20H2020%20WP2014-15_0.pdf
[35] http://www.gouvernement.lu/3322796/Programme-gouvernemental.pdf
[36] Source: STATEC
[37] Source: Eurostat (online data code: nama_nace10_c)
[38] http://reports.weforum.org/global-information-technology-report-2015/

3.2. STANDARDS CONTEXT OF THE ICT SECTOR

ICT is omnipresent in the global economy, it penetrates all the industry sectors and has become a major lever to accelerate economic growth and improve living conditions. But ICT is also becoming ever more complex by integrating numerous and various infrastructures and services, as with Smart Cities or Internet of Things. In this context, standards play a crucial role to make technologies interoperable and to provide a common language that will facilitate the advance of the ICT industry.

The current landscape of Standards Developing Organizations (SDO) active in the ICT sector is very broad and composed both of formal standards bodies that are acknowledged standards bodies, developing *de jure* (formal) standards, and *fora/consortia* developing *de facto* (existing and being used by fact) standards[39].

3.2.1. International level

3.2.1.1. ISO/IEC JTC 1

At the international level, ISO is a generic formal standards body, developing international standards for all industry sectors. IEC is another formal standards body preparing and publishing international standards for all electrical, electronic and related technologies collectively known as "electrotechnology". An agreement reached in 1976 defines the responsibilities of both of them: the IEC covers the field of electrical and electronic engineering and all other subject areas are attributed to ISO. In addition, to avoid an overlap of standardization and work in areas covered by both bodies, this agreement also allows the creation of Joint Technical Committees (JTC) between ISO and IEC. ICT is such an overlapping standardization domain that, in 1987, ISO and IEC formed a JTC known as ISO/IEC JTC 1. It is today clearly established that the committee ISO/IEC JTC 1 "Information Technology" (including its subcommittees) is the leading SDO for ICT standardization. ISO/IEC JTC 1 is composed of 20 subcommittees and 4 working groups, each of them responsible for the development of International Standards in its own ICT area (e.g.: Internet of Things, Big Data, Cloud Computing, etc.).

3.2.1.2. *Fora* and *Consortia*

Fora and *consortia*, in the standardization context, are associations regrouping individuals, companies, organizations or governments with a common objective of participating in the creation of *de facto* standards or technical specifications. Many of them are active in the ICT domain. This national standards analysis focuses on *fora* and *consortia* collaborating with ISO/IEC JTC 1 at the international level or participating in the European Multi-Stakeholder Platform on ICT Standardization at the European level.

3.2.2. European level

At the European level, in "A Digital Agenda for Europe" established by the European Commission, the lack of interoperability is considered as one of the seven most significant obstacles to a virtuous cycle of the digital economy. Thus, one of the seven pillars of the Digital Agenda is about "Interoperability and standards". Indeed, "*weaknesses in standard setting, public procurement and coordination*

[39] "*De facto* standards" is sometimes used for common solutions and practices that have not been formally developed and agreed upon. In this document however, this term is used for formal standards published by other structures than the official ones (i.e. ISO, IEC, ITU, CEN, CENELEC and ETSI)

between public authorities prevent digital services and devices used by Europeans from working together as well as they should"[40].

To tackle the different obstacles identified in "A Digital Agenda for Europe", the European Commission proposes a set of key actions. One of those actions is to propose legal measures on ICT interoperability to reform the rules on the implementation of ICT standards in Europe to allow the use of certain ICT *fora* and *consortia* standards. It is evident that nowadays ICT *fora* and *consortia* play an important role in the frame of ICT standardization. The underlying need is to reach "*effective interoperability between IT products and services to build a truly digital society*". Moreover, the European Commission has also launched a Work Program about ICT standardization entitled "2010-2013 ICT Standardisation Work Programme for industrial innovation". This Work Program was replaced at the end of 2013 by the "Rolling plan for ICT standardization", which was prepared by the European Commission, in collaboration with the European Multi-Stakeholder Platform on ICT Standardization (MSP). This Rolling Plan provides a multi-annual overview of the needs for preliminary or complementary ICT standardization activities to be undertaken in support of the EU policy activities. It is addressed to all ICT stakeholders and gives a transparent view on how policies are planned to be practically supported. It is collaboratively and regularly reviewed, on an annual or by-need basis, and takes into consideration the input from the EU Services as well as the advice of the MSP. The last update has been published at the beginning of 2016[41].

Moreover, in relation with the implementation of the Digital Single Market strategy, the European Commission published a Communication[42] setting out priorities in terms of ICT standardization to promote the digitalization of the European economy. The European Commission has particularly identified five priority areas for ICT standardization: the 5G communications, Cloud Computing, the Internet of Things (IoT), technologies related to data (e.g.: Big Data) and Cybersecurity. They are considered as the essential building blocks to make the implementation of the Digital Single Market a success. These areas have been especially selected based on recommendations of the MSP.

The European Commission plans various developments to strengthen the political and strategic importance of ICT standardization as a critical component of the Digital Single Market, in response to the increasing global competition.

3.2.2.1. European Multi-Stakeholder Platform on ICT Standardization (MSP)

The European Multi-Stakeholder Platform on ICT Standardization has been created by the European Commission through its Decision of November, 28 2011 (2011/C 349/04)[43], to advise on matters related to the implementation of ICT standardization policy (including the work program for ICT standardization, priority setting in support of legislation and policies, and identification of specifications developed by global ICT standards development organizations), in order to improve standards setting in the ICT field and to ensure interoperability between ICT applications, services and products[44].

This platform is an Advisory Expert Group on all matters related to European ICT standardization and its effective implementation. Its main responsibilities are to:

[40] European Commission - COM(2010) 245 final/2

[41] http://ec.europa.eu/DocsRoom/documents/15783/attachments/1/translations/en/renditions/native

[42] http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=15265

[43] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2011:349:0004:0006:EN:PDF

[44] In the context of the MSP, the term "standards" is used in a generic way for all such deliverables from both recognized standards organizations and from standardization *fora* and *consortia* – or the terms "standards and technical specifications" are used.

- Advise the European Commission on its ICT standardization work program;
- Identify potential future ICT standardization needs;
- Advise the European Commission on possible standardization mandates;
- Advise the European Commission on technical specifications in the field of ICT with regard to its referencing in public procurement and policies;
- Advise the European Commission on cooperation between standards developing organizations.

The MSP is composed of representatives of national authorities of the EU Member States and EFTA countries, stakeholder organizations representing industry, small and medium-sized enterprises, consumers and other societal stakeholders as well as European and international standardization bodies and other non-profit making organizations (which are professional societies, industry or trade associations) or other membership organizations active in Europe that, within their area of expertise, develop standards in the field of ICT.

Since January 2012, ILNAS - Digital trust department, is the Luxembourg's representative within the European Multi-Stakeholder Platform on ICT Standardization. ILNAS is therefore the official contact point between the national market and the MSP.

The Rolling Plan[45] established at the beginning of 2016 lists all the topics identified as EU policy priorities where standardization plays a role in the implementation of the respective policy. The main EU policy topics, related to ICT standardization, are grouped into four clusters, as described below in Table 4. For each topic, the Rolling Plan details the policy objectives, the legislation and policy documents, the needs and ongoing activities in terms of standardization, the other ongoing activities (stakeholder groups, technology platforms and research projects), and finally it proposes some new standardization actions to be taken.

Table 4: EU policy priorities related to ICT standardization

Societal Challenges	Innovation for the Digital Single Market
• eHealth • Active and Healthy Aging • Accessibility of ICT products and services • e-Skills and e-Learning • Emergency communications • eCall	• e-Procurement, Pre and Post award • e-Invoicing • Card, Internet and Mobile Payments • eXtensible Business Reporting Language (XBRL) • Online Dispute Resolution (ODR)
Sustainable growth	**Key enablers and security**
• Smart Grids and Smart Metering • Smart Cities / Technologies and Services for a Smart and Efficient Energy Use • ICT Environmental Impact • European Electronic Toll Service (EETS) • Intelligent Transport Systems (ITS) • Advanced Manufacturing • Robotics and autonomous systems	• Cloud computing • Public Sector Information, Open Data and Big Data • eGovernment • Electronic identification and trust services including e-signatures • Radio Frequency Identification (RFID) • Internet of Things (IoT) • Network and Information Security • ePrivacy • E-Infrastructures for Research Data and

[45] http://ec.europa.eu/DocsRoom/documents/15783/attachments/1/translations/en/renditions/native

	Computing-Intensive Science • Broadband Infrastructure Mapping • Preservation of Digital Cinema

The 2016 version of the Rolling Plan integrates two new topics under the "Sustainable growth" cluster: "Smart Cities" and "Robotics and autonomous systems", demonstrating their growing importance in the European policy objectives.

Moreover, the Rolling Plan covers technologies of horizontal importance in the contexts of ICT infrastructures and ICT standardization. It provides an overview of relevant basic horizontal standards and ongoing standardization activities in various technology areas with relevance across the specific topic areas. These technologies are summarized below in Table 5:

Table 5: Relevant horizontal areas and major covered technologies

Technology area		Technologies covered
Physical and Link		Cabling, USB, BUS specifications, Ethernet, WIFI, GSM, LTE, Signaling and framing specifications
Internet-working technologies		IP level technologies (e.g.: Binding to lower layers, Mobility solutions, Rendezvous, Locator/Identifier splits, Home networks, Tunneling, DNS, intra and inter domain routing, virtual networking, multi-cast, congestion control mechanism, TCP maintenance, and various traffic optimization mechanisms)
Applications	**Messaging and Media**	Application layer protocols (e.g.: various e-mail standards, HTTP, LDAP Internet based telephony (SIP and RTP), internet messaging (XMPP), emergency services, geolocation, and web platform (HTML, Cookies, XML, EcmaScript)
	Presentation and Interfacing	Fonts, Internationalization, Audio and Video Codecs, Accessibility standards, File formats (jpeg, SVG), APIs, Cascading style sheets
	Business logic	XML based document definitions, business semantics and Modelling Languages (e.g. invoicing standards)
Security and Privacy		Internet Public Key, Internet infrastructure (x.509 based), web authorization, JavaScript signing and encryption, transport layer security mechanism (TLS), Authentication information exchange mechanisms (SAML), Privacy enhancement mechanisms

3.2.2.2. CEN

CEN, as defined in Chapter 2, is the formal standards body in charge of developing ICT standards at the European level. The ICT sector is an active standardization domain for CEN, which has 10 technical committees directly concerned under its supervision (according to this standards analysis). The other ICT-related topics are being tackled at the international level by ISO/IEC JTC 1, which complies with the "Vienna Agreement" set up between CEN and ISO in June 1991. Its aim is to avoid parallel or conflicting standards and to provide mutual assistance in the work.

3.2.2.3. ETSI

ETSI is officially recognized by the European Union as a European Standardization Organization. It produces globally applicable standards for ICT including fixed, mobile, radio, converged, broadcast and internet technologies. ETSI is particularly involved in Smart ICT standardization with activities regarding, for example, Internet of Things, Smart Cities, Cybersecurity or Green ICT. Crucially, ETSI is also in charge of developing all standards relating to spectrum management and electromagnetic compatibility used in European law.

ETSI is organized in ten clusters, each of them representing a major component of a global ICT architecture and covering the work of a number of Technical Committees and a wide range of technologies:

- **Home & Office**:

This cluster is focusing on different standardization aspects for home and offices: the wireless systems, the interconnection and the services, including the Quality of Services (QoS) and the security[46].

- **Better Living with ICT**:

One of the responsibilities of this cluster is to develop standards to ensure a better efficiency of products and services through ICT, particularly by assessing their environmental aspects during all their life cycle. It also works on the developments of standards to guarantee the usability and accessibility of the technology to all, including the elderly, the young and people with disabilities[47].

- **Content Delivery**:

The Content Delivery cluster is developing standards to allow the convergence of different specifications for content delivery. In this frame, it is working on supporting standards for Internet Protocol Television (IPTV), mobile TV and broadcast TV[48].

- **Networks**:

This cluster is developing "*a comprehensive set of standards for access network technologies, from Digital Subscriber Line technologies (xDSL), fibre and cable, through to the latest developments with Internet Protocol (IP) networking technology and the Cloud*". It is also active in the development of standards for new network technologies such as Network Functions Virtualisation (NFV)[49].

- **Wireless Systems**:

Through its Wireless Systems cluster, ETSI is developing standards to define the radio technologies and systems (e.g.: 2G and 3G mobile telephony, broadcast radio and television, Wireless LAN and cordless technology, Global Navigation Satellite Systems, RFID and short range devices). It also works with regulatory authorities in Europe to deliver the standards needed to manage the radio spectrum environment and to guarantee a safe coexistence of the different systems involved[50].

- **Transportation**:

The Transportation cluster has activities in several transportation domains: road, railways, aviation and maritime. It is particularly working on the development of cooperative Intelligent Transport Systems (ITS), Air Traffic Management Systems (ATM) and on the interoperability of the European rail

[46] http://www.etsi.org/technologies-clusters/clusters/home-office
[47] http://www.etsi.org/index.php/technologies-clusters/clusters/better-living-with-ict
[48] http://www.etsi.org/technologies-clusters/clusters/content-delivery
[49] http://www.etsi.org/technologies-clusters/clusters/networks
[50] http://www.etsi.org/technologies-clusters/clusters/wireless-systems

system. It is also active in the satellite transport communications domain. Its work not only includes communications aspects but also efficiency, safety and energy consumption reduction considerations[51].

- **Connecting Things**:

This cluster is mainly focusing on the development of Internet of Things (IoT) standards. It is particularly working on Machine-to-Machine communications that will find applications in many promising and emerging domains such as Smart Cities, Smart buildings, Smart Grids, eHealth, etc. In this frame, ETSI is one of the founding partners of the oneM2M consortium, which is currently developing a common M2M Service Layer to ensure the interoperability of the numerous connected devices in the IoT landscape[52].

- **Interoperability**:

The Interoperability cluster is developing standards for testing the interoperability of ICT solutions. In this frame, ETSI regularly organizes interoperability events or Plugtests, to validate standards by testing the interoperability of equipment based on standards. Recently, some interoperability events have been organized to test technologies related to M2M and IoT, or regarding Electronic Signatures[53].

- **Public Safety**:

The Public Safety cluster is responsible for setting up standards to facilitate emergency communications for authorities, public safety and citizens. It is for example developing standards in support of emergency callings, Global Maritime Distress and Safety System or Satellite Emergency Communication[54].

- **Security**:

This cluster has a broad scope and holds a horizontal role in support of all the technical committees of ETSI. The cluster leads many activities in the security landscape, aiming to develop a secure digital environment for organizations and consumers: Electronic Signatures, Cybersecurity, Smart Cards, Security Algorithms, Mobile/Wireless communications, etc. ETSI is also working on emerging topics such as Quantum Key Distribution or Quantum-Safe Cryptography[55].

The *Annual report 2015*[56] of ETSI provides an overview of the recent achievements of the different clusters. ETSI has also published its *Work Programme 2015-2016*[57] to explain the objectives of the clusters regarding the period. One of these is the pursuing of its involvement in relevant European Commission funded research projects (e.g.: e-SENS, STORK 2.0) and the participation in Horizon 2020 to stay close to new technologies that could be standardized.

Education about standardization is also an important concern of ETSI. In this frame, it has become partner of the university certificate. This university diploma is a national pilot project initiative launched by ILNAS in collaboration with the University of Luxembourg (see Section 8.1) and ETSI's involvement allows the organization to promote its innovative standardization activities and participates in the development of ICT standardization skills at the national level.

[51] http://www.etsi.org/technologies-clusters/clusters/transportation
[52] http://www.etsi.org/technologies-clusters/clusters/connecting-things
[53] http://www.etsi.org/technologies-clusters/clusters/interoperability
[54] http://www.etsi.org/technologies-clusters/clusters/public-safety
[55] http://www.etsi.org/technologies-clusters/clusters/security
[56] http://www.etsi.org/images/files/AnnualReports/etsi-annual-report-april-2015.pdf
[57] http://www.etsi.org/images/files/WorkProgramme/etsi-work-programme-2015-2016.pdf

Moreover, ANEC GIE has become an ETSI member in March 2015 in order to closely follow Smart ICT technical standardization lead by ETSI. It ensures a better representation of the Grand Duchy of Luxembourg in the organization and facilitates the transfer of standardization knowledge from ANEC GIE to the national stakeholders.

3.2.3. National level

At the national level, the ICT sector is already an active standardization sector with 65 national delegates. The organization and development of the ICT technical standardization representation at the national level is one of the objectives of the "Policy on ICT technical standardization 2015-2020"[58] published by ILNAS. Through three lead projects, several activities have been launched by ANEC GIE, under the supervision of ILNAS, to foster and strengthen the national ICT sector in its involvement in standardization work:

- **Developing the interest and the involvement of the market (see Section 5.2):**
    - Drawing up a yearly national standards analysis for the ICT sector;
    - Defining a national implementation plan for ICT technical standardization (in line with the national standards analysis for the ICT sector).
- **Promoting and reinforcing the ICT standardization participation at national level:**
    - Providing information to the national community:

In order to share ICT standardization knowledge with the related community in Luxembourg (ISO/IEC JTC1, ETSI, ICT *fora* and *consortia*, etc.), ANEC GIE organizes, under the supervision of ILNAS, related workshops at national level, specifically in the frame of the ICT prospective and the domain of "Smart ICT".

    - Participating in relevant technical committees:

In order to better bring the relevant information to the national ICT standardization community, ILNAS commissioned ANEC GIE to follow the different activities of the technical committees of formal standards bodies, particularly ISO/IEC JTC 1 and ETSI.

[58] http://www.portail-qualite.public.lu/fr/publications/normes-normalisation/orientations-strategiques/politique-luxembourgeoise-pour-la-normalisation-technique-des-TIC-2015-2020/Policy-on-ICT-technical-standardization-_2015-2020_.pdf

- **Supporting and strengthening the Education about Standardization and the related research activities:**

    - Managing the pilot project university certificate "Smart ICT for Business Innovation":

ILNAS, in collaboration with the University of Luxembourg, has developed the university certificate[59]. This diploma, in its current version has been designed for experienced professionals who wish to enhance their ICT skills to allow them to take a broad view of the cutting-edge Smart ICT concepts and tools at their disposal in order to develop their sense of innovation.

This university certificate focuses on important aspects of Smart ICT and their applications, such as Cloud Computing, Big Data and Analytics, Data Digitization, Smart cities, and environmental issues related to ICT. Furthermore, in an interconnected world, information security and ICT governance are essential and these aspects are dealt with by international experts.

Embracing all these issues, technical standardization is a key source of knowledge in constant evolution. Therefore, the courses of the university certificate are substantially based on completed, on-going and planned standardization developments.

In this frame, all the Smart ICT issues are being detailed and studied by an international community of experienced industrials and researchers involved in international and European standardization committees and, in particular, in the different technical committees followed by ANEC GIE.

ILNAS commissioned ANEC GIE to implement this university certificate, and to carry out its development.

    - Developing research activities:

ILNAS commissioned ANEC GIE to reinforce the research and innovation activities related to standardization in the field of ICT, notably by defining some new research projects with the different stakeholders at national level, principally with the University of Luxembourg. Different developments could be future PhDs on "Smart ICT" topics, white papers on "Digital Trust for Smart ICT", development of a research program, with the University of Luxembourg, dedicated to the domains of "ICT Technical Standardization".

    - Prospective of new diplomas:

ILNAS and ANEC GIE, in collaboration with the University of Luxembourg, will analyze the possibility to define and propose new diplomas, in the area of ICT standardization, in line with the needs of the national market. These future developments will be based on the outcomes of the different research activities and the information provided by the different technical committees.

[59] http://www.portail-qualite.public.lu/fr/normes-normalisation/education-recherche/projets-phares-dans-l_education-a-la-normalisation/index.html

4. METHOD FOR THE STANDARDS ANALYSIS

This chapter proposes a standards analysis that was carried out in the frame of the "Luxembourg's policy on ICT technical standardization 2015-2020"[60]. This document provides a "snapshot" of the ICT sector and identifies opportunities for fostering and strengthening the national ICT sector in its involvement in standardization work. This chapter also presents the different steps that were followed, which are illustrated in Figure 2.

Figure 2: ICT standards analysis steps

4.1. STANDARDS WATCH

A standards watch was carried out in order to identify standardization technical committees of potential interest for the national stakeholders in the ICT sector. The analyzed technical committees belong to the formal standards bodies dealing with ICT standardization:

- ISO/IEC that forms a system for international standardization as a whole by means of the ISO/IEC Agreement of 1976[61];
- CEN;
- ETSI;
- ITU-T.

The other formal standards bodies (ISO, IEC, and CENELEC) do not specifically deal with ICT standardization but some technical committees have been selected due to their relevance with ILNAS and the national market needs.

However, it is important to note that some technical committees related to economic sectors other than ICT may produce standards related to ICT. These technical committees are identified in Chapter 11 and all the formal standards bodies are analyzed in this frame (step 3 of the standards analysis).

Regarding non-formal standards bodies, they are also considered in step 3 of the standards analysis and surveyed in Section 7.15.

[60] http://www.portail-qualite.public.lu/fr/publications/normes-normalisation/orientations-strategiques/politique-luxembourgeoise-pour-la-normalisation-technique-des-TIC-2015-2020/Policy-on-ICT-technical-standardization-_2015-2020_.pdf

[61] ISO/IEC Directives, Part 1 (2016, 12th Ed.)

The standard watch has been carried out in three stages, as described below.

❖ Stage 1: Identification of the standardization technical committees related to the ICT sector

This first step consisted in identifying technical committees relevant to the national ICT sector within the formal standards bodies:

- **Identification of the ICT technical committees:**

At the international level, ISO and IEC formed a Joint Technical Committee known as the ISO/IEC JTC 1 in 1987. The scope of this committee being "Information Technology", ISO/IEC JTC1 and all its subcommittees are considered relevant for this standards watch.

CEN standardization is organized in sectors and one of these sectors is ICT, encompassing all ICT technical committees. These technical committees are also relevant in the frame of the standards watch.

ETSI and ITU-T deal with standardization of telecommunications. Therefore, ETSI, ITU-T and their technical committees are thus fully in the scope of this standards watch.

- **European Multi-Stakeholder Platform on ICT standardization (MSP):**

The MSP, as described in section 3.2.2.1, is an advisory expert group created on the basis of a European Commission Decision, dealing with matters related to the implementation of ICT standardization policies.

In this frame, amongst its activities, the Technical Board (BT) CEN/CLC BT/WG 6 "ICT standardization policy" supports the CEN and CENELEC representatives in the European Commission's ICT Multi-Stakeholder Platform. It aims to develop ways and means for further improving the visibility and recognition of CEN and CENELEC, and to draft responses to political issues in ICT standardization context.

❖ Stage 2: Division of the ICT sector into subsectors

The ICT sector covers many issues, dispatched among a number of technical committees. In order to present the standards watch results, the ICT sector was divided into subsectors. The choice of these subsectors was based both on the list of identified committees and the national interests, as described in Section 5.2.

Fora and *consortia* (see Section 4.3) have not been included in the subsectors. Indeed, their scope is generally too large to be related to one or several subsectors. Moreover, it is usually difficult to have a clear view of the scope of committees composing the studied *fora*/*consortia*.

❖ Stage 3: Presentation of the results using identification cards for each standardization technical committee

Identification cards (ID-Cards) were designed in order to provide a quick overview of each surveyed technical committee and *fora*/*consortia*. Most of the identified technical committees are linked to formal standard bodies. However, non-formal standards bodies dealing with ICT standards are also important and interesting resources of standards. As the information available is slightly different for these two types of organizations, different templates were designed to present the watch results.

Figure 3 depicts the template used for ISO/IEC, ISO, CEN, CENELEC, ETSI, ITU-T and their technical committees.

Figure 3: ID-Card template used for ISO/IEC, ISO, CEN, CENELEC, ETSI, ITU-T and their technical committees

General information			
Committee		Title	
Creation date		MEMBERS 	
Secretariat			
Secretary			
Chairperson			
Organizations in liaison			
Web site			
Scope			
Structure			
Standardization work			
Published standards			
Standards under development			
Involvement of Luxembourg			
Comments			

The template used to present non-formal standards bodies is showed in Figure 4.

Figure 4: ID-Card template used for and non-formal standards bodies

General information			
Forum / Consortium		Title	
Creation date		MEMBERS 	
Chairperson			
Involvement of Luxembourg			
Web site			
Scope			
Executive summary			
Structure			
Standardization work			
Published standards			
Standards under development			

4.2. STAKEHOLDERS OF THE ICT SECTOR AND POTENTIAL INTERESTS FOR STANDARDIZATION

The "Luxembourg's policy on ICT technical standardization 2015-2020" [62] annually sets an implementation plan related to the national standards analysis. Its objective is to meet national stakeholders in order to define their interests in standardization and support them in the implementation of relevant opportunities. This allows a sharing knowledge with the national market in order to support the ICT sector in terms of development, competitiveness, visibility and performance, while enhancing the international recognition of the Grand Duchy of Luxembourg at the standardization level.

Concretely, after having compiled the selected technical committees in relation to the ICT sector into subsectors (Section 5.1), potential interests for the national stakeholders to participate in the standardization work were described (Section 5.2).

The objective is to facilitate the involvement of national stakeholders, by identifying their needs and increase their awareness of the relevant opportunities as described in the fourth step (Section 4.4).

[62] http://www.portail-qualite.public.lu/fr/publications/normes-normalisation/orientations-strategiques/politique-luxembourgeoise-pour-la-normalisation-technique-des-TIC-2015-2020/Policy-on-ICT-technical-standardization-_2015-2020_.pdf

4.3. ICT *FORA/ CONSORTIA* AND ECONOMIC INTERSECTORAL APPROACH

ICT is certainly one of the sectors having the highest number of non-formal standards bodies. In order to complete the ICT standards watch performed, a survey of the main *fora/consortia* seems particularly relevant. A selection of most relevant ICT *fora/consortia* with reference to the current national market has thus been done.

As acknowledged by CEN, many standardization activities in the ICT field are carried out by industry *consortia*. ICT *fora* and *consortia* are developing *de facto* standards widely spread in the ICT sector.

Fora and *consortia* included in this report meet at least one of the following criteria:

- Organizations which have a "Category A" liaison with ISO/IEC JTC 1. They make an effective contribution to the work of the technical committee and such organizations are given access to all the relevant documentation and are invited to the meetings. They may nominate experts to participate in a WG and propose an existing technical report or technical specification from any source to be submitted for vote as respectively a draft technical report or draft technical specification through the fast-track procedure[63];
- The Publicly Available Specifications (PAS) Submitters of ISO/IEC JTC 1. The work quality of these organizations is recognized by ISO/IEC JTC 1, and they are allowed to submit PAS as drafts for review and approval as international ISO/IEC JTC 1 standards[64];
- Organizations which have signed a Partner Standards Development Organization (PSDO) Cooperation Agreement (e.g. IEEE-SA) with formal standards bodies. The PSDO cooperation agreement provides opportunities to adopt and jointly develop international standards to serve the global marketplace;
- Member organizations of the European Multi-Stakeholder Platform on ICT standardization.

ICT can also be considered as a horizontal support to many other sectors in the worldwide economy. The examples of sectors where ICT is a cornerstone are numerous: aeronautics, automobile industry, banking industry, logistics, etc. To reach the same objective of completing the ICT standards watch performed (Section 4.1), a survey of all the formal standards bodies (ISO, IEC, CEN and CENELEC – ETSI and ITU-T) was performed in order to identify technical committees of other economic sectors related to ICT. This survey used the ICS (International Classification for Standards) codes to identify technical committees developing standards related to ICT. A research on every formal standards body has been done using ICS codes[65] (Table 6).

Each technical committee (representatively) developing standards corresponding to these ICS codes is identified within its economic sector and highlighted as an economic sector using ICT as a supporting sector.

[63] ISO/IEC Directives, part 1 – Consolidated JTC 1 Supplement 2015, Annex F
[64] List of approved JTC 1 PAS Submitters
[65] http://www.iso.org/iso/ics6-en.pdf

Table 6: ICS Codes related to the ICT sector

33 TELECOMMUNICATIONS. AUDIO AND VIDEO ENGINEERING:	35 INFORMATION TECHNOLOGY. OFFICE MACHINES:
- 33.020 Telecommunications in general; - 33.030 Telecommunication services. Applications; - 33.040 Telecommunication systems; - 33.050 Telecommunication terminal equipment; - 33.060 Radiocommunications; - 33.070 Mobile services; - 33.080 Integrated Services Digital Network (ISDN); - 33.100 Electromagnetic compatibility (EMC); - 33.120 Components and accessories for telecommunications equipment; - 33.140 Special measuring equipment for use in telecommunications; - 33.160 Audio, video and audiovisual engineering; - 33.170 Television and radio broadcasting; - 33.180 Fibre optic communications; - 33.200 Telecontrol. Telemetering.	- 35.020 Information technology (IT) in general; - 35.040 Character sets and information coding; - 35.060 Languages used in information technology; - 35.080 Software; - 35.100 Open systems interconnection (OSI); - 35.110 Networking; - 35.140 Computer graphics; - 35.160 Microprocessor systems; - 35.180 IT terminal and other peripheral equipment; - 35.200 Interface and interconnection equipment; - 35.220 Data storage devices; - 35.240 Applications of information technology; - 35.260 Office machines.

Moreover, several ICT concepts constitute niche opportunities for the national economic development of the ICT sector. Standardization can be an incubator to transform technology trends in effective standardization activities facilitating the access of new technologies to the global market and developing new services across the world. Therefore, the process to analyze promising standardization areas is presented in Chapter 9 to highlight the incubator role of ISO/IEC JTC 1 to transform technology trends in effective standardization activities.

4.4. DEFINITION OF THE OPPORTUNITIES FOR THE NATIONAL MARKET

Finally, the opportunities for the national market have been identified. These opportunities are based on the feedback of the national market, the relevant standardization developments at the European and international level, and the experience of ILNAS and ANEC GIE by participating into the ICT standardization sector.

Based on the standards analysis of the ICT sector and, in particular, on the potential interests emerging from the stakeholders, there are many opportunities for the national market. Convinced that national stakeholders have a real interest to seize these opportunities, ILNAS and ANEC GIE will jointly and actively contribute to inform them and support their normative developments. The identified opportunities should be seen by national stakeholders as proposals to efficiently drive standards participation forward with the aim to rapidly take advantage of standardization.

5. RESULTS OF THE STANDARDS ANALYSIS

5.1. RESULTS OF THE STANDARDS WATCH

The performed standards watch allowed to identify **46 standardization technical committees** (TC) (European and international) directly related to the ICT sector, which are described, through ID-Cards, in Chapter 7.

As defined in Section 4.2, national stakeholders have potential interests to follow and participate in standardization technical committees. To facilitate the identification of relevant technical committees regarding their activities, 13 subsectors have been defined in connection with:

- The main development priorities of stakeholders in the ICT sector at national level (e.g.: Cloud Computing, Data center, etc.);
- Areas of particular interest for ILNAS and the national ICT market (electronic signature, e-archiving). For these subsectors, the standards watch is extended to technical committees potentially out of the scope defined in Section 4.1 in order to establish a link between these subsectors and technical committees.

The 13 subsectors addressed in the standards analysis are described in Table 7.They cover 35 TC (out of 46 identified) listed in Table 8. According to market interests and standardization strategic developments, new subsectors may be added in future versions of this analysis. The 11 remaining TC are listed in Table 10.

5.1.1. ICT subsectors and related technical committees

Table 7: ICT subsectors

Subsector 1 - Cloud computing	Cloud Computing is currently a hot topic in ICT and is closely followed by many organizations at national level, making it relevant as a subsector. The main idea behind Cloud Computing is to store and process data in the cloud, access applications from anywhere and to maintain important information in the cloud, all of this being done faster and at lower cost than through conventional means. Cloud Computing is defined by ISO/IEC 17788:2014 as "*a paradigm for enabling network access to a scalable and elastic pool of shareable physical or virtual resources with self-service provisioning and administration on-demand*"[66]. The main characteristics of Cloud Computing are: - Broad network access: physical and virtual resources are available over a network and accessed through standard mechanisms that promote use by heterogeneous client platforms; - Measured service: the metered delivery of cloud services is such that usage can be monitored, controlled, reported, and billed; - Multi-tenancy isolation: in case of multi-tenancy of a Cloud resource, physical or virtual resources are allocated in such a way that multiple tenants and their computations and data are isolated from and inaccessible to one another; - On-demand self-service: a cloud service customer can provision computing capabilities, as needed, automatically or with minimal interaction with the cloud service provider; - Rapid elasticity and scalability: physical or virtual resources can be rapidly and elastically adjusted, in some cases automatically, to quickly increase or decrease resources; - Resource pooling: a cloud service provider's physical or virtual resources can be aggregated in order to serve one or more cloud service customers.

[66] International Standard ISO/IEC 17788:2014, Information technology -- Cloud computing -- Overview and Vocabulary (developed by ISO/IEC JTC 1/SC 38)

Subsector 2 - Data center	As stated by the European Commission in "A Digital Agenda for Europe", the data center industry acts as a key business enabler to support the continuous digitalization trend. In 2010, Luxembourg defined its data centers offer as a key component in its development strategy for the coming years (and EUR 100 million ICT infrastructure investment plan has been adopted[67]). As a result of this investment, Luxembourg currently boasts one of the most modern data center parks in Europe and has around 20 data centers in operation. Luxembourg has thus positioned itself as a leading data center marketplace in Europe and has probably one of the highest data center densities in Europe and the world[68]. It is also interesting to note that this subsector supports several other promising economic sectors such as entertainment and media; biotechnologies, health and patient management; and e-commerce. Data center is defined by ISO/IEC 30134-1:2016 as "*a structure, or group of structures, dedicated to the centralized accommodation, interconnection and operation of information technology and network telecommunications equipment providing data storage, processing and transport services together with all the facilities and infrastructures for power distribution and environmental control together with the necessary levels of resilience and security required to provide the desired service availability*"[69].
Subsector 3 - Telecommunications	Telecommunications is defined by ISO 5127:2001 as the "*theory and techniques of the transmission of signals by electromagnetic or electronic means*"[70]. The telecommunications subsector covers any transmission, emission or reception of signs, signals, writing, images and sounds or intelligence of any nature by wire, radio, optical or other electromagnetic systems[71].
Subsector 4 – Software and system engineering	According to ISO/IEC 2382-1:1993 concerning Fundamental terms in ICT, software engineering is defined as "*the systematic application of scientific and technological knowledge, methods, and experience to the design, implementation, testing, and documentation of software*"[72]. The International Standard ISO 16404:2013 defined system engineering as an "*interdisciplinary approach and means to enable the realization of successful systems, starting with the definition of customer needs, the identification of product functionality, and the intended validation very early in the lifecycle*"[73]. Software and system engineering is thus a broad subsector encompassing fundamental activities such as requirements engineering, design, coding, integration, installation and management of an information system.
Subsector 5 - Security	Information security includes three main dimensions: confidentiality, availability and integrity. In addition, other properties, such as authenticity, accountability, non-repudiation, and reliability can also be involved. Information security involves the application and management of appropriate security measures that involves consideration of a wide range of threats, with the aim of ensuring sustained business success and continuity, and minimizing the impacts of information security incidents: - Confidentiality is the property that information is not made available or disclosed to unauthorized individuals, entities or processes; - Integrity is the property of safeguarding the accuracy and completeness of assets. Accuracy could be threatened by (unauthorized or undesirable) fault, update or tampering. Completeness could be threatened by fault, altering or deletion;

[67] The future of data centres in Europe – Luxembourg: where else?, PricewaterhouseCoopers, 2010

[68] http://ict.investinluxembourg.lu/why-luxembourg/ict-luxembourg/data-centres-ecosystems

[69] International Standard ISO/IEC 30134-1: Information Technology -- Data Centres -- Key performance indicators -- Part 1: Overview and general requirements (developed by ISO/IEC JTC 1/SC 39)

[70] ISO 5127:2001, Information and documentation -- Vocabulary (developed by ISO/TC 46)

[71] Definition extracted from the International Telecommunication Convention (Nairobi, 1982)

[72] ISO/IEC 2382-1, Information technology -- Vocabulary -- Part 1: Fundamental terms (developed by ISO/IEC JTC 1)

[73] ISO 16404:2013, Space systems -- Programme management -- Requirements management (developed by ISO/TC 20/SC 14)

	- Availability is the property of being accessible and usable upon demand by an authorized entity[74]. This subsector deals thus with a large scope of standards at the hardware, software, network or management level.
Subsector 6 - Data management	As defined by ISO/IEC TR 10032:2003, data management consists of *"the activities of defining, creating, storing, maintaining and providing access to data and associated processes in one or more information systems"*[75]. This subsector encompasses the whole scope of data management, data going from characters or strings manipulated by a user to sophisticated and valuable assets. Data management can be performed in different environments such as a computer, a wired network or without contact (e.g. RFID - Radio-frequency identification, NFC - Near field communication technologies or Sensor Network); on various supports such as recorded media, hard drives or smartcards.
Subsector 7 – Electronic signature	ETSI has defined electronic signature as a *"data in electronic form that is attached to or logically associated with other electronic data and that serves as a method of authentication"*[76]. An electronic signature is thus a mechanism to authenticate the author of an electronic document (like the handwritten signature for a paper document), and to ensure its integrity. The Regulation (EU) n° 910/2014 of the European Parliament and of the Council[77] on electronic identification and trust services for electronic transactions in the internal market (eIDAS Regulation) is intended to provide a regulatory environment to enable secure and seamless between businesses, citizens and public authorities. In this frame, the eIDAS Regulation: - *"Ensures that people and businesses can use their own national electronic identification schemes (eIDs) to access public services in other EU countries where eIDs are available.* - *Creates a European internal market for eTS - namely electronic signatures, electronic seals, time stamp, electronic delivery service and website authentication - by ensuring that they will work across borders and have the same legal status as traditional paper based processes. Only by providing certainty on the legal validity of all these services, businesses and citizens will use the digital interactions as their natural way of interaction"*[78]. This subsector includes the different concepts and mechanisms upon which electronic signatures are based including public key cryptography, public key certificate, hash functions and Public Key Infrastructures (PKI).
Subsector 8 – E-archiving	Archiving consists in the maintenance of records for continuing use, where records are information created, received and maintained as evidence and as an asset by an organization or person, in pursuit of legal obligations or in the transaction of business. Moreover, in the frame of a continuing use, the preservation of records is a highly important notion that consists of processes and operations involved in ensuring the maintenance of records over time[79]. This analysis focuses on digital archives.

[74] Based on ISO/IEC 27000:2016, Information technology -- Security techniques -- Information security management systems -- Overview and vocabulary (developed by ISO/IEC JTC 1/SC 27)

[75] ISO/IEC TR 10032:2003, Information technology -- Reference Model of Data Management (developed by ISO/IEC JTC 1/SC 32)

[76] ETSI TS 101 733, Electronic Signatures and Infrastructures (ESI); CMS Advanced Electronic Signatures (CAdES) (developed by ETSI/TC ESI)

[77] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2014.257.01.0073.01.ENG

[78] https://ec.europa.eu/digital-single-market/en/trust-services-and-eid

[79] Based on ISO/IEC 30300:2011, Information and documentation -- Management systems for records -- Fundamentals and vocabulary (developed by ISO/TC 46/SC 11)

Subsector 9 – Sensor Networks	Sensor networks consist in a "*system of spatially distributed sensor nodes interacting with each other and, depending on applications, possibly with other infrastructure in order to acquire, process, transfer, and provide information extracted from its environment with a primary function of information gathering and possible control capability*"[80]. Sensor networks are essential for the development of numerous ICT innovations: Smart Cities, Smart Grids, Intelligent Transport Systems, Internet of Things, etc.
Subsector 10 – Governance of IT	Corporate governance involves a set of relationships between a company's management, its board, its shareholders and other stakeholders. Corporate governance also provides the structure through which the objectives of the company are set, and the means of attaining those objectives and monitoring performance are determined[81]. The governance of IT is thus a component or a subset of organization governance, which is one key element in improving economic efficiency and growth as well as enhancing investors' confidence. Governance of IT can be defined as the system by which the current and future use of IT is directed and controlled[82].
Subsector 11 – Internet of Things	The final study report of ISO/IEC JTC 1/SWG 5[83] defined Internet of Things (IoT) as: "*An infrastructure of interconnected objects, people, systems and information resources together with intelligent services to allow them to process information of the physical and the virtual world and react*". Many services can be envisioned as a result of technological progress and all objects can play an active role thanks to their connection to the Internet: real-time traffic updates (thanks to mobile tracking), building automation and controls, automatic energy management, intelligent shopping applications, vehicle auto-diagnosis, assistance for elderly or disabled people to help them living independently, etc. In this frame, standardization is essential to define a universal approach and thus ensure interoperability of IoT infrastructures.
Subsector 12 – Big Data	The Big Data Preliminary Report published by ISO/IEC JTC 1[84] defines Big Data as "*a data set(s) with characteristics (e.g. volume, velocity, variety, variability, veracity, etc.) that for a particular problem domain at a given point in time cannot be efficiently processed using current/existing/established/traditional technologies and techniques in order to extract value.*" Big Data is at the top of the agenda of a number of ICT stakeholders. Analytical functions performed on these large amounts of data may allow the production of new knowledge, offering great promises in terms of applications in all the economic sectors.
Subsector 13 – Smart Cities	There are many definitions of a smart city and many designations that refer to the same concept. ISO/TC 268 prefers the expression "smart community infrastructure". It proposes the following definition of this concept: "*a community infrastructure with enhanced technological performance that is designed, operated, and maintained to contribute to sustainable development and resilience of the community*"[85]. Smart Cities have many dimensions and encompass many economic sectors and technologies. Different dimensions are proposed for a smart city (e.g.: smart economy, smart mobility, smart environment, smart people, smart living, smart governance, etc.). In this frame we can consider a

[80] ISO/IEC 29182-2:2013, Information technology -- Sensor networks: Sensor Network Reference Architecture (SNRA) -- Part 2: Vocabulary and terminology (developed by ISO/IEC JTC 1/WG 7)

[81] OECD principles of corporate Governance

[82] Based on ISO/IEC TR 38502:2014, Information Technology -- Governance of IT -- Framework and model (developed by ISO/IEC JTC 1/SC 40)

[83] Based on the Study Report on Internet of Things (IoT) submitted to the 2014 ISO/IEC JTC 1 Plenary by the ISO/IEC JTC 1/SWG 5 on IoT. This SWG has been replaced at the end of 2014 by the WG 10 on IoT

[84] Based on the Preliminary Report on Big Data submitted to the 2014 ISO/IEC JTC 1 Plenary by the ISO/IEC JTC 1/SG 2 on Big Data. This SG has been replaced at the end of 2014 by the WG 9 on Big Data

[85] Definition available in ISO/TS 37151:2015, Smart community infrastructures -- Principles and requirements for performance metrics

smart city as a system of systems, meaning it is a complex construction that requires the development of many other technologies (e.g.: Internet of Things, Big Data, Intelligent Transport Systems, etc.).

The standardization issues are thus numerous and do not only concern ICT, which can be seen as a facilitator to help the city to become smart.

Following the definition of the subsectors categorizing the ICT sector, the technical committees are classified. The 35 standardization technical committees identified that are related to the selected ICT subsectors are listed below in the Table 8 (ETSI and ITU-T are included as a whole). In addition, in order to have access to more details, each technical committee has a detailed ID-Card presented in the following chapters. The exact page number referring to the specific ID-Card is also available in the following table.

Table 8: Identified technical committees by ICT subsector

SUBSECTOR	ORIGIN*	TECHNICAL COMMITTEE (TC)	ID-CARD Ref. Page
CLOUD COMPUTING	INT	ISO/IEC JTC 1/SC 38 - Cloud Computing and Distributed Platforms	47
	EU	ETSI/TC NTECH - Network Technologies	49
DATA CENTER	INT	ISO/IEC JTC 1/SC 39 - Sustainability for and by Information Technology	53
	EU	CLC/TC 215 - Electrotechnical aspects of telecommunication equipment	55
TELECOMMUNI-CATIONS	INT	ISO/IEC JTC 1/SC 6 - Telecommunications and information exchange between systems	59
	INT	ISO/IEC JTC 1/SC 25 - Interconnection of information technology equipment	61
	INT	ITU-T - International Telecommunication Union's Telecommunication Standardization Sector	63
	EU	ETSI - European Telecommunications Standards Institute	65
	EU	ETSI/TC SES - Satellite and Earth Stations & Systems	68
	EU	ETSI/TC ERM - Electromagnetic compatibility & Radio spectrum Matters	69
	EU	CEN/TC Project Committee 365 - Internet Filtering	71
SOFTWARE AND SYSTEM ENGINEERING	INT	ISO/IEC JTC 1/SC 7 - Software and systems engineering	75
	INT	ISO/IEC JTC 1/SC 22 - Programming languages, their environments and system software interfaces	77
	INT	ISO/IEC JTC 1/SC 29 - Coding of audio, picture, multimedia and hypermedia information	79
SECURITY	INT	ISO/IEC JTC 1/SC 27 - IT Security techniques	83
	INT	ISO/IEC JTC 1/SC 37 - Biometrics	86
	EU	ETSI/TC CYBER - Cyber Security	88
DATA MANAGEMENT	INT	ISO/IEC JTC 1/SC 2 - Coded character sets	91
	INT	ISO/IEC JTC 1/SC 23 - Digitally Recorded Media for Information Interchange and Storage	92
	INT	ISO/IEC JTC 1/SC 24 - Computer graphics, image processing and environmental data representation	93
	INT	ISO/IEC JTC 1/SC 31 - Automatic identification and data capture techniques	95
	INT	ISO/IEC JTC 1/SC 32 - Data management and interchange	97

SUBSECTOR	ORIGIN*	TECHNICAL COMMITTEE (TC)	ID-CARD Ref. Page
	INT	ISO/IEC JTC 1/SC 34 - Document description and processing languages	99
	EU	CEN/TC 225 - AIDC Technologies	101
ELECTRONIC SIGNATURE	INT	ISO/IEC JTC 1/SC 17 - Cards and personal identification	105
	EU	CEN/TC 224 - Personal Identification, Electronic Signature and Cards	107
	EU	ETSI/TC ESI - Electronic Signatures and Infrastructures	109
E-ARCHIVING	INT	ISO/TC 46/SC 11 - Archives/records management	113
SENSOR NETWORKS	INT	ISO/IEC JTC 1/WG 7 - Sensor Networks	117
GOVERNANCE OF IT	INT	ISO/IEC JTC 1/SC 40 - IT Service Management and IT Governance	121
INTERNET OF THINGS	INT	ISO/IEC JTC 1/WG 10 - Internet of Things	125
	EU	ETSI/TC SmartM2M - Smart Machine-to-Machine Communications	127
BIG DATA	INT	ISO/IEC JTC 1/WG 9 - Big Data	131
SMART CITIES	INT	ISO/IEC JTC 1/WG 11	135
	INT	ISO/TC 268	137

** EU: European origin and INT: International origin*

In summary, the 35 technical committees, which are potentially interesting regarding the national ICT subsectors, are specified below in Table 9. Note that ETSI and ITU-T as a whole are also related to the "telecommunications" subsector.

Table 9: Distribution of the selected technical committees in the ICT subsector

Subsector	European TC	International TC	Total
Subsector 1 – Cloud computing	1	1	**2**
Subsector 2 – Data center	1	1	**2**
Subsector 3 – Telecommunications	4	3	**7**
Subsector 4 – Software and System engineering	0	3	**3**
Subsector 5 – Security	1	2	**3**
Subsector 6 – Data management	1	6	**7**
Subsector 7 – Electronic signature	2	1	**3**
Subsector 8 – E-archiving	0	1	**1**
Subsector 9 – Sensor Networks	0	1	**1**

Subsector	European TC	International TC	Total
Subsector 10 – Governance of IT	0	1	**1**
Subsector 11 – Internet of Things	1	1	**2**
Subsector 12 – Big Data	0	1	**1**
Subsector 13 – Smart Cities	0	2	**2**
Total	**11**	**24**	**35**

5.1.2. Technical committees not related to subsectors

Finally, the standards watch has identified 11 technical committees that are focused on ICT standardization, but not related to any subsector (Table 7). Although these committees are not related to the current subsectors, they might be interesting for stakeholders.

These technical committees are presented in Table 10.

Table 10: Technical committees not related to subsectors

SDO	ORIGIN*	TECHNICAL COMMITTEE (TC)	ID-CARD Ref. Page
ISO/IEC	INT	ISO/IEC JTC 1 - Information technology	141
	INT	ISO/IEC JTC 1/SC 28 - Office equipment	145
	INT	ISO/IEC JTC 1/SC 35 - User interfaces	146
	INT	ISO/IEC JTC 1/SC 36 - Information technology for learning, education and training	148
CEN	EU	CEN/TC 247 Building - Automation, Controls and Building Management	150
	EU	CEN/TC 251 - Health Informatics	152
	EU	CEN/TC 287 - Geographic Information	153
	EU	CEN/TC 294 - Communication systems for meters and remote reading of meters	154
	EU	CEN/TC 428 - Project Committee - e-competences and ICT Professionalism	155
	EU	CEN/TC 434 - Project Committee - Electronic Invoicing	156
	EU	CEN/TC 440 - Electronic Public Procurement	158

5.2. INTERESTS FOR STAKEHOLDERS

Taking into account the ICT subsectors that were identified and classified on the previous section but also considering the different stakeholders of the ICT sector, this section is dedicated to explore the potential interests for national ICT stakeholders to participate in standardization activities. Through the implementation plan, these interests will be turned into concrete opportunities for stakeholders at the national level.

5.2.1. Definition of the implementation plan

In order to meet the national stakeholders' needs and interests, ILNAS and ANEC GIE develop each year an implementation plan. Based on this standards analysis, it defines a framework to approach national stakeholders and gives an overview of all the opportunities offered by standardization (Chapter 6), in relation to the interests for each ICT subsector.

5.2.2. Description of potential interests

The potential interests of stakeholders are the following:

Potential Interests	Descriptions
Information	Thanks to the participation in a standardization technical committee, the stakeholders are informed on the latest standardization developments related to their activities, allowing them to identify future requirements and to anticipate the consequences on their activities.
Performance	Through participating in standardization activities within a technical committee, stakeholders contribute to increase their performance, in particular: - Development of new skills through the contact with other key actors (networking); - Information on directions taken by other states or others organizations (benchmarking); - Translation of innovations into future rules (knowledge codification); - Anticipation of the obligation to comply with European regulatory requirements.
Services	In some cases, the follow-up of standards developments offers stakeholders the opportunity to develop new services related to their activities.
Projects	Research projects directly related to standardization or involving standards in order to codify the acquired knowledge are regularly launched. Stakeholders can access useful information in the framework of future calls for tenders as well as benefit from specific support to get involved in projects.
Training	Thanks to the knowledge of standards and its development process, stakeholders have solid and reliable elements to update, improve or develop trainings in the ICT sector.
Investments	Stakeholders could have an interest in investing in new technologies or concepts.

6. OPPORTUNITIES FOR THE NATIONAL MARKET

The purpose of the sector-based standards analysis is to involve identified national stakeholders in a standardization approach to support and stimulate the ICT sector in terms of competitiveness, visibility and performance.

Based on the standards analysis of the ICT sector, and especially the potential interests for the stakeholders, there are many opportunities for the national market. Convinced that national actors have a real interest to seize these opportunities, ILNAS and ANEC GIE will jointly and actively contribute to inform them and support their normative steps. The identified opportunities should be seen by national stakeholders as a series of proposals which could lead to go further and to engage in future actions in order to more rapidly take advantage of standardization.

The opportunities listed below are available at the national level, according to the interests of the stakeholders in the ICT sector.

❖ Participation in ICT technical committees

The ICT sector is, at national level, the most mature standardization sector. Luxembourg is registered as "O-member" of ISO/IEC JTC 1, and 65 delegates from Luxembourg are currently involved in international and European technical committees from the ICT sector.

Participating in ICT standardization technical committees offers a broad set of opportunities:

- Giving your opinion during the standardization process;
- Valuing your know-how and good practices;
- Accessing draft standards;
- Anticipating future evolutions;
- Collaborating with strategic partners and international experts;
- Valuing your organization at national and international level;
- Identifying development opportunities;
- Placing your organization in the competition.

❖ Stronger commitment as a national delegate (chairman, head of delegation, editor of European or international standards)

Registration as a national delegate offers the possibility to assume different levels of involvement:

- Chairman of a national mirror committee: each national mirror committee has to nominate a chairman who will be in charge of the organization of the national community of delegates registered in this committee. Indeed, the chairman has to vote on the draft standards and ensure that the national position concerning a vote will represent the consensus in the national mirror committee;
- Head of delegation: national delegates can be nominated by the national mirror committee to represent its position during the plenary meetings of the corresponding international or European technical committees;
- Editor or co-editor of standards documents: each standards project is subject to a call for participation. In this frame, a national delegate can choose to actively participate in the project as editor or coeditor. He will then take the responsibility to ensure the successful conduct of the project until its publication.

Some national delegates from the ICT sector have already been (co-)editors of standards documents such as technical reports (ISO/IEC TR 20000-4, ISO/IEC TR 20000-5 and ISO/IEC TR 27015:2012, ISO/IEC TR 14516-3), international standards (ISO/IEC 27010, ISO/IEC 27034-4, ISO/IEC 33050-4) or other various standards documents (ISO/IEC JTC 1/SC 27/WG 5 Standing Document 2 – Part 1).

❖ Participation in national Smart ICT workshops

In order to share the ICT standardization knowledge with the related community in Luxembourg (ISO/IEC JTC1, ETSI, ICT *fora* and *consortia*, etc.), ILNAS organizes, at national level in collaboration with ANEC GIE, workshops in the framework of ICT prospective and, more specifically in the domain of "Smart ICT".

For example, a Smart ICT workshop, dedicated to the yearly ISO/IEC JTC 1 environmental scan results, was organized by ILNAS on June 4th, 2015[86]. On this occasion, Mr. Mario Wendt, the chairman of the ISO/IEC JTC 1 Special Working Group on Planning (SWG-P)[87], presented the planning process of the SWG and the intermediate results of the yearly survey. Moreover, Mr. Volker Jacumeit, the secretary of the JTC 1/SWG-P and German delegate for the CEN-CENELEC-ETSI Cyber Security Coordination Group (CSCG), provided an overview of the CSCG activities. Finally, a round table with national delegates, Mrs. Béatrix Barafort (Chairwoman of the national mirror committee ISO/IEC JTC 1/SC 40), Mr. Cédric Mauny (Vice Chairman of the national mirror committee ISO/IEC JTC 1/SC 27) and the JTC 1/SWG-P experts led to fruitful exchanges on the role and activities of the national standardization delegates and allowed ILNAS to identify new ways of development to better support their work.

Moreover, ILNAS, with the support of ANEC GIE, organized several breakfasts dedicated to the promotion of standardization. For example, a breakfast "Data Centers & Standardization" was organized on July 2nd, 2015[88], a workshop "Standardization and Green Computing" on February 9th 2016[89] and a breakfast "Big Data White Paper" on May 25 2016[90]. During these events, international standardization activities regarding data centers were presented and relevant information to participate in the standardization work were provided. These meetings are organized to bring together national stakeholders of a dedicated ICT subsector and to provide them with the relevant standardization knowledge and facilitate their engagement in the standards development process. In this manner, ILNAS organizes one or two hour sessions dedicated to technical standardization of a specific ICT subsector, on a regular basis.

❖ Benefit from the support offered by the national standards body

As the national standards body, ILNAS has to provide support to national delegates and to coordinate the activities of the different committees at the national level. These duties are of primary importance and well stated in the "Luxembourg's Policy on ICT technical standardization 2015-2020" which aims to enhance the organization and development of the ICT technical standardization representation at the national level.

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[86] http://www.portail-qualite.public.lu/fr/actualites/normes-normalisation/2015/workshop-smart-ict-juin-2015/index.html

[87] The JTC 1/SWG-P has been replaced by the JTC 1 Advisory Group at the end of 2015

[88] http://www.portail-qualite.public.lu/fr/actualites/normes-normalisation/2015/petit-dejeuner-normalisation-et-data-centers/index.html

[89] http://www.portail-qualite.public.lu/fr/actualites/normes-normalisation/2016/ws-normalisation-green-computing/index.html

[90] http://www.portail-qualite.public.lu/fr/actualites/normes-normalisation/2016/breakfast-big-data/index.html

A result expected from the standards analysis focusing on the ICT sector is to raise awareness and increase the participation of Luxembourg's stakeholders in standardization technical committees, either at European or international level.

Moreover, national delegates benefit from the experience of ILNAS in order to:

- Propose new standardization projects in international or European technical committees;
- Propose the development of national standards.

❖ Profit from services in relation to standards evolutions

Services in relation to standards and their developments can be proposed to the ICT sector. It could be, for example, standards watch focusing on a specific subsector or a thematic study associating regulatory requirements and standardization duties.

Since 2013, ILNAS, supported by ANEC GIE, has been developing on-demand products and services in order to support and improve the competitiveness of the national economic market through a better knowledge of standardization.

Currently, the products and services offered encompass:

- Coaching;
- Diagnosis;
- Focused standards watch;
- Standards analysis;
- Information about links between research projects and standardization;
- Awareness and training.

ILNAS has recently published its training courses catalog[91] in the field of technical standardization for the year 2016. The catalog offers awareness modules to understand the key standardization concepts, and detailed modules to understand the standardization issues while developing its skills. A training dedicated to standardization in the ICT sector is available on demand for national stakeholders.

❖ Following the standardization work performed in ICT *fora/consortia*

Considering the importance for the market of ICT standards developed by *fora/consortia*, with regards to the number and the range of standards published, it is interesting to follow ICT standardization work performed in *fora/consortia* at the national level.

However, it is important to see upstream if the national actors are interested in further following and participating in ICT *fora/consortia*. Moreover, based on the national market's interest, a selection shall be done to follow a selected number of ICT *fora/consortia*. It is important to note that ICT is certainly one of the sectors that has the highest number of active standardization *fora/consortia*.

❖ Involvement at the strategic level of ICT standardization and identification of promising standardization areas

ISO/IEC JTC 1/JAG (JTC 1 Advisory Group) is not intended to develop standards. It advises and supports the JTC 1 Chair in pursuit of the JTC 1 mission and objectives. In this frame it covers planning activities of ISO/IEC JTC 1 and the definition of its action plans.

[91] http://www.portail-qualite.public.lu/fr/publications/normes-normalisation/information-sensibilisation/catalogue-formation-2016/Catalogue_de_formation_2016_WEB.pdf

By following the work performed by the JAG, national stakeholders can identify technology trends defined as "mature" for standardization work and which therefore should quickly spread more widely on the global market (see Chapter 9).

❖ **Following the standardization work performed by the European multi-stakeholder platform on ICT standardization (MSP)**

Since January 2012, ILNAS - Digital trust department, is the Luxembourg's representative within the European Multi-Stakeholder Platform on ICT Standardization (see Section 3.2.2.1). In this frame, ILNAS is the official national contact point dedicated to exchange information between the market and the European multi-stakeholder platform on ICT standardization.

In this context, interested stakeholders have the opportunity to join ILNAS' mailing list to receive relevant MSP documents regarding their area of interest. This registration offers the possibility to comment these documents through ILNAS.

❖ **Participation in research projects involving standardization**

Research in the ICT sector is important in Luxembourg, with several actors active in this field. Moreover, as mentioned by the CEN-CENELEC[92], the role of standardization is recognized as a bridge between research activities and the market, both by EU institutions and R&D stakeholders. Indeed, standardization is identified in Horizon 2020 as one of the measures that will support the market take-up of research results and innovation.

With the support of Luxembourg's standards body, national stakeholders of the ICT technologies sector could have opportunities to be involved in these research projects.

In this context, a second version of the White Paper "Digital Trust - Towards excellence in ICT"[93] was published in 2014 by ILNAS to investigate and develop the knowledge areas of digital trust. It is worth noting that ILNAS commissioned ANEC GIE to update and develop, every two years, the White Paper on "Digital Trust & Smart ICT". In this frame, an update is undergoing and a new version will be published in 2016. This new version will cover current security and trust aspects in three highly relevant areas: Cloud Computing, Big Data and Internet of Things. The aim is to leverage latest relevant standards as well as state-of-the-art research work to provide a high quality and up-to-date review on recent developments in the area. Further, based on statistics and trends, economic challenges and prospective will be highlighted in the context of Digital Trust.

Moreover, two White Papers concerning Smart ICT concepts have been published by ILNAS in 2016:

- The White Paper "Green Computing"[94]

This White Paper surveys, from a holistic perspective, various topics and technologies in the area of sustainability and Information Technology (IT), also known as Green Computing or Green ICT. An investigation is made regarding questions on the environmental impact of current IT usage, energy efficiency of IT products and how IT can contribute to business sustainability. The aim of the document is therefore to present a comprehensive review of the state-of-the-art approaches to help companies in developing sustainable and environmental friendly products and services which are supported or

[92] http://www.cencenelec.eu/research/Pages/default.aspx

[93] http://www.portail-qualite.public.lu/fr/publications/confiance-numerique/etudes-nationales/white-paper-digital-trust-june-2014/White-Paper-Digital-Trust-June-2014.pdf (Firstly published in 2012)

[94] http://www.portail-qualite.public.lu/fr/publications/normes-normalisation/information-sensibilisation/white-paper-green-computing/white-paper-green-computing.pdf

enabled by IT. In this context, standardization is presented as the cornerstone to guide and support organizations to achieve sustainability. A thorough review is conducted on the most relevant standards related to the topic of Green Computing from different standardization bodies such as ISO, IEC, CENELEC, ETSI, and ITU and *consortia* such as ECMA and IEEE. Finally, the Eco-management and Audit Scheme (EMAS) is surveyed as an environmental management system which enables organizations to assess, manage, and continuously improve their environmental performance. Because the requirements of ISO 14001 "Environmental management systems" are an integral part of EMAS, organizations that comply with EMAS automatically comply with the requirements of such standard.

- The White Paper "Big Data"[95]

This document aims at surveying current advances in Big Data and Big Data Analytics from two complementary points of view: a technical analysis perspective and a business and economic prospective analysis. Therefore, the document is intended for those professionals seeking guidance in one or both domains and can be used in its whole as a compendium where technical and IT governance aspects of Big Data are equally treated. Standards and technical standardization is also presented as an essential tool to improve the interoperability between various applications and prevent vendor lock-in, to provide interfaces between relational and non-relational data stores and to support the large diversity of current data types and structures. Finally, some conclusions on Big Data are presented with an outlook on how to integrate them in the business environment to create value.

❖ Contribution to the improvement of Luxembourg's status in the standardization field

By enhancing the participation in standardization activities and by implementing the opportunities listed previously, Luxembourg will strengthen its presence in the standardization field and significantly improve its image at European and international level, which will benefit the entire national market.

[95] http://www.portail-qualite.public.lu/fr/publications/normes-normalisation/information-sensibilisation/white-paper-big-data/WP_BigData_v1.pdf

❖ **SUMMARY**

To summarize, the opportunities identified for the national market and available at the national level for the different ICT stakeholders are:

- Participation in ICT technical committees;
- Stronger commitment as a national delegate (chairman, head of delegation, editor of European or international standards);
- Participation in national Smart ICT workshops;
- Benefit from the support offered by the national standards body;
- Profit from services in relation to standards evolutions;
- Following the standardization work performed in ICT *fora/consortia*;
- Involvement at the strategic level of ICT standardization and identification of promising standardization areas;
- Following the standardization work performed by the European multi-stakeholder platform on ICT standardization (MSP);
- Participation in research projects involving standardization;
- Contribution to the improvement of Luxembourg's status in the standardization field.

As long as the stakeholders of the sector wish to seize these opportunities ILNAS, supported by ANEC GIE, can provide an active contribution and support.

As the national standards body, ILNAS offers national stakeholders the possibility to follow specific standardization activities of technical committees, either at European or international level. It supports those who are interested to participate in standardization activities, namely by providing information and delivering trainings. Therefore, resources from ILNAS and ANEC GIE are specifically dedicated to these aspects and are able to efficiently support and inform the future national delegates[96].

To reinforce this support, a person is appointed as the specific point of contact for delegates of the ICT sector. As such, the information and support provided would also stay as close as possible to the issues related to this sector.

[96] Declaration of interest in ICT standardization

7. ICT STANDARDS WATCH

The objective of the ICT standards watch is to identify the main organizations developing standards in the field of ICT and their related technical committees. This document takes into account every Standards Developing Organization (SDO), i.e. **formal standards bodies** developing *de jure* (or formal) standards, and ***fora*** and ***consortia*** developing *de facto* standards[97].

This chapter focuses on the presentation of technical committees related to ICT standardization. It considers both formal standards bodies and *fora*/*consortia*:

❖ ISO/IEC standardization committees

ISO is the world's dominant developer and publisher of International Standards in terms of scope. It has around 20,000 standards published and more than 4,500 standards under development[98]. ISO is in charge of developing International Standards for all industry sectors. IEC prepares and publishes International Standards for all electrical, electronic and related technologies – collectively known as "electrotechnology". To prevent an overlap in standardization work related to information technology, ISO and IEC formed a Joint Technical Committee in 1987 known as ISO/IEC JTC 1.

In addition to ISO/IEC JTC1 subcommittees, ISO/TC 46/SC 11 and ISO/TC 268 are also presented. Although these TCs are not directly related to the ICT domain as defined in Section 4.1, they are respectively linked to the "e-archiving" and "Smart Cities" topics defined as a subsector in Section 5.1.

❖ CEN and CENELEC standardization committees

CEN, the European Committee for Standardization, and CENELEC, the European Committee for Electrotechnical Standardization, are the European counterparts of ISO and IEC. They are now collaborating on their standards work in the domain of ICT. The standardization work is hosted at the CEN level except for the technical committee CENELEC/TC 215, particularly relevant for the "Data center" subsector as described in Section 5.1.

❖ ETSI - European Telecommunications Standards Institute

The European Telecommunications Standards Institute (ETSI) produces globally applicable standards for ICT including fixed, mobile, radio, converged, broadcast and internet technologies. ETSI is officially recognized by the European Union as a European Standardization Organization. The high quality of its work and its open approach to standardization has helped it to evolve into a European major institute.

In this section, an ID-Card is provided for ETSI in general. By its scope – specifically focused on telecommunications – the whole of ETSI is considered as related to the "telecommunications" subsector. Specific technical committees are detailed due to their particular importance for subsectors (e.g.: ETSI/TC ESI for the "electronic signature" subsector).

[97] Hesser, W., Czaya, A., & Riemer, N. (2007). Development of Standards. In W. Hesser (Ed.), *Standardisation in Companies and Markets* (pp. 123-169). Hamburg: Helmut Schmidt University.
[98] http://www.iso.org/iso/home/about/iso-in-figures.htm

❖ ITU-T - International Telecommunication Union - Telecommunication Standardization Sector

The International Telecommunication Union - Telecommunication Standardization Sector (ITU-T) is an "intergovernmental public-private partnership organization" which brings together experts from around the world to develop international standards known as ITU-T Recommendations which represents defining elements in the global infrastructure of information and communication technologies.

From its inception in 1865, with ITU originally meaning the International Telegraph Union, ITU-T has now evolved to a contribution-led, consensus-based approach to standards development in which all countries and companies, no matter how large or small, are afforded equal rights to influence the development of ITU-T Recommendations. From its beginnings, as a body standardizing international telegraph exchange (through its formative role in telecommunications and in today's converged ICT ecosystem), ITU-T has provided the world's best facilities to the global standardization community and remains the world's only truly global ICT standards body[99].

An ID-Card is provided in Section 7.3 for ITU-T in general. By its scope – specifically focused on telecommunications – the whole of ITU-T is considered as related to the "telecommunications" subsector.

❖ FORA/CONSORTIA

In order to complete the ICT standards watch, a survey of the main *fora*/*consortia* seems particularly relevant. Regarding the highest number of non-formal standards bodies in this sector, it is not realistic to present them all. Thus, a selection of the most relevant *fora*/*consortia* for the current national market has been done.

As acknowledged by CEN, many standardization activities in the ICT field are carried out by industry *consortia*. ICT *fora* and *consortia* are developing *de facto* standards widely spread in the ICT sector. The purpose of Section 7.15 is thus to present some well-known ICT *fora* and *consortia*.

The fora and *consortia* included in this report meet, at least, one of the following criteria (details are provided in Section 4.3):

- Organizations which have a Category A liaison with ISO/IEC JTC 1;
- The Publicly Available Specifications (PAS) Submitters of ISO/IEC JTC 1;
- Organizations which have signed a Partner Standards Development Organization (PSDO) Cooperation Agreement (e.g. IEEE-SA) with formal standards bodies;
- Member organizations of the European Multi-Stakeholder Platform on ICT standardization.

[99] http://www.itu.int/en/ITU-T/about/Pages/default.aspx

7.1. CLOUD COMPUTING

Cloud Computing is currently a hot topic in ICT and is closely followed by many organizations at national level, making it relevant as a subsector. The main idea behind Cloud Computing is to store and process data in the cloud, access applications from anywhere and to maintain important information in the cloud, all of this being done faster and at lower cost than through conventional means.

Cloud Computing is defined by ISO/IEC 17788:2014 as "a paradigm for enabling network access to a scalable and elastic pool of shareable physical or virtual resources with self-service provisioning and administration on-demand"[100].

The main characteristics of Cloud Computing are:

- *Broad network access: physical and virtual resources are available over a network and accessed through standard mechanisms that promote use by heterogeneous client platforms;*
- *Measured service: the metered delivery of cloud services is such that usage can be monitored, controlled, reported and billed;*
- *Multi-tenancy isolation: in case of multitenancy, physical or virtual resources are allocated in such a way that multiple tenants and their computations and data are isolated from and inaccessible to one another;*
- *On-demand self-service: a cloud service customer can provision computing capabilities, as needed, automatically or with minimal interaction with the cloud service provider;*
- *Rapid elasticity and scalability: physical or virtual resources can be rapidly and elastically adjusted, in some cases automatically, to quickly increase or decrease resources;*
- *Resource pooling: a cloud service provider's physical or virtual resources can be aggregated in order to serve one or more cloud service customers.*

[100] *International Standard ISO/IEC 17788:2014, Information technology -- Cloud computing -- Overview and Vocabulary (developed by ISO/IEC JTC 1/SC 38)*

7.1.1.ISO/IEC JTC 1/SC 38

<table>
<tr><th colspan="4">General information</th></tr>
<tr><td>Committee</td><td>ISO/IEC JTC 1/SC 38</td><td>Title</td><td>Cloud Computing and Distributed Platforms</td></tr>
<tr><td>Creation date</td><td>2009</td><td rowspan="5">MEMBERS
  </td><td rowspan="5">Participating Countries (28):
United States, Australia, Austria, Belgium, Brazil, Canada, China, Denmark, Finland, France, Germany, India, Ireland, Israel, Italy, Japan, Republic of Korea, Luxembourg, Netherlands, Poland, Russian Federation, Singapore, Slovakia, South Africa, Spain, Sweden, Switzerland, United Kingdom

Observing Countries (11):
Argentina, Bosnia and Herzegovina, Czech Republic, Hong Kong, New Zealand, Norway, Portugal, Serbia, Turkey, Uruguay, Zambia</td></tr>
<tr><td>Secretariat</td><td>ANSI (USA)</td></tr>
<tr><td>Secretary</td><td>Ms. Lisa Rajchel</td></tr>
<tr><td>Chairperson</td><td>Dr. Donald Deutsch</td></tr>
<tr><td>Organizations in liaison</td><td>CSCC, Cloud security alliance, DMTF, Ecma International, INLAC, ITU, OASIS, OGF, SNIA, EC, EuroCloud, TM Forum</td></tr>
<tr><td>Web site</td><td colspan="3">http://www.iso.org/iso/standards_development/technical_committees/list_of_iso_technical_committees/iso_technical_committee.htm?commid=601355</td></tr>
<tr><td>Scope</td><td colspan="3">Standardization in the area of Cloud Computing and Distributed Platforms including but not limited to:
- Service Oriented Architecture (SOA);
- Service Level Agreement;
- Interoperability and Portability;
- Data and their Flow Across Devices and Cloud Services.</td></tr>
<tr><td>Structure</td><td colspan="3">JTC 1/SC 38/WG 3 Cloud Computing Service Level Agreements (CCSLA)
JTC 1/SC 38/WG 4 Cloud Computing Interoperability and Portability (CCIP)
JTC 1/SC 38/WG 5 Cloud Computing Data and its Flow (CCDF)</td></tr>
<tr><th colspan="4">Standardization work</th></tr>
<tr><td>Published standards</td><td colspan="3">Number of published ISO/IEC standards under the direct responsibility of JTC 1/SC 38 (number includes updates): 8</td></tr>
<tr><td>Standards under development</td><td colspan="3">7</td></tr>
<tr><th colspan="4">Involvement of Luxembourg</th></tr>
<tr><td colspan="4">9 delegates

- Mrs. Myriam Djerouni — Banque de Luxembourg S.A.
- Mr. Jean-Michel Remiche — POST Telecom S.A.
- Mrs. Shenglan Hu — POST Telecom PSF S.A.
- Mr. Michel Ayme — Atos Luxembourg PSF S.A.
- Mr. Qiang Tang — University of Luxembourg
- Mr. Shyam Wagle — University of Luxembourg
- Mrs. Ana-Maria Simionovici — University of Luxembourg
- Mr. Johnatan Pecero — ANEC GIE
- Mr. Joseph Emeras — ANEC GIE</td></tr>
</table>

Comments

ISO/IEC JTC 1/SC 38, Cloud Computing and Distributed Platforms, is responsible for the development of standards to support distributed computing paradigms- especially in the area of Cloud Computing. With the progression of service oriented architecture specification and the publication of ISO/IEC 17788 and 17789, standards presenting a taxonomy, terminology and vocabulary, from the Cloud Computing collaboration with ITU-T/SG 13, SC 38 is turning its focus to identifying other standardization initiatives in these rapidly developing areas. Based on an understanding of the market/business/user requirements for Cloud Computing standards and a survey of related standardization activities within ISO/IEC JTC 1 and other standards setting organizations, new Cloud Computing standardization initiatives will be proposed and initiated. SC 38 approved two new projects on Interoperability and Portability and Data Flow. By initiating standardization activities only after first identifying Cloud Computing standardization requirements, ISO/IEC JTC 1/SC 38 will address the public and private sector needs for standards that address end-user requirements and facilitate the rapid deployment of Cloud Computing.

The current SC 38 work program includes:

- ISO/IEC FDIS 19086-1, Information technology -- Cloud computing -- Service level agreement (SLA) framework and Technology -- Part 1: Overview and concepts;
- ISO/IEC NP 19086-2, Information technology -- Cloud computing -- Service level agreement (SLA) framework and Technology -- Part 2: Metrics;
- ISO/IEC DIS 19086-3, Information technology -- Cloud computing -- Service level agreement (SLA) framework and technology -- Part 3: Core requirements;
- ISO/IEC CD 19941, Information Technology -- Cloud Computing -- Interoperability and Portability;
- ISO/IEC CD 19944, Information Technology -- Cloud Computing – Data and their Flow across Devices and Cloud Services.

7.1.2.ETSI/TC NTECH

General information			
Committee	**NTECH**	**Title**	**Network Technologies**
Creation date	2012	**MEMBERS** 	/
Chairperson	Mr. Bruno Chartras		
Organizations in liaison	/		
Web site	https://portal.etsi.org/ntech		
Scope	TC NTECH missions consist in: - Provide detailed architecture and protocol (profile) specifications for use in networks addressing the control, data and management planes in both the service and transport layers of these networks, including security; - Provide protocol profile specifications for service interconnection and network interconnection; - Identify and monitor relevant work on Future Networks technologies performed outside ETSI and provide guidelines on their applicability to ETSI compliant networks. It includes the maintenance of Cloud Computing deliverables.		
Structure	NTECH/WG NTECH AFI Working Group Evolution of Management towards Autonomic Future Internet		
Standardization work			
Published standards	19		
Standards under development	9		
Involvement of Luxembourg			
/			
Comments			
ETSI TC NTECH is notably responsible for the maintenance of ETSI Cloud Computing deliverables. It was also responsible for the development of a set of reports on Cloud standardization, addressing users' priorities, the status of related standards, security conformance and interoperability, and the relation between standards and Open Source development. This work has been done by ETSI Specialist Task Force 486 in the frame of the Cloud Standards Coordination (CSC) Phase 2, that has been concluded at the beginning of 2016 with the publication of four reports that are now freely available: - SR 003 381, Cloud Standards Coordination Phase 2; Identification of Cloud user needs; - SR 003 382, Cloud Standards Coordination Phase 2; Cloud Computing Standards and Open Source; Optimizing the relationship between standards and Open Source in Cloud Computing; - SR 003 391, Cloud Standards Coordination Phase 2; Interoperability and Security in Cloud Computing; - SR 003 392, Cloud Standards Coordination Phase 2; Cloud Computing Standards Maturity Assessment; A new snapshot of Cloud Computing Standards.		

7.2. DATA CENTER

As stated by the European Commission in "A Digital Agenda for Europe", the data center industry acts as a key business enabler to support the continuous digitalization trend. In 2010, Luxembourg defined its data centers offer as a key component in its development strategy for the coming years (and EUR 100 million ICT infrastructure investment plan has been adopted[101]. As a result of this investment, Luxembourg currently boasts one of the most modern data center parks in Europe and has around 20 data centers in operation. Luxembourg has thus positioned itself as a leading data center marketplace in Europe and has probably one of the highest data center densities in Europe and the world[102].

It is also interesting to note that this subsector supports several other promising economic sectors such as entertainment and media; biotechnologies, health and patient management; and e-commerce.

Data center is defined by ISO/IEC 30134-1:2016 as "a structure, or group of structures, dedicated to the centralized accommodation, interconnection and operation of information technology and network telecommunications equipment providing data storage, processing and transport services together with all the facilities and infrastructures for power distribution and environmental control together with the necessary levels of resilience and security required to provide the desired service availability"[103].

[101] *The future of data centres in Europe – Luxembourg: where else?, PricewaterhouseCoopers, 2010*
[102] *http://ict.investinluxembourg.lu/why-luxembourg/ict-luxembourg/data-centres-ecosystems*
[103] *International Standard ISO/IEC 30134-1:2016, Information Technology -- Data Centres -- Key performance indicators -- Part 1: Overview and general requirements (developed by ISO/IEC JTC 1/SC 39)*

7.2.1. ISO/IEC JTC 1/SC 39

General information			
Committee	**ISO/IEC JTC 1/SC 39**	**Title**	**Sustainability for and by Information Technology**
Creation date	2012	**MEMBERS** 	**Participating Countries (17):** United States, Belgium, Canada, China, Finland, France, Germany, Italy, Japan, Republic of Korea, **Luxembourg**, Netherlands, Norway, Russian Federation, Singapore, South Africa, United Kingdom **Observing Countries (10):** Argentina, Australia, Austria, Czech Republic, Islamic Republic of Iran, Ireland, Kenya, Poland, Spain, Switzerland
Secretariat	ANSI (USA)		
Secretary	Ms. Sally Seitz		
Chairperson	Mr. Jay Taylor		
Organizations in liaison	Ecma International, ITU, TGG, ETSI		
Web site	http://www.iso.org/iso/standards_development/technical_committees/list_of_iso_technical_committees/iso_technical_committee.htm?commid=654019		
Scope	Standardization related to the intersection of resource efficiency and IT which supports environmentally and economically viable development, application, operation and management aspects. To avoid any duplication of work and to support innovation, SC 39 will engage in active liaison and collaboration with: - Other JTC 1 entities; - ISO/TC 207, ISO/TC 242, ISO/TC 257; - IEC/TC 100, IEC/TC 108, IEC/TC 111, SMB/SG 4, IEC/PC 118, IEC/TC 57/WG 21, IEC/TC 9 and SMB/SG 3; - ITU-T/SG 5; and - Any other appropriate body including external organizations (e.g. *consortia*).		
Structure	JTC 1/SC 39/WG 1 Resource Efficient Data Centres JTC 1/SC 39/WG 2 Green ICT		
Standardization work			
Published standards	Number of published ISO/IEC standards under the direct responsibility of JTC 1/SC 39 (number includes updates): 4		
Standards under development	8		
Involvement of Luxembourg			
9 delegates			
- Mr. Didier Monestes (Chairman)	Systemic Area Network S.à r.l.		
- Mr. Bruno Fery	EBRC S.A.		
- Mr. Antoine François	EBRC S.A.		
- Mr. Sébastien Renauld	EBRC S.A.		
- Mr. Sébastien Richard	EBRC S.A.		
- Mr. Francis Gillard	LOW ENERGY CONSULTING S.à.r.l.		
- Mr. Valentin Plugaru	University of Luxembourg		

- Mr. Johnatan Pecero ANEC GIE
- Mr. Nicolas Domenjoud ANEC GIE

Comments

ISO/IEC JTC 1/SC 39 is focusing on the development of International Standards to use IT technology in a more sustainable manner. The subcommittee is particularly working on the optimization of data centers efficiency and on the development of solutions for the steady reduction of energy consumption of IT equipment. The SC has already published several standards:

- ISO/IEC 19395:2015, Information technology -- Sustainability for and by information technology -- Smart data centre resource monitoring and control. This International Standard provides Messages that facilitate integrated or "smart" monitoring and control of Resources in those islands.
- ISO/IEC 30134-1:2016, Information technology -- Data centres -- Key performance indicators -- Part 1: Overview and general requirements;
- ISO/IEC 30134-2:2016, Information Technology -- Data Centres -- Key performance indicators -- Part 2: Power usage effectiveness (PUE);
- ISO/IEC 30134-3:2016, Information Technology -- Data Centres -- Key Performance Indicators -- Part 3: Renewable Energy Factor (REF).

The current work program includes:

- ISO/IEC PDTR 20913, Information Technology -- Data Centres -- Key Performance Indicators -- Guidelines on holistic investigation methodology for data centre key performance indicators;
- ISO/IEC AWI TR 30131, Information technology -- Data Centres -- Taxonomy and Maturity Model;
- ISO/IEC PDTR 30132-1, Information technology -- Information technology sustainability -- Energy efficient computing models -- Part 1: Guidelines for energy efficiency evaluation;
- ISO/IEC WD TR 30132-2, Information technology -- Information technology sustainability -- Energy efficient computing models -- Part 2: Application guidelines of energy efficient evaluation methodology;
- ISO/IEC NP TR 30132-3, Information technology -- Information technology sustainability -- Energy efficient computing models -- Part 3: Development guidelines of energy efficiency evaluation;
- ISO/IEC WD TR 30133, Information technology -- Data Centres -- Guidelines for resource efficient data centres
- ISO/IEC CD 30134-4, Information Technology -- Data Centres -- Key performance indicators – Part 4: IT Equipment Energy Efficiency for Servers (ITEE);
- ISO/IEC CD 30134-5, Information Technology -- Data Centres -- Key Performance Indicators -- Part 5: IT Equipment Utilization for Servers (ITEU_SV)

The future series of standards ISO/IEC 30134 will provide a set of key performance indicators for data centers. Several other metrics are currently under consideration by the SC 39:

- Carbon Usage Effectiveness (CUE);
- Water Usage Effectiveness (WUE);
- Water Reuse Effectiveness (WR);
- Data Centre Cost Efficiency (DCCE);
- Data Centre Profit Efficiency (DCPE);
- Coefficient of Performance (COP);
- Seasonally adjusted Energy Efficiency Ratio (SEER).

7.2.2. CENELEC/TC 215

<table>
<tr><th colspan="4">General information</th></tr>
<tr><td>Committee</td><td>CLC/TC 215</td><td>Title</td><td>Electrotechnical aspects of telecommunication equipment</td></tr>
<tr><td>Creation date</td><td>1991</td><td rowspan="5">MEMBERS
  </td><td rowspan="5">33 members of CEN/CENELEC</td></tr>
<tr><td>Secretariat</td><td>Germany</td></tr>
<tr><td>Secretary</td><td>Dipl. Ing. Thomas Wegmann</td></tr>
<tr><td>Chairperson</td><td>Mr. Mike Gilmore</td></tr>
<tr><td>Organizations in liaison</td><td>EC, EURALARM</td></tr>
<tr><td>Web site</td><td colspan="3">http://www.cenelec.eu/dyn/www/f?p=104:7:127814256114401::::FSP_ORG_ID:1258297</td></tr>
<tr><td>Scope</td><td colspan="3">The priorities of CLC/TC 215 are:
- To address standardization in the field of electrotechnical aspects of telecommunication equipment and associated infrastructures and liaise with other standardization bodies as appropriate;
- To prepare harmonized standards (EN, TS or TR) covering all aspects of generic and application-specific telecommunications cabling (e.g. ISDN, LAN and others) within all types of premises;
- These documents also cover the requirements and recommendations for building infrastructures related to the effective installation and operation of associated telecommunication equipment by reference to the existing or forthcoming standards provided by the relevant committees or using technical inputs from them;
- To provide contributions to ETSI standards (EN and/or other deliverables) in areas related to those detailed above;
- To serve as a mediator in those cases where in accordance with the CENELEC-ETSI-Agreement ETSI indicates to CENELEC the need of standardization activities (EN/TS/TR or contributions to ETSI deliverables) of electrotechnical aspects related to its work;
- Identification of the appropriate TC within CENELEC, thereby providing proper assignment of the technical work to the responsible group of experts;
- Where an appropriate TC within CENELEC cannot be identified, TC 215 may decide to establish a Working Group to resolve a specific task;
- To review international standardization results of ISO/IEC JTC 1 as far as telecommunication equipment with respect to Customer Premises Cabling and Energy Efficient Data Centers are concerned. This includes coordination of harmonization and assignment to the responsible organization in close cooperation with CEN bearing in mind JTC 1 being a joint ISO/IEC-Committee.</td></tr>
<tr><td>Structure</td><td colspan="3">CLC/TC 215/WG 01 Cabling design
CLC/TC 215/WG 01-04 Testing of installed cabling
CLC/TC 215/WG 02 Cabling installation – Quality assurance and installation practices
CLC/TC 215/WG 03 Facilities and infrastructures</td></tr>
<tr><th colspan="4">Standardization work</th></tr>
<tr><td>Published standards</td><td colspan="3">49</td></tr>
<tr><td>Standards under development</td><td colspan="3">5</td></tr>
</table>

Involvement of Luxembourg

7 delegates

- Mr. Didier Monestes (Chairman)	Systemic Area Network S.à r.l.
- Mr. Bruno Fery	EBRC S.A.
- Mr. Antoine François	EBRC S.A.
- Mr. Sébastien Renauld	EBRC S.A.
- Mr. Sébastien Richard	EBRC S.A.
- Mr. Sébastien Varrette	University of Luxembourg
- Mr. Francis Gillard	LOW ENERGY CONSULTING S.à.r.l.

Comments

CENELEC/TC 215/WG 3 is working on energy efficient data centres in the framework mandate M/462, a specific requests from the of the European Commission in the context of the Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products.

CENELEC/TC 215 Working Group 3 is the competent European body to prepare European Standards in the field data centers. A liaison between CLC/TC 215 and ISO/IEC JTC 1/SC 39 was established to transpose the international standardization at the European level.

In response to expressed European market needs for a holistic set of standards addressing a variety of subjects including energy efficiency enablement, TC 215/WG 3 currently focuses on the development of series EN 50600 "Information technology - Data center facilities and infrastructures".

Series EN 50600 specifies requirements and recommendations to support the various parties involved in the design, planning, procurement, integration, installation, operation and maintenance of facilities and infrastructures within data centers.

The following parts have already been published:

- EN 50600-1:2012, Information technology - Data centre facilities and infrastructures - Part 1: General concepts;
- EN 50600-2-1:2014, Information technology - Data centre facilities and infrastructures - Part 2-1: Building construction;
- EN 50600-2-2:2014, Information technology - Data centre facilities and infrastructures - Part 2-2: Power distribution;
- EN 50600-2-3:2014, Information technology - Data centre facilities and infrastructures - Part 2-3: Environmental control;
- EN 50600-2-4:2015, Information technology - Data centre facilities and infrastructures - Part 2-4: Telecommunications Cabling Infrastructure;
- EN 50600-2-5:2016, Information technology - Data centre facilities and infrastructures - Part 2-5: Security systems;
- EN 50600-3-1:2016, Information technology - Data centre facilities and infrastructures - Part 3-1: Management and operational information;
- CLC/TR 50600-99-1:2016, Information technology - Data centre facilities and infrastructures - Part 99-1: Recommended practices for energy management.

The following parts are still under development:

- FprEN 50600-4-1, Information technology - Data centre facilities and infrastructures - Part 4-1: Overview and general requirements for key performance indicators (transposition from JTC 1/SC 39);
- FprEN 50600-4-2, Information technology - Data centre facilities and infrastructures - Part 4-2: Key performance indicator PUE (transposition from JTC 1/SC 39);
- FprEN 50600-4-3, Information technology - Data centre facilities and infrastructures - Part 4-3: Key performance indicator REF (transposition from JTC 1/SC 39).

7.3. TELECOMMUNICATIONS

Telecommunications is defined by ISO 5127:2001 as the "theory and techniques of the transmission of signals by electromagnetic or electronic means"[104].

The telecommunications subsector covers any transmission, emission or reception of signs, signals, writing, images and sounds or intelligence of any nature by wire, radio, optical or other electromagnetic systems[105].

[104] *ISO 5127:2001, Information and documentation -- Vocabulary (developed by ISO/TC 46)*
[105] *Definition extracted from the International Telecommunication Convention (Nairobi, 1982)*

7.3.1.ISO/IEC JTC 1/SC 6

<table>
<tr><th colspan="4">General information</th></tr>
<tr><td>Committee</td><td>ISO/IEC JTC 1/SC 6</td><td>Title</td><td>Telecommunications and information exchange between systems</td></tr>
<tr><td>Creation date</td><td>1964</td><td rowspan="5">MEMBERS
  </td><td rowspan="5">Participating Countries (18):
Republic of Korea, Austria, Belgium, Canada, China, Czech Republic, Finland, Germany, Greece, Japan, Kazakhstan, Netherlands, Russian Federation, Spain, Switzerland, Tunisia, United Kingdom, United States

Observing Countries (30):
Argentina, Bosnia and Herzegovina, Colombia, Cuba, Cyprus, France, Ghana, Hong Kong, Hungary, Iceland, India, Indonesia, Islamic Republic of Iran, Ireland, Italy, Kenya, Malaysia, Malta, New Zealand, Norway, Philippines, Poland, Romania, Saudi Arabia, Serbia, Singapore, Slovenia, Thailand, Turkey, Ukraine</td></tr>
<tr><td>Secretariat</td><td>KATS (Republic of Korea)</td></tr>
<tr><td>Secretary</td><td>Ms. Jooran Lee</td></tr>
<tr><td>Chairperson</td><td>Dr. Hyun Kook Kahng</td></tr>
<tr><td>Organizations in liaison</td><td>CEPT, CERN, EC, ETSI, Ecma International, ICAO, IEEE, ISOC, ITSO, ITU, OASIS, UNCTAD, UNECE, UPU, WMO, NFC Forum, MFA Forum</td></tr>
<tr><td>Web site</td><td colspan="3">http://www.iso.org/iso/standards_development/technical_committees/list_of_iso_technical_committees/iso_technical_committee.htm?commid=45072</td></tr>
<tr><td>Scope</td><td colspan="3">Standardization in the field of telecommunications dealing with the exchange of information between open systems including system functions, procedures, parameters as well as the conditions for their use. The standardization encompasses protocols and services of lower layers including physical, data link, network, and transport as well as those of upper layers including but not limited to Directory and ASN.1. Future Network has recently been added as an important work scope. A considerable part of the work is done in effective cooperation with ITU-T and other standardization bodies including IEEE 802 and Ecma International.</td></tr>
<tr><td>Structure</td><td colspan="3">JTC 1/SC 6/WG 1 Physical and data link layers
JTC 1/SC 6/WG 7 Network, transport and future network
JTC 1/SC 6/WG 10 Directory, ASN.1 and Registration</td></tr>
<tr><th colspan="4">Standardization work</th></tr>
<tr><td>Published standards</td><td colspan="3">Number of published ISO/IEC standards under the direct responsibility of JTC 1/SC 6 (number includes updates): 360</td></tr>
<tr><td>Standards under development</td><td colspan="3">22</td></tr>
<tr><th colspan="4">Involvement of Luxembourg</th></tr>
<tr><td colspan="4">NO (no registered delegate)</td></tr>
<tr><th colspan="4">Comments</th></tr>
<tr><td colspan="4">ISO/IEC JTC 1/SC 6 is, amongst other, in charge of the development of the ISO/IEC 29181 series of standards entitled “Future Network -- Problem Statement and Requirements”, that aims to specify problem statement and requirements for the various issues of Future Network such as overall aspects, naming and addressing, switching and routing, mobility, security, media transport, and service composition.

Examples of noteworthy standards developed by ISO/IEC JTC 1/SC 6 are:</td></tr>
</table>

- ISO/IEC 8824 series of standards entitled "Information technology -- Abstract Syntax Notation One (ASN.1)";
- ISO/IEC 9594 series of standards entitled "Information technology -- Open Systems Interconnection -- The Directory";
- ISO/IEC TR 20002:2012, Information technology -- Telecommunications and Information Exchange Between Systems -- Managed P2P: Framework.

7.3.2.ISO/IEC JTC 1/SC 25

General information			
Committee	**ISO/IEC JTC 1/SC 25**	**Title**	**Interconnection of information technology equipment**
Creation date	1987	**MEMBERS** 	**Participating Countries (29):** Germany, Australia, Austria, Belgium, Canada, China, Czech Republic, Denmark, Finland, France, India, Ireland, Israel, Italy, Japan, Kazakhstan, Republic of Korea, Lebanon, Mexico, Netherlands, Norway, Poland, Russian Federation, Singapore, Spain, Sweden, Switzerland, United Kingdom, United States **Observing Countries (18):** Argentina, Bosnia and Herzegovina, Croatia, Cuba, Ghana, Greece, Hong Kong, China, Hungary, Iceland, Indonesia, Kenya, Malaysia, New Zealand, Philippines, Romania, Serbia, Turkey, Ukraine
Secretariat	DIN (Germany)		
Secretary	Mr. Jürgen Tretter		
Chairperson	Mr. Rainer Schmidt		
Organizations in liaison	EC, Ecma International, ITU, UNCTAD, UNECE		
Web site	http://www.iso.org/iso/standards_development/technical_committees/list_of_iso_technical_committees/iso_technical_committee.htm?commid=45270		
Scope	Standardization of microprocessor systems; and of interfaces, protocols, architectures and associated interconnecting media for information technology equipment and networks, generally for commercial and residential environments, to support embedded and distributed computing environments, storage systems, other input/output components, home and building electronic systems including customer premises smart grid applications for electricity, gas, water and heat. NOTE: This scope includes requirements for components, assemblies and subsystems. However, standardization of cables, waveguides and connectors remains within the relevant product technical committees and subcommittees of IEC. The scope includes the development of network interfaces, in liaison with committees for external utility networks, to support smart grid applications at the customer premises.		
Structure	JTC 1/SC 25/TG 1 Project Team: Taxonomy and Terminology (PTTT) JTC 1/SC 25/WG 1 Home electronic systems JTC 1/SC 25/WG 3 Customer premises cabling JTC 1/SC 25/WG 4 Interconnection of computer systems and attached equipment		
Standardization work			
Published standards	Number of published ISO/IEC standards under the direct responsibility of JTC 1/SC 25 (number includes updates): 185		
Standards under development	20		
Involvement of Luxembourg			
NO (no registered delegate)			

Comments

Some standards in development or developed, that are representative of the work of ISO/IEC JTC 1/SC 25 are:

- ISO/IEC 11801 series of standards regarding generic cabling for customer premises;
- ISO/IEC 14165 series of standards concerning Fiber Channel;
- ISO/IEC 30100-2 series of standards on home network resource management.

Standards for Generic cabling, Small Computer System Interface (SCSI), Fiber Channel and Intelligent homes and buildings are at some of the priorities of the subcommittee.

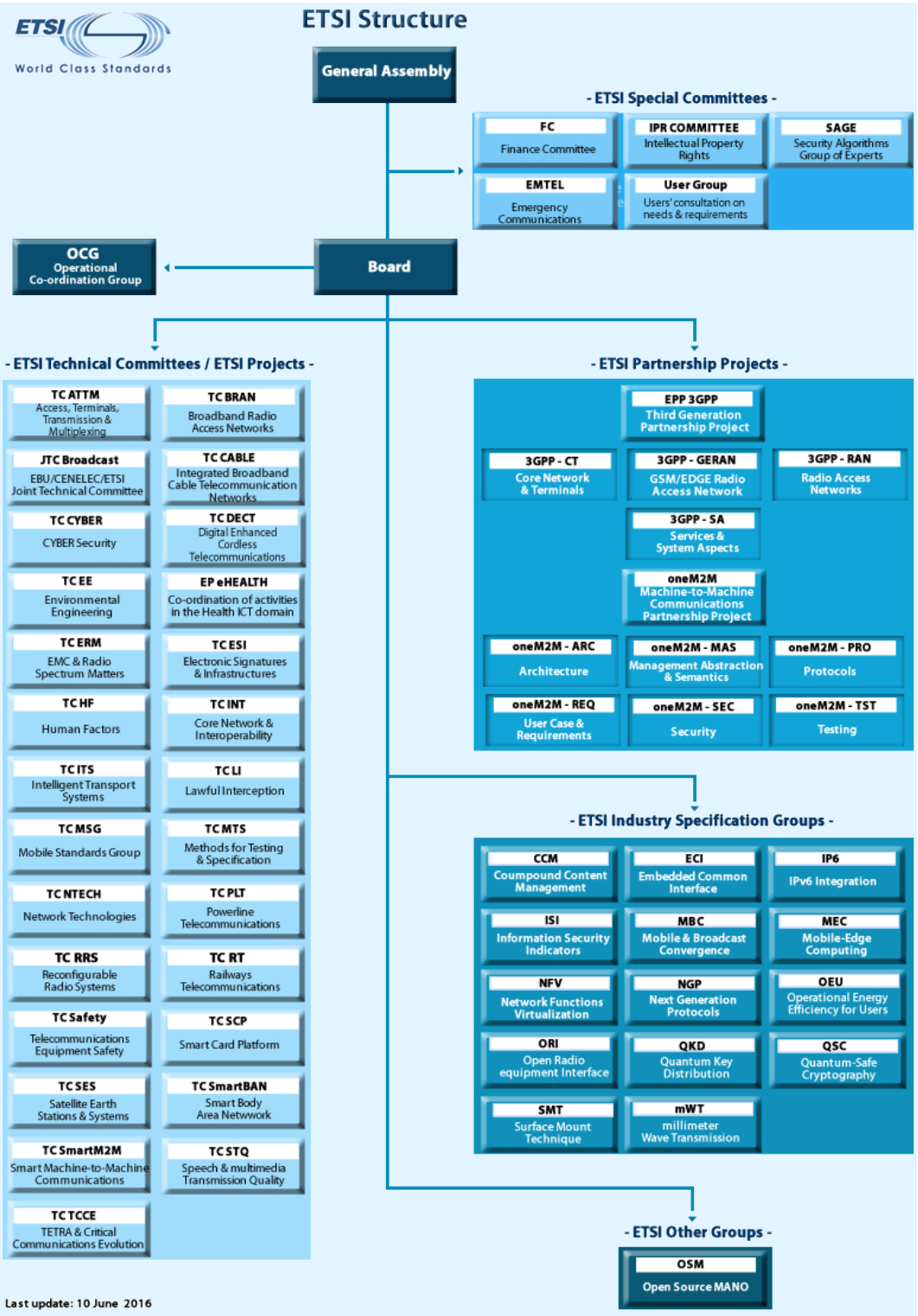
7.3.3. ITU-T - International Telecommunication Union - Telecommunication Standardization Sector

General information			
Organization	**ITU-T**	**Title**	**ITU - Telecommunication Standardization Sector**
Creation date	1865	**MEMBERS** 	193 countries and over 700 private-sector entities and academic institutions
Chairperson	Mr. Chaesub Lee		
Web site	http://www.itu.int/en/ITU-T/Pages/default.aspx		
Scope	The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.		
Structure	**Advisory Group** - Telecommunication Standardization Advisory Group (TSAG) **Study Groups** - SG 2: Operational aspects of service provision and telecommunications management - SG 3: Tariff and accounting principles including related telecommunication economic and policy issues - SG 5: Environment and climate change - SG 9: Television and sound transmission and integrated broadband cable networks - SG 11: Signaling requirements, protocols and test specifications - SG 12: Performance, QoS and QoE - SG 13: Future networks including cloud computing, mobile and next generation networks - SG 15: Networks, Technologies and Infrastructures for Transport, Access and Home - SG 16: Multimedia coding, systems and applications - SG 17: Security - SG 20: IoT and its applications including smart cities and communities (SC&C) **Focus Groups** - Focus Group on IMT-2020 (FG IMT-2020) - Focus Group Digital Financial Services (FG DFS) **Joint Coordination Activities** - Joint Coordination Activity on Software-Defined Networking (JCA-SDN) - Joint Coordination Activity on technical aspects of telecommunication networks to support the Internet (JCA-Res178) - Joint Coordination Activity on Child Online Protection (JCA-COP) - Joint Coordination Activity on Internet of Things and Smart Cities & Communities (JCA-IoT and SC&C) - Joint Coordination Activity on ICT and climate change (JCA-ICT&CC) - Joint Coordination Activity on Accessibility and Human factors (JCA-AHF) - Joint Coordination Activity for Identity Management (JCA-IdM) - Joint Coordination Activity on IPTV (JCA-IPTV) - Joint Coordination Activity on Conformance and Interoperability Testing (JCA-CIT)		

	Global Standards Initiative - Internet of Things Global Standards Initiative (IoT-GSI) - IPTV Global Standards Initiative (IPTV-GSI) **Committees** - Standardization Committee for Vocabulary
Standardization work	
Published standards	Over 4000 ITU-T Recommendations
Standards under development	/
Involvement of Luxembourg	
3 members - *Service des medias et des Communications* - *Institut Luxembourgeois de Régulation* (ILR) - POST Luxembourg	
Comments	
The main products of ITU-T are normative Recommendations, which are standards that define how telecommunication networks operate and interwork. ITU-T Recommendations are non-binding, however they are generally complied with due to their high quality and because they guarantee the interconnectivity of networks and enable telecommunication services to be provided on a worldwide scale.	

7.3.4. ETSI – European Telecommunications Standards Institute

General information			
Organization	**ETSI**	**Title**	**European Telecommunications Standards Institute**
Creation date	1988	**MEMBERS**	More than 800 ETSI member organizations drawn from 64 countries across 5 continents worldwide
Chairperson	Mr. Luis Jorge Romero		
Web site	http://www.etsi.org/website/homepage.aspx		
Scope	ETSI is a producer of globally applicable standards for Information and Communications Technologies (ICT), including fixed, mobile, radio, converged, broadcast and Internet technologies. The high quality of our work and our open approach to standardization has seen our influence extend from our European roots to impact the world. ETSI is officially recognized by the European Union as a European Standards Organization. Our activities are driven by time to market and our standards help ensure the free movement of goods within the single European market, allowing enterprises in the EU to be more competitive. ETSI is a not-for-profit organization with more than 800 member organizations worldwide, drawn from 64 countries and five continents. Members include some of the world's leading companies and national administrations working alongside R&D organizations, smaller businesses and innovative start-ups. ETSI is at the forefront of emerging technologies. We are building close relationships with research bodies and addressing the technical issues that will drive the economy of the future and improve life for the next generation. ETSI is a world-renowned organization with a solid reputation for technical excellence. We make our expertise available to our members and customers through a range of services for growing ideas and enabling technology.		

Structure	
Standardization work	
Published standards	More than 32000 standards and reports
Standards under development	More than 1100

Involvement of Luxembourg

9 members

- ILNAS
- ANEC GIE
- eWitness
- FBConsulting
- Interdisciplinary Centre for Security, Reliability and Trust (SnT)
- Luxtrust
- POST Telecom
- SES S.A
- Skylane Optics

Comments

High quality and low time-to-market are ETSI's constant aims and it continually strives to collaborate with research bodies. ETSI is active in vital complementary areas such as interoperability and offers event services related to standardization including forum hosting.

The international reputation of ETSI is built on openness, discussion, consensus, and direct input from their members. ETSI is officially recognized by the European Union as a European Standardization Organization. The quality of its work and its open approach to standardization has helped it to evolve into a European roots - global branches operation with a good reputation for technical excellence. The following ETSI standards are used in Luxembourg by ILNAS to supervise/accredit Certification Service Providers:

- ETSI TS 102 042 "Policy requirements for certification authorities issuing public key certificates";
- ETSI TS 102 023 "Policy requirements for time-stamping authorities";
- ETSI EN 319 401 "General Policy Requirements for Trust Service Providers";
- ETSI EN 319 403 "Trust Service Provider Conformity Assessment - Requirements for conformity assessment bodies assessing Trust Service Providers";
- ETSI EN 319 411-1 "Policy and security requirements for Trust Service Providers issuing certificates; Part 1: General requirements";
- ETSI EN 319 411-2 "Policy and security requirements for Trust Service Providers issuing certificates; Part 2: Requirements for trust service providers issuing EU qualified certificates";
- ETSI EN 319 411-3 "Policy and security requirements for Trust Service Providers issuing certificates; Part 3: Policy Requirements for Certification Authorities issuing public key certificates".

7.3.5.ETSI/TC SES

General information			
Committee	**SES**	**Title**	**Satellite and Earth Stations & Systems**
Creation date	/	**MEMBERS** 	/
Chairperson	Mr. Jean-Jacques Bloch		
Organizations in liaison	CEN, CENELEC, CEPT, CIRM, EMSA, ERA, ERTICO, ITU, TIA		
Web site	https://portal.etsi.org/ses		
Scope	Responsible for all aspects related to satellite earth stations and systems. The field includes: - All types of satellite communication systems, services and applications including fixed, mobile and broadcasting - Satellite navigation systems and services - All types of earth stations and earth station equipment, especially the radio frequency interfaces and network and/or user interfaces - Protocols implemented in earth stations and satellite systems Primary Committee for coordinating the position of ETSI with relevant ITU Study Groups.		
Structure	SES HARM Harmonization under the R&TTE Directive (99/5/EC) SES MAR ESV Maritime and Railways Satellite Earth stations on Board Vessels & Train SES SatEC Satellite Emergency Communication SES SCN Satellite Communication and Navigation		
Standardization work			
Published standards	501		
Standards under development	44		
Involvement of Luxembourg			
2 members - SES S.A. - Interdisciplinary Centre for Security, Reliability and Trust (SnT)			
Comments			
/			

7.3.6.ETSI/TC ERM

General information			
Committee	**ERM**	**Title**	**Electromagnetic compatibility & Radio spectrum Matters**
Creation date	2005	**MEMBERS** 	/
Chairperson	Mr. Holger Butscheidt		
Organizations in liaison	ADCO R&TTE, CCSA, CEN, CENELEC, CEPT, Continua Health Alliance, DMR Association, EASA, ECC, Ecma Intl, ERA, ERTICO, ESMIG, EUROCAE, GIFSI, IEC, IEEE, ISO/IEC JTC1, ITU, TIA, TSDSI		
Web site	https://portal.etsi.org/erm		
Scope	All TC-ERM activities have a common theme of electromagnetic and/or radio spectrum compatibility. - Studies of the EMC and radio parameters and their methods of measurement - taking due account of the work in the international community and specifically IEC; - Preparation of ETSI deliverables as required by ETSI members or those to support mandated work from the EC/EFTA in support of EU Directives or as requested by CEPT ECC; - Preparation of ETSI deliverables including harmonized standards used to describe the electromagnetic and/or radio environment; - Co-ordination of ETSI positions on the efficient use of the radio spectrum and spectrum allocations and the administration of the MoU between CEPT ECC and ETSI. These activities will be carried out in close cooperation with relevant ETSI Technical Bodies; - TC-ERM (EMC and Radio Spectrum Matters) also provides ETSI with a center of technical expertise in the radio and EMC fields, able to offer advice to ETSI Technical Bodies, the ETSI Board, and the ETSI General Assembly.		
Structure	ERM TG11	Wideband data systems	
	ERM TG17	Standards for Broadcast and Ancillary Communications Equipment	
	ERM TG26	Maritime and Radio Amateur activities	
	ERM TG28	Generic Short Range Devices	
	ERM TG30	Medical Devices	
	ERM TG34	Radio Frequency Identification Devices (RFID)	
	ERM TG37	Intelligent Transport Systems (EMC & Radio Spectrum Matters)	
	ERM TG41	Wireless Industrial Applications	
	ERM WGEMC	Working Group Electromagnetic Compatibility	
	ERM WGRM	Working Group Radio Matters	
	ERM TG AERO	Aeronautical	
	ERM JTFER	TC ERM / TC RRS Joint Task Force	
	ERM TFES	Task Force for ERM and MSG for Harmonised Standards for IMT-2000	
	ERM TGDMR	Digital Mobile Radio	
	ERM TGSRR	Automotive and Surveillance Radar	
	ERM TGUWB	Ultra Wide Band	
	ERM JWG CLC 210	Joint Working Group between CLC/TC 210 and ETSI/TC ERM	

Standardization work	
Published standards	888
Standards under development	167
Involvement of Luxembourg	
/	
Comments	
/	

7.3.7.CEN/TC Project Committee 365

General information			
Committee	**CEN/TC Project Committee 365**	**Title**	**Internet Filtering**
Creation date	2007	**MEMBERS** 	33 members of CEN/CENELEC
Secretariat	AENOR (Spain)		
Secretary	Ms. P. Garcia Lopez		
Chairperson	/		
Organizations in liaison	/		
Web site	http://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP_ORG_ID:625771&cs=1F652BC44F0DDC3A32C5C992CAE9778AF		
Scope	Standardization in the area of 'Internet Filtering' with the objective to define a set of standards in the form of a European Technical Specification that will give internet users more confidence in choosing a suitable filtering product or service.		
Structure	/		
Standardization work			
Published standards	1		
Standards under development	0		
Involvement of Luxembourg			
NO (no registered delegate)			
Comments			
CEN/PC 365 has published the Technical Specification CEN/TS 16080:2013 to define a set of criteria on how Web filters shall perform and shall give Internet users more confidence in choosing a suitable product or service in order to help protecting children online.			

7.4. SOFTWARE AND SYSTEM ENGINEERING

According to ISO/IEC 2382-1:1993 concerning Fundamental terms in ICT, software engineering is defined as "the systematic application of scientific and technological knowledge, methods, and experience to the design, implementation, testing, and documentation of software"[106].

The International Standard ISO 16404:2013 defined system engineering as an "interdisciplinary approach and means to enable the realization of successful systems, starting with the definition of customer needs, the identification of product functionality, and the intended validation very early in the lifecycle"[107].

Software and system engineering is thus a broad subsector encompassing fundamental activities such as requirements engineering, design, coding, integration, installation, and management of an information system.

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[106] *ISO/IEC 2382-1, Information technology -- Vocabulary -- Part 1: Fundamental terms (developed by ISO/IEC JTC 1)*

[107] *ISO 16404:2013, Space systems -- Programme management -- Requirements management (developed by ISO/TC 20/SC 14)*

7.4.1.ISO/IEC JTC 1/SC 7

General information			
Committee	**ISO/IEC JTC 1/SC 7**	**Title**	**Software and systems engineering**
Creation date	1987	**MEMBERS** 	**Participating Countries (39):** Canada, Argentina, Australia, Belgium, Brazil, China, Costa Rica, Czech Republic, Denmark, Finland, France, Germany, India, Ireland, Israel, Italy, Japan, Kazakhstan, Republic of Korea, **Luxembourg,** Malaysia, Mexico, Netherlands, New Zealand, Peru, Poland, Portugal, Romania, Russian Federation, Slovakia, South Africa, Spain, Sweden, Switzerland, Thailand, Ukraine, United Kingdom, United States, Uruguay **Observing Countries (20):** Austria, Bosnia and Herzegovina, Chile, Colombia, Cuba, Cyprus, Estonia, Ghana, Hong Kong, Hungary, Iceland, Indonesia, Islamic Republic of Iran, Kenya, Morocco, Norway, Philippines, Serbia, The former Yugoslav Republic of Macedonia, Turkey
Secretariat	SCC (Canada)		
Secretary	Dr. Witold Suryn		
Chairperson	Mr. François Coallier		
Organizations in liaison	AES, Ecma International, IEEE, INCOSE, ISACA, ITU, PMI, WMO, itSMF, TCG, ESI software, IAITAM, LEADing Practice, The SPICE User Group, TMMi, BSA, ETSI		
Web site	http://www.iso.org/iso/standards_development/technical_committees/list_of_iso_technical_committees/iso_technical_committee.htm?commid=45086		
Scope	Standardization of processes, supporting tools and supporting technologies for the engineering of software products and systems. Note: The processes, tools and technologies are within the scope of JTC 1 terms of references and exclude specific tools and technologies that have been assigned by JTC 1 to other of its SC's.		
Structure	JTC 1/SC 7/STTF — Spanish Translation Task Force JTC 1/SC 7/AG 1 — Life Cycle Processes Harmonization Advisory Group (LCPHAG) JTC 1/SC 7/SWG 1 — JTC 1/SC7 Business Planning Group (BPG) JTC 1/SC 7/SWG 5 — Standards management group JTC 1/SC 7/SWG 22 — Vocabulary validation JTC 1/SC 7/WG 2 — System software documentation JTC 1/SC 7/WG 4 — Tools and environment JTC 1/SC 7/WG 6 — Software Product and System Quality JTC 1/SC 7/WG 7 — Life cycle management JTC 1/SC 7/WG 10 — Process assessment JTC 1/SC 7/WG 19 — Techniques for Specifying IT Systems JTC 1/SC 7/WG 20 — Software and systems bodies of knowledge and professionalization JTC 1/SC 7/WG 21 — Information technology asset management JTC 1/SC 7/WG 24 — SLC Profile and guidelines for VSE JTC 1/SC 7/WG 26 — Software testing JTC 1/SC 7/WG 28 — Joint between ISO/IEC JTC 1/SC 7 and ISO/TC 159/SC 4: Common Industry Formats for Usability Reports JTC 1/SC 7/WG 42 — Architecture		

Standardization work	
Published standards	Number of published ISO/IEC standards under the direct responsibility of JTC 1/SC 7 (number includes updates): 166
Standards under development	30

Involvement of Luxembourg

7 delegates

- Mr. Alain Renault (Chairman)	Luxembourg Institute of Science and Technology (LIST)
- Mrs. Béatrix Barafort (Vice-Chairwoman)	LIST
- Mr. Stéphane Cortina	LIST
- Mr. Michel Picard	LIST
- Mr. Christophe Feltus	LIST
- Mrs. Jeanette Ewen	EWEN Consult S.à.r.l.
- Mr. Dietmar Gehring	UBS Fund Services Luxembourg S.A.

Comments

Some of the main standards published by the subcommittee are:

- ISO/IEC/IEEE 15288:2015, Systems and software engineering -- System life cycle processes;
- ISO/IEC 19759:2015, Software Engineering -- Guide to the Software Engineering Body of Knowledge (SWEBOK);
- ISO/IEC 20000-1:2011, Information technology -- Service management -- Part 1: Service management system requirements;
- ISO/IEC 15504 series of standards concerning Process assessment (7 parts);
- ISO/IEC 12207:2008, Systems and software engineering -- Software life cycle processes;
- ISO/IEC 38500:2008, Corporate governance of information technology;
- ISO/IEC 25000 series of standards concerning Software Product Quality Requirements and Evaluation (also known as the SQuaRE series);
- ISO/IEC/IEEE 29119 parts 1, 2 and 3:2013, Systems and software engineering -- Software Testing (part 5 is under development).

It is important to note that ISO/IEC 20000 and ISO/IEC 38500 series of standards are under the responsibility of the subcommittee ISO/IEC JTC 1/SC 40 since the 2013 JTC 1 Plenary Meeting. Indeed, SC 40 has been formed through a merger of working groups previously attached to SC 7 and JTC 1. Moreover the ISO/IEC 15504 series of standards is following a major revision and will be derived in the ISO/IEC 33000 series.

7.4.2.ISO/IEC JTC 1/SC 22

General information			
Committee	**ISO/IEC JTC 1/SC 22**	**Title**	**Programming languages, their environments and system software interfaces**
Creation date	1985	**MEMBERS** 	**Participating Countries (20):** United States, Austria, Canada, China, Denmark, Finland, France, Germany, Italy, Japan, Kazakhstan, Republic of Korea, Netherlands, Portugal, Russian Federation, Slovenia, Spain, Switzerland, Ukraine, United Kingdom **Observing Countries (24):** Argentina, Belgium, Bosnia and Herzegovina, Bulgaria, Cuba, Czech Republic, Egypt, Ghana, Greece, Hungary, Iceland, India, Indonesia, Islamic Republic of Iran, Ireland, Democratic People's Republic Korea, Malaysia, New Zealand, Norway, Poland, Romania, Serbia, Sweden, Thailand
Secretariat	ANSI (United States)		
Secretary	Ms. Sally Seitz		
Chairperson	Mr. Rex Jaeschke		
Organizations in liaison	Ecma International, Linux Foundation, ACM SIGAda, Ada-Europe, MISRA		
Web site	http://www.iso.org/iso/standards_development/technical_committees/list_of_iso_technical_committees/iso_technical_committee.htm?commid=45202		
Scope	Standardization of programming languages (such as COBOL, Fortran, Ada, C, C++ and Prolog) and their environments (such as POSIX and Linux). SC 22 also produces common language-independent specifications to facilitate standardized bindings between programming languages and system services, as well as greater interaction between programs written in different languages. The most recently created WG has a project to document the vulnerabilities of various programming languages. Program portability between different implementations of the same language is a key goal.		
Structure	JTC 1/SC 22/WG 4 COBOL JTC 1/SC 22/WG 5 Fortran JTC 1/SC 22/WG 9 Ada JTC 1/SC 22/WG 14 C JTC 1/SC 22/WG 17 Prolog JTC 1/SC 22/WG 21 C++ JTC 1/SC 22/WG 23 Programming Language Vulnerabilities		
Standardization work			
Published standards	Number of published ISO/IEC standards under the direct responsibility of JTC 1/SC 22 (number includes updates): 107		
Standards under development	17		
Involvement of Luxembourg			
NO (no registered delegate)			

Comments

ISO/IEC JTC 1/SC 22 is responsible for the standardization of programming languages, their environments and systems software interfaces (specialized languages or environments assigned to the work program of another Subcommittee or Technical Committee are excluded).

The SC is currently working on the development of extensions for the programming language C++. It has also initiated the development of a series of standards that will offer guidance to avoid vulnerabilities in programming languages.

Examples of programming languages standardized through ISO/IEC JTC 1/SC 22 are:

- PLIP
- Pascal
- APL
- COBOL
- Fortran
- ALGOL
- PL/I
- Basic
- Ada
- C
- POSIX
- ISLisp
- Prolog
- FIMS
- C++
- PCTE
- Ruby
- C#

7.4.3.ISO/IEC JTC 1/SC 29

General information			
Committee	**ISO/IEC JTC 1/SC 29**	**Title**	**Coding of audio, picture, multimedia and hypermedia information**
Creation date	1991	**MEMBERS** 	**Participating Countries (27):** Japan, Australia, Austria, Belgium, Canada, China, Finland, France, Germany, Greece, Hungary, India, Israel, Italy, Japan, Republic of Korea, Lebanon, Netherlands, Poland, Portugal, Russian Federation, Singapore, Spain, Sweden, Switzerland, Ukraine, United Kingdom, United States **Observing Countries (16):** Argentina, Bosnia and Herzegovina, Czech Republic, Denmark, Hong Kong, Indonesia, Islamic Republic of Iran, Ireland, Malaysia, Morocco, Norway, Romania, Serbia, Slovakia, South Africa, Turkey
Secretariat	JISC (Japan)		
Secretary	Mr. Shinji Watanabe		
Chairperson	Mr. Kohtaro Asai		
Organizations in liaison	3GPP, AES, AGICOA, ATSC, CIE, CISAC, ETSI, FIAPF, IMTC, ISOC, ITU, MMA, SMPTE, WIPO, NATO, VSF, OMA, VESA, Ecma International, I3A, ABU, ISMA, IPTC, Entertainment Content Ecosystem, OPF, W3C, IDF, J2G, CEA, CCSDS, VirF, OIPF, CableLabs, AVS, DVB, NISO, QUALINET, Wireless Gigabit Alliance, OMG, EBU, OGC, Khronos, IFPI, ATIS, AFPC, DCMI, IEEE, BDA, DICOM, DMP, Digital TV Group		
Web site	http://www.iso.org/iso/standards_development/technical_committees/list_of_iso_technical_committees/iso_technical_committee.htm?commid=45316		
Scope	Standardization of coded representation of audio, picture, multimedia, and hypermedia information - and sets of compression and control functions for use with such information - such as: - Audio information; - Bi-level and Limited Bits-per-pixel Still Pictures; - Digital Continuous-tone Still Pictures; - Computer Graphic Images; - Moving Pictures and Associated Audio; - Multimedia and Hypermedia Information for Real-time Final Form Interchange; - Audio Visual Interactive Script ware. Excluded: Character Coding.		
Structure	JTC 1/SC 29/AG 1 Advisory Group on Management JTC 1/SC 29/WG 1 Coding of still pictures JTC 1/SC 29/WG 11 Coding of moving pictures and audio		
Standardization work			
Published standards	Number of published ISO/IEC standards under the direct responsibility of JTC 1/SC 29 (number includes updates): 563		
Standards under development	111		

Involvement of Luxembourg
NO (no registered delegate)
Comments

Coding of audio, picture, multimedia and hypermedia information provides efficient way to represent, preserve and convey entertainment, art, news, education, record of experiences and so on. People can enjoy any kind of media anywhere they want, employing handheld devices equipped with wireless capabilities. This does not mean just consuming media but generating media as well.

The coding technologies have a significant role in any service and activity employing digital media information. SC 29 has been working to standardize coding of multimedia and their control function, interface with other elements, middleware for general and/or specific applications. Many international standards from SC 29 have been adopted and used, and those standards have been contributing to the industry.

There are still emerging needs for digital media representation with higher quality or advanced features such as Ultra HD with scalability in some applications, 3D and free viewpoint video with rich media interface. Moreover, the industry keeps improving methods for compression, composition, description and manipulation of digital media. This, and pervasiveness of digital information, is offering a lot of opportunities for the industry.

Examples of success standards developed by ISO/IEC JTC 1/SC 29 are:

- ISO/IEC 10918-1:1994, Information technology -- Digital compression and coding of continuous-tone still images: Requirements and guidelines;
- ISO/IEC 10918-5:2013, Information technology -- Digital compression and coding of continuous-tone still images: JPEG File Interchange Format (JFIF);
- ISO/IEC 11172:1993, Information technology -- Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s -- Parts 1 to 3;
- ISO/IEC 15444-1:2004, Information technology -- JPEG 2000 image coding system: Core coding system;
- ISO/IEC 23001 series of standards concerning MPEG systems technologies.

7.5. SECURITY

Information security includes three main dimensions: confidentiality, availability and integrity. In addition, other properties, such as authenticity, accountability, non-repudiation, and reliability can also be involved. Information security involves the application and management of appropriate security measures that involves consideration of a wide range of threats, with the aim of ensuring sustained business success and continuity, and minimizing the impacts of information security incidents:

- *Confidentiality is the property that information is not made available or disclosed to unauthorized individuals, entities or processes;*
- *Integrity is the property of safeguarding the accuracy and completeness of assets. Accuracy could be threatened by (unauthorized or undesirable) fault, update or tampering. Completeness could be threatened by fault, altering or deletion;*
- *Availability is the property of being accessible and usable upon demand by an authorized entity[108].*

This subsector deals thus with a large scope of standards at the hardware, software, network or management level.

[108] *Based on ISO/IEC 27000:2016, Information technology -- Security techniques -- Information security management systems -- Overview and vocabulary (developed by ISO/IEC JTC 1/SC 27)*

7.5.1.ISO/IEC JTC 1/SC 27

<table>
<tr><th colspan="4">General information</th></tr>
<tr><td>Committee</td><td>ISO/IEC JTC 1/SC 27</td><td>Title</td><td>IT Security techniques</td></tr>
<tr><td>Creation date</td><td>1990</td><td rowspan="5">MEMBERS
  </td><td rowspan="5">Participating Countries (52):
Germany, Algeria, Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, China, Cyprus, Czech Republic, Côte d'Ivoire, Denmark, Finland, France, India, Ireland, Israel, Italy, Japan, Kazakhstan, Kenya, Republic of Korea, Lebanon, Luxembourg, Malaysia, Mauritius, Mexico, Netherlands, New Zealand, Norway, Panama, Peru, Poland, Portugal, Romania, Russian Federation, Rwanda, Singapore, Slovakia, South Africa, Spain, Sri Lanka, Sweden, Switzerland, The Former Yugoslav Republic of Macedonia, Ukraine, United Arab Emirates, United Kingdom, United States, Uruguay

Observing Countries (21):
Belarus, Bosnia and Herzegovina, Costa Rica, El Salvador, Estonia, Ghana, Hong Kong, Hungary, Iceland, Indonesia, Islamic Republic of Iran, Lithuania, Morocco, State of Palestine, Portugal, Saudi Arabia, Serbia, Slovenia, Swaziland, Thailand, Turkey</td></tr>
<tr><td>Secretariat</td><td>DIN (Germany)</td></tr>
<tr><td>Secretary</td><td>Ms. Krystyna Passia</td></tr>
<tr><td>Chairperson</td><td>Dr. Walter Fumy</td></tr>
<tr><td>Organizations in liaison</td><td>(ISC)2, CCETT, Cloud security alliance, ECBS, ENISA, EPC, ETSI, Ecma International, IEEE, ISACA, ISSEA, ITU, MasterCard International, MasterCard Europe, CCBD, TCG, Opengroup UK, ISA, ABC4Trust, CSCC, TMForum, INLAC, TAS3, PRACTICE, ISF, FIRST, OIDF, , PQCCRYPTO, ISCI, Kantara Initiative, EuroCloud, PRIPARE, PICOS, Article 29 Data Protection Working Party, Interpol, ETSI, EUDCA, TREsPASS</td></tr>
<tr><td>Web site</td><td colspan="3">http://www.iso.org/iso/standards_development/technical_committees/list_of_iso_technical_committees/iso_technical_committee.htm?commid=45306</td></tr>
<tr><td>Scope</td><td colspan="3">The development of standards for the protection of information and ICT. This includes generic methods, techniques and guidelines to address both security and privacy aspects, such as:
- Security requirements capture methodology;
- Management of information and ICT security; in particular, information security management systems (ISMS), security processes, security controls and services;
- Cryptographic and other security mechanisms, including but not limited to mechanisms for protecting the accountability, availability, integrity and confidentiality of information;
- Security management support documentation including terminology, guidelines as well as procedures for the registration of security components;
- Security aspects of identity management, biometrics and privacy;
- Conformance assessment, accreditation and auditing requirements in the area of information security;
- Security evaluation criteria and methodology.

SC 27 engages in active liaison and collaboration with appropriate bodies to ensure the proper development and application of SC 27 standards and technical reports in relevant areas.</td></tr>
</table>

Structure	JTC 1/SC 27/SWG-M	Special Working Group on Management
	JTC 1/SC 27/SWG-T	Transversal Items
	JTC 1/SC 27/WG 1	Information security management systems
	JTC 1/SC 27/WG 2	Cryptography and security mechanisms
	JTC 1/SC 27/WG 3	Security evaluation testing and specification
	JTC 1/SC 27/WG 4	Security controls and services
	JTC 1/SC 27/WG 5	Identity management and privacy technologies

Standardization work	
Published standards	Number of published ISO/IEC standards under the direct responsibility of JTC 1/SC 27 (number includes updates): 153
Standards under development	74

Involvement of Luxembourg

24 delegates

- Mr. Benoit Poletti (Chairman)	INCERT GIE
- Mr. Cédric Mauny (Vice-Chairman)	Telindus Luxembourg S.A.
- Mr. Carlo Harpes (Vice-Chairman)	itrust consulting S.à.r.l.
- Mr. Tom Leclerc	Telindus Luxembourg S.A.
- Mr. Peter Schaffer	Ernst & Young Business Advisory Services S.à.r.l.
- Mr. Guillaume Bentag	Ernst & Young Business Advisory Services S.à.r.l.
- Mr. Olivier Montee	Cours@home Luxembourg S.à.r.l.
- Mr. Stéphane Cortina	Luxembourg Institute of Science and Technology (LIST)
- Mr. Hervé Cholez	LIST
- Mr. Nicolas Mayer	LIST
- Mr. René Saint-Germain	ALTIRIAN S.A.
- Mr. Sébastien Poggi	Victor Buck Services S.A.
- Mr. Alex Mckinnon	itrust consulting S.à.r.l.
- Mr. Matthieu Aubigny	itrust consulting S.à.r.l.
- Mrs. Shenglan Hu	POST Telecom PSF S.A.
- Mrs. Myriam Djerouni	Banque de Luxembourg S.A.
- Mr. Qiang Tang	University of Luxembourg
- Mrs. Emelyne Baudrier	Luxembourg Conseil S.à.r.l.
- Mr. David Naramski	NOWINA SOLUTIONS S.à.r.l.
- Mrs. Mélanie Gagnon	MGSI S.à.r.l.
- Mr. Serge Raucq	Vectif ACF S.A.
- Mr. Clement Gorlt	INCERT GIE
- Mr. Enrico Ozzano	BIL S.A.
- Mr. Nicolas Domenjoud	ANEC GIE

Comments

SC 27 is an internationally recognized center of information and IT security standards expertise serving the needs of business sectors as well as governments. Its work covers the development of standards for the protection of information and ICT.

Working Groups

The scope of the **WG 1** covers all aspects of standardization related to information security management systems: requirements, methods and processes, security controls, sector and application specific use of ISMS, governance, information security economics and accreditation, certification and auditing of ISMS.

The scope of the **WG 2** covers both cryptographic and non-cryptographic techniques and mechanisms including

confidentiality, entity authentication, non-repudiation, key management and data integrity (e.g.: message authentication, hash-functions, digital signatures, etc.).

The scope of the **WG 3** covers aspects related to security engineering, with particular emphasis on, but not limited to standards for IT security specification, evaluation, testing and certification of IT systems, components, and products. The following aspects may be distinguished: security evaluation criteria, methodology for application of the criteria, security functional and assurance specification of IT systems, components and products, testing methodology for determination of security functional and assurance conformance, accreditation schemes, administrative procedures for testing, evaluation and certification.

The **WG 4** is developing and maintaining International Standards, Technical Specifications and Technical Reports for information security in the area of Security Controls and Services, to assist organizations in the implementation of the ISO/IEC 27000-series of ISMS International Standards and Technical Reports. Also the Scope of WG 4 includes evaluating and developing International Standards for addressing existing and emerging information security issues and needs and other security aspects that resulted from the proliferation and use of ICT and Internet related technology in organizations (such as multinationals corporations, SMEs, government departments, and non-profit organizations).

Finally, **WG 5** is responsible of the development and maintenance of standards and guidelines addressing security aspects of identity management, biometrics and privacy.

Standards

The best-known standard developed by SC 27 are ISO/IEC 27001:2013, Information technology -- Security techniques -- Information security management systems -- Requirements and ISO/IEC 27002:2013, Information technology -- Security techniques -- Code of practice for information security controls. Organizations setting up an ISMS certified compliant with ISO/IEC 27001 are increasingly numerous[109].

It is important to note that the committee works in liaison with many other JTC 1/SCs on the development of standards related to security for specific subsectors. For example, SC 27 has published International Standard related to the security for Cloud Computing and a new one regarding security and privacy aspects in cloud SLAs is under development (in liaison with ISO/IEC JTC 1/SC 38):

- ISO/IEC 27018:2014, Information technology -- Security techniques -- Code of practice for protection of personally identifiable information (PII) in public clouds acting as PII processors;
- ISO/IEC 27017:2015, Information technology -- Security techniques -- Code of practice for information security controls based on ISO/IEC 27002 for cloud services;
- ISO/IEC NP 19086-4, Information technology -- Cloud computing -- Service level agreement (SLA) framework and technology -- Part 4: Security and privacy.

[109] Source: ISO survey 2014

7.5.2.ISO/IEC JTC 1/SC 37

General information			
Committee	**ISO/IEC JTC 1/SC 37**	**Title**	**Biometrics**
Creation date	2002	**MEMBERS** 	**Participating Countries (29):** United States, Australia, Canada, China, Czech Republic, Denmark, Egypt, Finland, France, Germany, India, Israel, Italy, Japan, Republic of Korea, Malaysia, Netherlands, New Zealand, Norway, Poland, Portugal, Russian Federation, Singapore, South Africa, Spain, Sweden, Switzerland, Ukraine, United Kingdom **Observing Countries (13):** Austria, Belgium, Bosnia and Herzegovina, Ghana, Hungary, Indonesia, Islamic Republic of Iran, Ireland, Kenya, Romania, Serbia, Thailand, Turkey
Secretariat	ANSI (United States)		
Secretary	Ms. Michaella Miller		
Chairperson	Mr. Fernando Podio		
Organizations in liaison	IBIA, ILO, ITU, OASIS, VoiceXML, FRONTEX		
Web site	http://www.iso.org/iso/standards_development/technical_committees/list_of_iso_technical_committees/iso_technical_committee.htm?commid=313770		
Scope	Standardization of generic biometric technologies pertaining to human beings to support interoperability and data interchange among applications and systems. Generic human biometric standards include: common file frameworks; biometric application programming interfaces; biometric data interchange formats; related biometric profiles; application of evaluation criteria to biometric technologies; methodologies for performance testing and reporting and cross jurisdictional and societal aspects. Excluded is the work in ISO/IEC JTC 1/SC 17 to apply biometric technologies to cards and personal identification. Excluded is the work in ISO/IEC JTC 1/SC 27 for biometric data protections techniques, biometric security testing, evaluations, and evaluations methodologies.		
Structure	JTC 1/SC 37/WG 1 Harmonized biometric vocabulary JTC 1/SC 37/WG 2 Biometric technical interfaces JTC 1/SC 37/WG 3 Biometric data interchange formats JTC 1/SC 37/WG 4 Technical Implementation of Biometric Systems JTC 1/SC 37/WG 5 Biometric testing and reporting JTC 1/SC 37/WG 6 Cross-Jurisdictional and Societal Aspects of Biometrics		
Standardization work			
Published standards	Number of published ISO/IEC standards under the direct responsibility of JTC 1/SC 37 (number includes updates): 122		
Standards under development	23		
Involvement of Luxembourg			
NO (no registered delegate)			

Comments

The goal of ISO/IEC JTC 1/SC 37 is to ensure a high priority, focused, and comprehensive approach worldwide for the rapid development and approval of formal international biometric standards. These standards are necessary to support the rapid deployment of significantly better, open systems standard-based security solutions for purposes such as homeland defense and the prevention of ID theft.

Biometrics provide for secure transactions, positive identification and better informed human judgment. The deployment of standards-based, high-performance, interoperable biometric solutions is expected to increase levels of security for critical infrastructures that have not, until now, been properly served by other technologies. ISO/IEC JTC 1/SC 37, Biometrics, is responsible for the development of a large portfolio of biometric standards in support of interoperability and data interchange. These standards support a diverse range of systems and applications designed to provide the reliable verification and identification of individuals.

Topics addressed by these standards include biometric data interchange formats for a number of biometric modalities (e.g. finger, face, iris, signature/sign, vascular data), biometric technical interface standards (e.g. APIs), biometric performance and conformance testing methodology standards, biometric application profiles, biometric sample quality standards, and standards in support of cross-jurisdictional issues related to the utilization of biometric technologies in commercial applications. Moreover, a harmonized biometric vocabulary (ISO/IEC 2982-37:2012) that will serve the standards community as well as other customers has been published in 2012 and is currently under revision.

The current work program of ISO/IEC JTC 1/SC 37 includes for example:

- The ISO/IEC 24779 series of standards, which define pictograms, icons and symbols for use with biometric systems;
- The ISO/IEC 30137 series of standards concerning the use of biometrics in video surveillance systems.

7.5.3.ETSI/TC CYBER

General information			
Committee	**CYBER**	**Title**	**Cyber Security**
Creation date	2014	**MEMBERS** 	/
Chairperson	Mr. Charles Brookson		
Organizations in liaison	CEN, CENELEC, ENISA, GIFSI, ISO/IEC JTC 1, TCG		
Web site	https://portal.etsi.org/cyber		
Scope	The activities of ETSI TC CYBER include the following broad areas: - Cyber Security - Security of infrastructures, devices, services and protocols - Security advice, guidance and operational security requirements to users, manufacturers and network and infrastructure operators - Security tools and techniques to ensure security - Creation of security specifications and alignment with work done in other TCs.		
Structure	/		
Standardization work			
Published standards	4		
Standards under development	12		
Involvement of Luxembourg			
/			
Comments			

ETSI TC CYBER has published seven technical report and technical specifications since its creation in 2014, including:

- ETSI TR 103 305, CYBER; Critical Security Controls for Effective Cyber Defence. It describes a specific set of technical measures available to detect, prevent, respond, and mitigate damage from the most common to the most advanced of cyber-attacks developed and maintained by the Council of Cybersecurity. The measures reflect the combined knowledge of actual attacks and effective defences.
- ETSI TR 103 306, CYBER; Global Cyber Security Ecosystem. This Technical Report provides a structured overview of cyber security work occurring in multiple other technical forums worldwide.

The work program of TC CYBER include the following projects:

- ETSI TR 103 304, CYBER; PII Protection and Retention;
- ETSI TR 103 305, CYBER; Critical Security Controls for Effective Cyber Defence (revision);
- ETSI TR 103 331, CYBER; Structured threat information sharing;
- ETSI TR 103 369, CYBER; Design requirements ecosystem;
- ETSI TR 103 370, CYBER; Practical introductory guide to privacy;
- ETSI TR 103 421, CYBER; Network Gateway Cyber Defence;
- ETSI TS 103 485, CYBER; Mechanisms for privacy assurance and verification;
- ETSI TS 103 486, CYBER; Identity management and naming schema protection mechanisms;
- ETSI EG 203 310, CYBER; Post Quantum Computing Impact on ICT Systems; Recommendations on Business Continuity and Algorithm Selection.

7.6. DATA MANAGEMENT

As defined by ISO/IEC TR 10032:2003, data management consists of "the activities of defining, creating, storing, maintaining and providing access to data and associated processes in one or more information systems"[110].

This subsector encompasses the whole scope of data management, data going from characters or strings manipulated by a user to sophisticated and valuable assets. Data management can be performed in different environments such as a computer, a wired network or without contact (e.g. RFID - Radio-frequency identification, NFC - Near field communication technologies or Sensor Network); on various supports such as recorded media, hard drives or smartcards.

[110] *ISO/IEC TR 10032:2003, Information technology -- Reference Model of Data Management (developed by ISO/IEC JTC 1/SC 32)*

7.6.1.ISO/IEC JTC 1/SC 2

General information			
Committee	**ISO/IEC JTC 1/SC 2**	**Title**	**Coded character sets**
Creation date	1987	**MEMBERS** 	**Participating Countries (27):** Japan, Austria, Canada, China, Egypt, Finland, France, Germany, Greece, Hungary, Iceland, India, Indonesia, Ireland, Democratic People's Republic of Korea, Republic of Korea, Lithuania, Mongolia, Norway, Poland, Russian Federation, Serbia, Sri Lanka, Tunisia, Ukraine, United Kingdom, United States **Observing Countries (22):** Armenia, Belgium, Bosnia and Herzegovina, Cuba, Czech Republic, Estonia, Ghana, Hong Kong, Islamic Republic of Iran, Israel, Italy, Kazakhstan, Malaysia, Morocco, Netherlands, Romania, Slovenia, Sweden, Switzerland, Thailand, Turkey, Viet Nam
Secretariat	JISC(Japan)		
Secretary	Ms. Toshiko Kimura		
Chairperson	Dr. Yoshiki Mikami		
Organizations in liaison	CCSDS, EC, ISOC, ITU, UNCTAD, UNECE, UNICODE, WIPO, WMO, UC Berkeley, UNU-IIST, HKITF, W3C, TCA		
Web site	http://www.iso.org/iso/home/standards_development/list_of_iso_technical_committees/iso_technical_committee.htm?commid=45050		
Scope	Standardization of graphic character sets and their characteristic including string ordering, associated control functions, their coded representation for information interchange and code extension techniques. Excluded: audio and picture coding.		
Structure	JTC 1/SC 2/WG 2 Universal coded character set		
Standardization work			
Published standards	Number of published ISO/IEC standards under the direct responsibility of JTC 1/SC 2 (number includes updates): 54		
Standards under development	3		
Involvement of Luxembourg			
NO (no registered delegate)			
Comments			

Noteworthy standards of ISO/IEC JTC 1/SC 2 are:

- ISO 646:1991, Information technology -- ISO 7-bit coded character set for information interchange;
- ISO/IEC 8859 series of standards entitled "8-bit single-byte coded graphic character sets";
- ISO/IEC 10646:2014, Information technology -- Universal Coded Character Set (UCS) (published for the first time in 1993).

The SC is currently revising ISO/IEC 10646 concerning the Universal Coded Character Set (UCS).

7.6.2.ISO/IEC JTC 1/SC 23

<table>
<tr><th colspan="4">General information</th></tr>
<tr><td>Committee</td><td>ISO/IEC JTC 1/SC 23</td><td>Title</td><td>Digitally Recorded Media for Information Interchange and Storage</td></tr>
<tr><td>Creation date</td><td>1987</td><td rowspan="5">MEMBERS
  </td><td rowspan="5">Participating Countries (6):
Japan, China, Republic of Korea, Netherlands, Russian Federation, Switzerland

Observing Countries (20):
Argentina, Belgium, Bosnia and Herzegovina, Bulgaria, Cuba, Czech Republic, Finland, France, Ghana, Hungary, Iceland, India, Indonesia, Islamic Republic of Iran, Italy, Kazakhstan, Poland, Romania, Serbia, Thailand</td></tr>
<tr><td>Secretariat</td><td>JISC(Japan)</td></tr>
<tr><td>Secretary</td><td>Ms. Toshiko Kimura</td></tr>
<tr><td>Chairperson</td><td>Mr. Key Yamashita</td></tr>
<tr><td>Organizations in liaison</td><td>Ecma International, WIPO</td></tr>
<tr><td>Web site</td><td colspan="3">http://www.iso.org/iso/standards_development/technical_committees/list_of_iso_technical_committees/iso_technical_committee.htm?commid=45240</td></tr>
<tr><td>Scope</td><td colspan="3">Standardization in the field of removable digital storage media utilizing optical, holographic and magnetic recording technologies, and flash memory technologies for digital information interchange, including:
- Algorithms for the lossless comprehension of data;
- Volume and file structure;
- Methods for determining the life expectancy of digital storage media;
- Methods for error monitoring of digital storage media.</td></tr>
<tr><td>Structure</td><td colspan="3">/</td></tr>
<tr><th colspan="4">Standardization work</th></tr>
<tr><td>Published standards</td><td colspan="3">Number of published ISO/IEC standards under the direct responsibility of JTC 1/SC 23 (number includes updates): 142</td></tr>
<tr><td>Standards under development</td><td colspan="3">2</td></tr>
<tr><th colspan="4">Involvement of Luxembourg</th></tr>
<tr><td colspan="4">NO (no registered delegate)</td></tr>
<tr><th colspan="4">Comments</th></tr>
<tr><td colspan="4">Examples of standards developed by ISO/IEC JTC 1/SC 23 are:
- ISO/IEC 10995:2011, Information technology -- Digitally recorded media for information interchange and storage -- Test method for the estimation of the archival lifetime of optical media;
- ISO/IEC 12862:2011, Information technology -- 120 mm (8,54 Gbytes per side) and 80 mm (2,66 Gbytes per side) DVD recordable disk for dual layer (DVD-R for DL).

The current work program of ISO/IEC JTC 1/SC 23 includes the revision of ISO/IEC 29121, which specifies a data migration method for optical disks for long-term data storage.</td></tr>
</table>

7.6.3.ISO/IEC JTC 1/SC 24

<table>
<tr><th colspan="4">General information</th></tr>
<tr><td>Committee</td><td>ISO/IEC JTC 1/SC 24</td><td>Title</td><td>Computer graphics, image processing and environmental data representation</td></tr>
<tr><td>Creation date</td><td>1987</td><td rowspan="5">MEMBERS
  </td><td rowspan="5">Participating Countries (11):
United Kingdom, Australia, China, Egypt, France, Japan, Republic of Korea, Russian Federation, Switzerland, United States

Observing Countries (23):
Argentina, Austria, Belgium, Bosnia and Herzegovina, Canada, Cuba, Czech Republic, Finland, Ghana, Hungary, Iceland, India, Indonesia, Islamic Republic of Iran, Italy, Kazakhstan, Malaysia, Poland, Portugal, Romania, Serbia, Slovakia, Thailand</td></tr>
<tr><td>Secretariat</td><td>BSI (United Kingdom)</td></tr>
<tr><td>Secretary</td><td>Dr. Charles A. Whitlock</td></tr>
<tr><td>Chairperson</td><td>Mrs. Myeong Wee Lee</td></tr>
<tr><td>Organizations in liaison</td><td>SEDRIS Organization, WIPO, Web3D, SISO USA, OGC, IHO, DGIWG</td></tr>
<tr><td>Web site</td><td colspan="3">http://www.iso.org/iso/standards_development/technical_committees/list_of_iso_technical_committees/iso_technical_committee.htm?commid=45252</td></tr>
<tr><td>Scope</td><td colspan="3">Standardization of interfaces for information technology based applications relating to:
- Computer graphics;
- Image processing;
- Environmental data representation;
- Support for the augmented reality continuum (ARC);
- Interaction with, and visual presentation of, information.

<u>Included are the following related areas:</u>
Modeling and simulation, related reference models; virtual reality with accompanying augmented reality/augmented virtuality aspects, related reference models; application program interfaces; functional specifications; representation models; interchange formats, encodings and their specifications, including metafiles; device interfaces; testing methods; registration procedures; presentation and support for creation of multimedia, hypermedia, and mixed reality documents.

<u>Excluded:</u>
Character and image coding; coding of multimedia and hypermedia document interchange formats; JTC 1 work in user system interfaces and document presentation: ISO/TC 207 work on ISO 14000 environment management, ISO/TC 211 work on geographic information and geomatics; and software environments as described by ISO/IEC JTC 1/SC 22.</td></tr>
<tr><td>Structure</td><td colspan="3">JTC 1/SC 24/WG 6 Augmented reality continuum presentation and interchange
JTC 1/SC 24/WG 7 Image processing and interchange
JTC 1/SC 24/WG 8 Environmental representation
JTC 1/SC 24/WG 9 Augmented reality continuum concepts and reference model</td></tr>
<tr><th colspan="4">Standardization work</th></tr>
<tr><td>Published standards</td><td colspan="3">Number of published ISO/IEC standards under the direct responsibility of JTC 1/SC 24 (number includes updates): 80</td></tr>
<tr><td>Standards under development</td><td colspan="3">7</td></tr>
</table>

Involvement of Luxembourg
NO (no registered delegate)
Comments

Examples of standards developed by ISO/IEC JTC 1/SC 23 are:

- ISO/IEC 11072:1992, Information technology -- Computer graphics -- Computer Graphics Reference Model;
- ISO/IEC 18041-4:2007, Information technology -- Computer graphics, image processing and environmental data representation -- Environmental Data Coding Specification (EDCS) language bindings -- Part 4: C (under revision);
- ISO/IEC 19777-2:2006, Information technology -- Computer graphics and image processing -- Extensible 3D (X3D) language bindings -- Part 2: Java.

The current work program notably includes:

- ISO/IEC CD 18038, Information technology -- Computer graphics, image processing and environmental data representation and coding of audio, picture, multimedia and hypermedia information -- Sensor representation in mixed and augmented reality (MAR);
- ISO/IEC CD 18039, Information technology -- Computer graphics, image processing and environmental data representation and coding of audio, picture, multimedia and hypermedia information -- Mixed and augmented reality reference model;
- ISO/IEC CD 18040, Information technology -- Computer graphics, image processing and environmental data representation and coding of audio, picture, multimedia and hypermedia information -- Live actor and entity representation in mixed and augmented reality (MAR);
- ISO/IEC NP 18520, Benchmarks for MAR -- Geometric registration and tracking method;
- ISO/IEC 19774 series of standards regarding Humanoid Animation (H-Anim);
- The revision of ISO/IEC 19777-1, Information technology -- Computer graphics, image processing and environmental data representation -- Extensible 3D (X3D) language bindings -- Part 1: ECMAScript.

7.6.4.ISO/IEC JTC 1/SC 31

<table>
<tr><th colspan="4">General information</th></tr>
<tr><td>Committee</td><td>ISO/IEC JTC 1/SC 31</td><td>Title</td><td>Automatic identification and data capture techniques</td></tr>
<tr><td>Creation date</td><td>1996</td><td rowspan="5">MEMBERS
  </td><td rowspan="5">Participating Countries (26):
United States, Australia, Austria, Belgium, Brazil, Canada, China, Colombia, Czech Republic, Denmark, France, Germany, India, Ireland, Israel, Japan, Republic of Korea, Netherlands, Peru, Philippines, Russian Federation, Slovakia, South Africa, Sweden, Switzerland, United Kingdom

Observing Countries (20):
Argentina, Bosnia and Herzegovina, Finland, Ghana, Hong Kong, Hungary, Indonesia, Islamic Republic of Iran, Italy, Kazakhstan, Kenya, Luxembourg, Malaysia, New Zealand, Romania, Serbia, Singapore, Spain, Thailand, Turkmenistan</td></tr>
<tr><td>Secretariat</td><td>ANSI (United States)</td></tr>
<tr><td>Secretary</td><td>Mr. Eddy Merrill</td></tr>
<tr><td>Chairperson</td><td>Mr. Dan Kimball</td></tr>
<tr><td>Organizations in liaison</td><td>AIM Global, ETSI, Ecma International, GS1, IATA, ITU, OGC, UPU, NATO</td></tr>
<tr><td>Web site</td><td colspan="3">http://www.iso.org/iso/standards_development/technical_committees/list_of_iso_technical_committees/iso_technical_committee.htm?commid=45332</td></tr>
<tr><td>Scope</td><td colspan="3">Standardization of data formats, data syntax, data structures, data encoding, and technologies for the process of automatic identification and data capture and of associated devices utilized in inter-industry applications and international business interchanges and for mobile applications.</td></tr>
<tr><td>Structure</td><td colspan="3">JTC 1/SC 31/WG 1 Data carrier
JTC 1/SC 31/WG 2 Data structure
JTC 1/SC 31/WG 4 Radio communications</td></tr>
<tr><th colspan="4">Standardization work</th></tr>
<tr><td>Published standards</td><td colspan="3">Number of published ISO/IEC standards under the direct responsibility of JTC 1/SC 31 (number includes updates): 116</td></tr>
<tr><td>Standards under development</td><td colspan="3">37</td></tr>
<tr><th colspan="4">Involvement of Luxembourg</th></tr>
<tr><td colspan="4">1 delegate

- Mrs. Maria Sotiri POST Telecom S.A.</td></tr>
<tr><th colspan="4">Comments</th></tr>
<tr><td colspan="4">Technologies such as bar coding and radiofrequency identification (RFID) provide quick, accurate and cost-effective ways to identify, track, acquire and manage data and information about items, personnel, transactions and resources. These are known as the automatic identification and data capture (AIDC) technologies.

AIDC is an industry term that describes the identification and/or direct collection of data into a microprocessor-</td></tr>
</table>

controlled device, such as a computer system or a programmable logic controller (PLC), without the use of a keyboard. AIDC technologies provide a reliable means not only to identify but also to track items. It is possible to encode a wide range of information, beginning with a basic item or the identification of a person, to comprehensive details about the item or person, e.g. item description, size, weight, color, etc.

ISO/IEC JTC 1/SC 31, Automatic identification and data capture techniques, is responsible for more than 100 published or in-progress standards in this area. These standards address bar code symbologies (how a bar code is created and read), RFID air interface (how an RFID tag is read), real-time locating systems, and mobile item identification (which explains how a device such as a phone is used to read and access data as well as providing standards to define how the data associated with the technology are stored and read).

The current work program of ISO/IEC JTC 1/SC 31 particularly includes:

- The revision of the multipart standard ISO/IEC 15961 regarding "Information technology -- Radio frequency identification (RFID) for item management: Data protocol";
- The revision of the multipart standard ISO/IEC/IEEE 21451 concerning "Information technology -- Smart transducer interface for sensors and actuators";
- The development of the multipart standard ISO/IEC 19823 entitled "Information technology -- Conformance test methods for security service crypto suites";
- The development of the multipart standard ISO/IEC 29167 concerning security services in the area of "Information technology -- Automatic identification and data capture techniques".

It is also important to note that SC 31 is currently developing four standards regarding the Internet of Things in the supply chain and another one to specify the common rules applicable for unique identification that are required to ensure full compatibility across different identities:

- ISO/IEC AWI 18574, Information technology -- Internet of Things (IoT) in the supply chain -- Containerized cargo;
- ISO/IEC AWI 18575, Information technology -- Internet of Things (IoT) in the supply chain -- Products & product packages;
- ISO/IEC AWI 18576, Information technology -- Internet of Things (IoT) in the supply chain -- Returnable transport items (RTIs);
- ISO/IEC AWI 18577, Information technology -- Internet of Things (IoT) in the supply chain -- Transport units;
- ISO/IEC 29161, Information technology -- Data structure -- Unique identification for the Internet of Things.

7.6.5.ISO/IEC JTC 1/SC 32

General information			
Committee	**ISO/IEC JTC 1/SC 32**	**Title**	**Data management and interchange**
Creation date	1997	**MEMBERS** 	**Participating Countries (13):** United States, Canada, China, Czech Republic, Côte d'Ivoire, Egypt, Finland, Germany, India, Japan, Republic of Korea, Russian Federation, United Kingdom **Observing Countries (24):** Argentina, Australia, Austria, Belgium, Bosnia and Herzegovina, France, Ghana, Hungary, Iceland, Indonesia, Islamic Republic of Iran, Ireland, Italy, Kazakhstan, **Luxembourg**, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Spain, Switzerland, Turkey
Secretariat	ANSI (USA)		
Secretary	Ms. Michaela Miller		
Chairperson	Mr. Jim Melton		
Organizations in liaison	CISAC, ITSO, ITU, Infoterm, UNECE, WMO, OMG, EUROSTAT, DCMI		
Web site	http://www.iso.org/iso/standards_development/technical_committees/list_of_iso_technical_committees/iso_technical_committee.htm?commid=45342		
Scope	Standards for data management within and among local and distributed information systems environments. SC32 provides enabling technologies to promote harmonization of data management facilities across sector-specific areas. Specifically, SC32 standards include: - Reference models and frameworks for the coordination of existing and emerging standards; - Definition of data domains, data types and data structures, and their associated semantics; - Languages, services and protocols for persistent storage, concurrent access, concurrent update and interchange of data; - Methods, languages, services, and protocols to structure, organize, and register metadata and other information resources associated with sharing and interoperability, including electronic commerce.		
Structure	JTC 1/SC 32/WG 1 eBusiness JTC 1/SC 32/WG 2 MetaData JTC 1/SC 32/WG 3 Database language JTC 1/SC 32/WG 4 SQL/Multimedia and application packages		
Standardization work			
Published standards	Number of published ISO/IEC standards under the direct responsibility of JTC 1/SC 32 (number includes updates): 84		
Standards under development	21		
Involvement of Luxembourg			
1 delegate - Mr. Johnatan Pecero (Acting as Chairman) ANEC GIE			

Comments

ISO/IEC JTC 1/SC 32 is especially in charge of standardizing the SQL language and developing XML-related standards.

Examples of standards developed by ISO/IEC JTC 1/SC 32 are:

- ISO/IEC 9075-1:2011, Information technology -- Database languages -- SQL -- Part 1: Framework (SQL/Framework) (under revision);
- ISO/IEC 11179-1:2004, Information technology -- Metadata registries (MDR) -- Part 1: Framework (under revision);
- ISO/IEC 19503:2005, Information technology -- XML Metadata Interchange (XMI);
- ISO/IEC 19763-1:2015, Information technology -- Metamodel framework for interoperability (MFI) -- Part 1: Framework.

The subcommittee is particularly working on the revision of the ISO/IEC 9075 series of standards concerning the SQL database language.

7.6.6.ISO/IEC JTC 1/SC 34

<table>
<tr><th colspan="4">General information</th></tr>
<tr><td>Committee</td><td>ISO/IEC JTC 1/SC 34</td><td>Title</td><td>Document description and processing languages</td></tr>
<tr><td>Creation date</td><td>1998</td><td rowspan="5">MEMBERS
  </td><td rowspan="5">Participating Countries (22):
Japan, Armenia, Bulgaria, Chile, China, Czech Republic, Egypt, Finland, France, Germany, India, Italy, Republic of Korea, Lebanon, Malta, Netherlands, Pakistan, Poland, Russian Federation, Slovakia, Sri Lanka, United Kingdom

Observing Countries (32):
Argentina, Austria, Belgium, Bosnia and Herzegovina, Canada, Croatia, Cyprus, Côte d'Ivoire, Denmark, Greece, Hong Kong, Hungary, Indonesia, Islamic Republic of Iran, Ireland, Israel, Kazakhstan, Lithuania, Luxembourg, Malaysia, Mexico, Norway, Portugal, Romania, Serbia, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, Ukraine</td></tr>
<tr><td>Secretariat</td><td>JISC (Japan)</td></tr>
<tr><td>Secretary</td><td>Ms. Toshiko Kimura</td></tr>
<tr><td>Chairperson</td><td>Professor Sam Gyun Oh</td></tr>
<tr><td>Organizations in liaison</td><td>Ecma International, OASIS, W3C, ETSI</td></tr>
<tr><td>Web site</td><td colspan="3">http://www.iso.org/iso/standards_development/technical_committees/list_of_iso_technical_committees/iso_technical_committee.htm?commid=45374</td></tr>
<tr><td>Scope</td><td colspan="3">Standardization in the field of document structures, languages and related facilities for the description and processing of compound and hypermedia documents, including:
- Languages for describing document logical structures and their support facilities;
- Languages for describing document-like objects in web environments;
- Document processing architecture and formatting for logical documents;
- Languages for describing interactive documents;
- Multilingual font information interchange and related services;
- Final-form document architecture and page information interchange;
- Hypermedia document structuring language and application resources;
- API's for document processing.</td></tr>
<tr><td>Structure</td><td colspan="3">JTC 1/SC 34/AG 1 Forward planning
JTC 1/SC 34/WG 4 Office Open XML
JTC 1/SC 34/WG 6 OpenDocument Format
JTC 1/SC 34/JWG 7 Joint JTC 1/SC 34 – TC 46/SC 4 – IEC/TC 100/TA 10 WG: EPUB
JTC 1/SC 34/WG 8 Document processing and presentation</td></tr>
<tr><th colspan="4">Standardization work</th></tr>
<tr><td>Published standards</td><td colspan="3">Number of published ISO/IEC standards under the direct responsibility of JTC 1/SC 34 (number includes updates): 78</td></tr>
<tr><td>Standards under development</td><td colspan="3">10</td></tr>
<tr><th colspan="4">Involvement of Luxembourg</th></tr>
<tr><td colspan="4">1 delegate
- Mr. David Naramski (Acting as Chairman) NOWINA SOULTIONS S.à.r.l.</td></tr>
</table>

Comments

ISO/IEC JTC 1/SC 34 has inherited from its predecessors (ISO/TC 97/SC 18/WG 8 and ISO/IEC JTC 1/SC 18/WG 8) the responsibility for the maintenance of many important standards that have been hugely influential in the development of the World Wide Web.

These standards include ISO 8879 (SGML), ISO/IEC 10179 (DSSSL) and ISO/IEC 10744 (HyTime). These standards still inform work on new standards development within ISO/IEC JTC 1/SC 34, as well as continuing to influence the work of other bodies such as OASIS and W3C. The subcommittee is currently working on International Standards regarding Office Open XML File Formats.

7.6.7.CEN/TC 225

General information			
Committee	**CEN/TC 225**	**Title**	**AIDC Technologies**
Creation date	1989	**MEMBERS** 	33 members of CEN/CENELEC
Secretariat	TSE (Turkey)		
Secretary	Ms. Aysegül Ibrisim		
Chairperson	Mr. Claude Tételin		
Organizations in liaison	ECISS, EDIFICE, EDMA (Brussels), EFPIA, EHIBCC, EUCOMED, EuroCommerce, GS1, ODETTE, UPU		
Web site	http://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP_ORG_ID:6206&cs=1E12277AECC001196A7556B8DBCDF0A1C		
Scope	Standardization of data carriers for automatic identification and data capture, of the data element architecture therefore, of the necessary test specifications and of technical features for the harmonization of cross-sector applications. Establishment of an appropriate system of registration authorities, and of means to ensure the necessary maintenance of standards.		
Structure	CEN/TC 225/WG 1 CEN/TC 225/WG 3 CEN/TC 225/WG 4 CEN/TC 225/WG 5 CEN/TC 225/WG 6	Optical Readable Media Security and data structure Automatic ID applications RFID, RTLS and on board sensors Internet of Things - Identification, Data Capture and Edge Technologies	
Standardization work			
Published standards	26		
Standards under development	3		
Involvement of Luxembourg			
NO (no registered delegate)			
Comments			

When preparing standards for Europe, CEN/TC 225 will take into account the technical specifications, standards and regulations currently available or being prepared at international levels. In particular, the technical work in ISO/IEC JTC 1/SC 31 (Automatic Identification and Data Capture (AIDC) techniques) and ISO/IEC JTC 1/SC 27 (Privacy) will be taken into account.

CEN/TC 225 delivers EN standards and technical reports to:

- Close the standardization gaps identified by the EC M436 mandate process;
- Guide the deployment of AIDC systems in public and private enterprises within Europe;
- Ensure the deployments are secure and protect personal privacy issues identified by the EC M436 mandate process;

- Provide standards and industrial guidelines for the unique identification of all types of objects supporting the free global movement of goods, enhanced health and safety aspects in industries and in governmental sector;
- Pay a particular attention to Future Internet and the Internet of Things which includes unique identification schemes, privacy and security aspects.

Furthermore, CEN/TC 225:

- Focuses on issues arising from the EC M436 mandate process and rapidly develop EN/TR to deliver the objectives of the EC Mandate;
- Uses and refine the resulting frameworks, especially in relation to PIA's (Privacy Impact Assessment), to build application guidelines and standards;
- Promotes the CEN/TC 225 WG work plans to mirror committees in all CEN member states;
- Establishes and maintain effective liaisons with other ESOs (European Standardization Organizations), global standards organizations, trade associations and regulatory bodies;
- Evaluates the need for adopting ISO/IEC 18000 (and related) standards as EN standards;
- Takes into account technical standards and regulations currently available or being prepared at international levels. In particular, to take into account the technical work developed by ISO/IEC JTC 1/SC 31;
- Uses the Vienna Agreement to ensure alignment of European AIDC standards with the ISO environment.

The current work program of CEN/TC 225 includes the development of two standards concerning:

- Information technology - Automatic identification and data capture techniques - Electronic identification plate;
- Information technology - RFID in rail;
- Information technology - Automatic identification and data capture techniques - Electronic identification plate.

7.7. ELECTRONIC SIGNATURE

ETSI has defined electronic signature as a "data in electronic form that is attached to or logically associated with other electronic data and that serves as a method of authentication"[111].

An electronic signature is thus a mechanism to authenticate the author of an electronic document (like the handwritten signature for a paper document), and to ensure its integrity.

The Regulation directive (EU) n° 910/20141999/93/EC of the European Parliament and of the Council on electronic identification and trust services for electronic transactions in the internal market (eIDAS Regulation)[112] a Community framework for electronic signatures establishes is intended to provide a regulatory environment to enable secure and seamless between businesses, citizens and public authorities harmonized electronic signature similar to the handwritten signature. In this frame, the eIDAS Regulation:

- *"Ensures that people and businesses can use their own national electronic identification schemes (eIDs) to access public services in other EU countries where eIDs are available.*
- *Creates a European internal market for eTS - namely electronic signatures, electronic seals, time stamp, electronic delivery service and website authentication - by ensuring that they will work across borders and have the same legal status as traditional paper based processes. Only by providing certainty on the legal validity of all these services, businesses and citizens will use the digital interactions as their natural way of interaction"[113].*

This subsector includes the different concepts and mechanisms upon which electronic signatures are based including public key cryptography, public key certificate, hash functions and Public Key Infrastructures (PKI).

---

[111] *ETSI TS 101 733, Electronic Signatures and Infrastructures (ESI); CMS Advanced Electronic Signatures (CAdES) (developed by ETSI/TC ESI)*

[112] *http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2014.257.01.0073.01.ENG*

[113] *https://ec.europa.eu/digital-single-market/en/trust-services-and-eid*

7.7.1.ISO/IEC JTC 1/SC 17

General information			
Committee	**ISO/IEC JTC 1/SC 17**	**Title**	**Cards and personal identification**
Creation date	1969	**MEMBERS** 	**Participating Countries (33):** United Kingdom, Armenia, Australia, Austria, Belgium, Canada, China, Czech Republic, Denmark, Finland, France, Germany, India, Israel, Italy, Japan, Kenya, Republic of Korea, **Luxembourg**, Malaysia, Netherlands, Norway, Poland, Romania, Russian Federation, Singapore, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, United States **Observing Countries (19):** Argentina, Bosnia and Herzegovina, Croatia, Estonia, Ghana, Hungary, Iceland, Indonesia, Islamic Republic of Iran, Ireland, Kazakhstan, Lithuania, New Zealand, Portugal, Serbia, Thailand, Turkey, Ukraine, Viet Nam
Secretariat	BSI (United Kingdom)		
Secretary	Mr. Jean Stride		
Chairperson	Mr. Richard A. Mabbott		
Organizations in liaison	AMEX, CCETT, Ecma International, IATA, ICAO, ICMA, ILO, MasterCard International, MasterCard Europe, VISA, VISA EU, NFC Forum, UNECE, JAVA CARD FORUM, EUDCA		
Web site	http://www.iso.org/iso/standards_development/technical_committees/list_of_iso_technical_committees/iso_technical_committee.htm?commid=45144		
Scope	Standardization in the area of: - Identification and related documents; - Cards and devices associated with their use in inter-industry applications and International interchange.		
Structure	JTC 1/SC 17/WG 1 Physical characteristics and test methods for ID-cards JTC 1/SC 17/WG 3 Identification cards - Machine readable travel documents JTC 1/SC 17/WG 4 Integrated circuit card with contacts JTC 1/SC 17/WG 5 Registration Management Group (RMG) JTC 1/SC 17/WG 8 Integrated circuit cards without contacts JTC 1/SC 17/WG 9 Optical memory cards and devices JTC 1/SC 17/WG 10 Motor vehicle driver license and related documents JTC 1/SC 17/WG 11 Application of biometrics to cards and personal identification		
Standardization work			
Published standards	Number of published ISO/IEC standards under the direct responsibility of JTC 1/SC 17 (number includes updates): 118		
Standards under development	40		
Involvement of Luxembourg			
2 delegates - Mr. Valentin Lacave (Chairman) Telindus Luxembourg S.A. - Mr. Enrico Ozzano BIL S.A.			

Comments

ISO/IEC JTC 1 subcommittee SC 17, Cards and personal identification, is responsible for the development of a large portfolio of card standards in support of interoperability and data interchange.

At a minimum, the standards define the physical dimensions of the card and the geometry of the terminals which read those cards (e.g. the slot in an ATM). Then, depending on the reading technology, the standards define how the card "couples" with the card terminal and thereby communicates with the underlying application (e.g. motorized mag strip readers in ATMs, magnetic stripe swipe readers in Point-of-Sale terminals, slot readers in hotel card key locks).

At their most basic level, standards maintain interoperability between cards and the card readers that read them. For a closed system or national implementation, interoperability is important so that components, such as the cards or the chips on smart cards sourced on the open market from various manufacturers, will interoperate, with a high degree of confidence, with card readers sourced from different manufacturers.

Two of the most sophisticated technologies involve microprocessors embedded in the card, also known as "smart cards". These are "cards with contacts" and "contactless cards". Cards with contacts are usually inserted manually into a "dip reader" whereas contactless cards use radio frequency coupling to enable "touch and go" for rapid transit ticket gates and "wave and pay" to make low value purchases in retail outlets such as fast food restaurants. Electronic passports (ePassports) and citizen identification cards are further examples where contactless standards have been adopted.

7.7.2.CEN/TC 224

<table>
<tr><th colspan="4">General information</th></tr>
<tr><td>Committee</td><td>CEN/TC 224</td><td>Title</td><td>Personal identification and related personal devices with secure element, systems, operations and privacy in a multi sectorial environment</td></tr>
<tr><td>Creation date</td><td>1989</td><td rowspan="5">MEMBERS
  </td><td rowspan="5">33 members of CEN/CENELEC</td></tr>
<tr><td>Secretariat</td><td>AFNOR (France)</td></tr>
<tr><td>Secretary</td><td>Ms. Caroline De Condé</td></tr>
<tr><td>Chairperson</td><td>Mr. Franck Leroy</td></tr>
<tr><td>Organizations in liaison</td><td>ANEC, CCC, EPC, ERTICO, ETSI, Euro Commerce, FRONTEX, GlobalPlatform, Master Card Europe, UIC, VISA International</td></tr>
<tr><td>Web site</td><td colspan="3">http://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP_LANG_ID,FSP_ORG_ID:25,6205&cs=1A98C573151AB3D7A22712120D94364C1#1</td></tr>
<tr><td>Scope</td><td colspan="3">The development of standards for strengthening the interoperability and security of personal identification and its related personal devices, systems, operations and privacy in a multi sectorial environment. It covers:
- Operations such as applications and services like electronic identification, electronic signature, payment and charging, access and border control;
- Personal devices with secure elements independently of their form factor, such as cards, mobile devices, and their related interfaces;
- Security services including authentication, confidentiality, integrity, biometrics, protection of personal and sensitive data;
- System components such as accepting devices, servers, cryptographic modules;

CEN/TC 224 multi-sectorial environment involves sectors such as Government/Citizen, Transport, Banking, e-Health, as well as Consumers and providers from the supply side such as card manufacturers, security technology, conformity assessment body, software manufacturers.</td></tr>
<tr><td>Structure</td><td colspan="3">CEN/TC 224/WG 6 User Interface
CEN/TC 224/WG 11 Transport applications
CEN/TC 224/WG 15 European citizen card
CEN/TC 224/WG 16 Application Interface for smart cards used as Secure Signature Creation Devices
CEN/TC 224/WG 17 Protection Profiles in the context of SSCD
CEN/TC 224/WG 18 Biometrics</td></tr>
<tr><th colspan="4">Standardization work</th></tr>
<tr><td>Published standards</td><td colspan="3">48</td></tr>
<tr><td>Standards under development</td><td colspan="3">25</td></tr>
</table>

Involvement of Luxembourg

4 delegates

- Mr. Benoit Poletti (Chairman)	INCERT GIE
- Mrs. Shenglan Hu	POST Telecom PSF
- Mr. Enrico Ozzano	BIL S.A.
- Mrs. Maria Sotiri	POST Telecom S.A.

Comments

As a matter of principle, CEN/TC 224 does not duplicate the work of ISO/IEC JTC 1/SC 17 but, either transposes some of the related International Standards or uses them as the basis for specific European works. In a number of cases, the ultimate objective of the work of CEN/TC 224 is to contribute to international standardization.

The current objectives of CEN/TC 224 are to elaborate or maintain standards on:

- General card characteristics and technologies;
- Man machine interface;
- Inter-sector electronic purse;
- Telecommunications integrated circuit cards and terminals;
- Surface transport applications;
- Identification, Authentication and Signature (IAS) services based on smart secure devices;
- Biometrics for the need of European travel or governmental documents;
- Health sector cards.

Additional objectives of CEN/TC 224 are to consider the requirements for further standardization in the following areas:

- Additional devices under the control of the card (new displays, new embedded input/output devices on-board the card including electronic display, capacitive or resistive keypad, button, biosensor, power supply device, etc.) leading to new use relevant cases
- Privacy Impact Assessment (PIA): requirement for an evaluation model of privacy-by-design card-based products and/or services
- Privacy by design and convergence platform: starting the design with privacy requirements at the project outset and capitalizing on a common platform ground fulfilling a minimum requirement set for privacy supporting a diversity of applications on top of it.

CEN/TC 224 is particularly involved in the development of standards under the standardization mandate M/460 concerning Electronic Signatures.

7.7.3.ETSI/TC ESI

General information			
Committee	**ESI**	**Title**	**Electronic Signatures and Infrastructures**
Creation date	/	**MEMBERS** 	/
Chairperson	Mr. Riccardo Genghini		
Organizations in liaison	CAB Forum, CEN, CENELEC, ENISA, ISO, ISO/IEC JTC 1, ISOC/IETF, ITU, OASIS, SAFE-BioPharma, UNECE, UPU		
Web site	http://portal.etsi.org/esi		
Scope	TC ESI is the lead body within ETSI in relation to Electronic Signatures and Infrastructures, including the preparation of reports and other necessary activities, by: - Developing generic standards, guides and reports relating to electronic signatures and related trust infrastructures to protect electronic transactions and ensure trust and confidence with business partners; - Liaising with other ETSI bodies in relation to electronic signatures and related trust infrastructures; - Liaising with bodies external to ETSI in relation to electronic signatures and related trust infrastructures; - Establishing a continuing work plan in relation to electronic signatures and related trust infrastructures.		
Structure	/		
Standardization work			
Published standards	194		
Standards under development	65		
Involvement of Luxembourg			
1 member - eWitness			
Comments			
The committee addresses some basic needs of secure electronic commerce and of secure electronic document exchange in general by providing specifications for a selected set of technical items that have been found both necessary and sufficient to meet minimum interoperability requirements. Examples of business transactions based on electronic signatures and public key certificates are purchase requisitions, contracts and invoice applications. The lack of standards to support the use of electronic signatures and public key certificates has been identified as one of the greatest impediments to electronic commerce. The deployment of vendor-specific new infrastructures is currently in progress. It is recognized by different parties that there is an urgent need for standards to provide the basis for an open electronic commerce environment. Speedy specifications in this area		

will make it possible to influence early developments.

The ETSI strategy is in line with, and endorsed by the initiative of the EU Commission to establish a harmonized infrastructure for electronic signatures. In this frame, ETSI/TC ESI works, in collaboration will CEN TC 224, on the execution of EC Mandate M/460 to provide a rationalized framework for digital signatures standardization.

7.8. E-ARCHIVING

Archiving consists in the maintenance of records for continuing use, where records are information created, received and maintained as evidence and as an asset by an organization or person, in pursuit of legal obligations or in the transaction of business. Moreover, in the frame of a continuing use, the preservation of records is a highly important notion that consists of processes and operations involved in ensuring the maintenance of records over time[114].

This analysis focuses on digital archives.

[114] *Based on ISO/IEC 30300:2011, Information and documentation — Management systems for records — Fundamentals and vocabulary (developed by ISO/TC 46/SC 11)*

7.8.1.ISO/TC 46/SC 11

General information			
Committee	**ISO/TC 46/SC 11**	**Title**	**Archives/records management**
Creation date	1998	**MEMBERS** 	**Participating Countries (29):** Australia, Bulgaria, Canada, China, Colombia, Czech Republic, Estonia, Finland, France, Germany, Ireland, Italy, Japan, Kenya, Republic of Korea, Luxembourg, Malaysia, Netherlands, New Zealand, Norway, Portugal, Russian Federation, South Africa, Spain, Sweden, Switzerland, Ukraine, United Kingdom, United States **Observing Countries (16):** Argentina, Austria, , Belgium, Cuba, Denmark, Greece, Islamic Republic of Iran, , Lithuania, Poland, Romania, Serbia, Singapore, Slovakia, Slovenia, Sri Lanka, Thailand
Secretariat	SA (Australia)		
Secretary	Ms. Agnes Simai		
Chairperson	Mr. David Moldrich		
Organizations in liaison	ICA, IRMT, InterPARES		
Web site	http://www.iso.org/iso/home/standards_development/list_of_iso_technical_committees/iso_technical_committee.htm?commid=48856		
Scope	Standardization of principles for the creation and management of documents, records and archives as evidence of transactions and covering all media including digital multimedia and paper.		
Structure	TC 46/SC 11/WG 1 Metadata TC 46/SC 11/WG 7 JWG on Digital Records preservation TC 46/SC 11/WG 8 Management of systems for records TC 46/SC 11/WG 10 Implementation Guidelines for the disposition of records TC 46/SC 11/WG 13 Revision of ISO 15489-1 and ISO/TR 15489-2 TC 46/SC 11/WG 14 Records requirements in enterprise Architecture		
Standardization work			
Published standards	Number of published ISO standards under the direct responsibility of TC 46/SC 11 (number includes updates): 17		
Standards under development	2		
Involvement of Luxembourg			
9 delegates			
- Mr. Lucas Colet (Chairman) PricewaterhouseCoopers SC - Mrs. Sylvie Forastier Linklaters LLP - Mrs. Stefanie Zutter Knowledge@Work - Mr. Alain Wahl ILNAS - Mr. Serge Raucq Vectis ACF S.A. - Mr. Reidun Valo Vectis ACF S.A. - Mr. Michel Picard Luxembourg Institute of Science and Technology (LIST) - Mr. Cyril Miel OpenText S.A. - Mr. Henri Montin Centre des Technologies de l'Information de l'Etat			

Comments

ISO/TC 46/SC 11 is responsible for the standardization of best practices in managing archives and records by providing a managerial framework, as well as standards and guidance for the design and application of records practices and processes to ensure authoritative and reliable information and evidence of business activity in organizations.

ISO/TC 46/SC 11 is currently developing the standard ISO/DIS 17068, Information and documentation -- Trusted third party repository for digital records.

7.9. SENSOR NETWORKS

Sensor networks consist in a "system of spatially distributed sensor nodes interacting with each other and, depending on applications, possibly with other infrastructure in order to acquire, process, transfer, and provide information extracted from its environment with a primary function of information gathering and possible control capability"[115].

Sensor networks are essential for the development of numerous ICT innovations: Smart Cities, Smart Grids, Intelligent Transport Systems, Internet of Things, etc.

[115] *ISO/IEC 29182-2:2013, Information technology -- Sensor networks: Sensor Network Reference Architecture (SNRA) -- Part 2: Vocabulary and terminology (developed by ISO/IEC JTC 1/WG 7)*

7.9.1.ISO/IEC JTC 1/WG 7

<table>
<tr><th colspan="4">General information</th></tr>
<tr><td>Committee</td><td>ISO/IEC JTC 1/WG 7</td><td>Title</td><td>Sensor networks</td></tr>
<tr><td>Creation date</td><td>2009</td><td rowspan="5">MEMBERS
  </td><td rowspan="5">Participating countries (18):
Republic of Korea, Australia, Austria, Canada, China, Finland, France, Germany, Japan, Luxembourg, Netherlands, Norway, Pakistan, Singapore, South Africa, Spain, Sweden, United Kingdom, United States</td></tr>
<tr><td>Secretariat</td><td>KATS (Republic of Korea)</td></tr>
<tr><td>Secretary</td><td>Ms. Jooran Lee</td></tr>
<tr><td>Chairperson</td><td>Dr. Yongjin Kim</td></tr>
<tr><td>Organizations in liaison</td><td>DEWI, OGC, IEEE Instrumentation and Measurement Society TC 9, ITU-T SG 20</td></tr>
<tr><td>Web site</td><td colspan="3">http://isotc.iso.org/livelink/livelink/open/jtc1wg7</td></tr>
<tr><td>Scope</td><td colspan="3">The ISO/IEC JTC 1/WG 7 has been established with the following Terms of Reference:

1) In the area of generic solutions for sensor networks, undertake standardization activities that support and can be applied to the technical work of all relevant JTC 1 entities and to other standards organizations. This includes activities in sensor networks such as the following:
- Standardization of terminology;
- Development of a taxonomy;
- Standardization of reference architectures;
- Development of guidelines for interoperability;
- Standardization of specific aspects of sensor networks.

2) In the area of application - oriented sensor networks, identify gaps and commonalities that may impact standardization activities within the scope of JTC 1. Further, share this information with relevant entities within and outside of JTC 1. Unless better pursued within another JTC 1 entity, the following standardization activities may be pursued as projects by this Working Group:
- Addressing the technology gaps within the scope of JTC 1 entities;
- Exploiting technology opportunities where it is desirable to provide common approaches to the use of sensor networks across application domains;
- Addressing emerging areas related to M2M and IoT.

3) In order to foster communication and sharing of information between groups working in the field of sensor networks:
- Seek liaison relationships with all relevant JTC 1 SCs/WGs;
- Seek liaison relationships with other organizations outside JTC 1 including but not limited to: relevant ISO TCs, IEC TCs and ITU-T SGs, IEEE 1451, IEEE 1588, IEEE P2030, IEEE 802.15, Open Geospatial Consortium, ZigBee Alliance, IETF 6LoWPAN, IETF ROLL WG, ETSI, IPSO Alliance, EPCglobal, ISA 100, LONMARK, KNX Association, Zwave Alliance;
- Consider the possibility of conducting joint projects with relevant ITU-T SG;
- Seek input from relevant research projects and consortia.</td></tr>
<tr><td>Structure</td><td colspan="3">/</td></tr>
<tr><th colspan="4">Standardization work</th></tr>
<tr><td>Published standards</td><td colspan="3">Number of published ISO/IEC standards under the direct responsibility of JTC 1/WG 7 (number includes updates): 10</td></tr>
</table>

Standards under development	5

Involvement of Luxembourg

1 delegate

- Mr. Joseph Emeras ANEC GIE

Comments

ISO/IEC JTC 1/WG 7 has notably published the ISO/IEC 29182 series of standards for Sensor Network Reference Architecture (SNRA). This series aims to provide guidance to facilitate the design and development of sensor networks, to improve interoperability of sensor networks, and to make sensor network components plug-and-play, so that it becomes fairly easy to add/remove sensor nodes to/from an existing sensor network.

The subcommittee has also published a standard for sensor networks to support smart grids technology and another one which specifies the interfaces between the application layers of service providers and sensor network gateways:

- ISO/IEC 30101:2014, Information technology -- Sensor networks: Sensor network and its interfaces for smart grid system;
- ISO/IEC 30128:2014, Information technology -- Sensor networks -- Generic Sensor Network Application Interface.

The current work program includes:

- ISO/IEC DIS 19637, Information technology -- Sensor Network Testing Framework;
- ISO/IEC FDIS 30140-1, Information technology -- Underwater acoustic sensor network -- Part 1: Reference model;
- ISO/IEC DIS 30140-2, Information technology -- Underwater acoustics sensor network -- Part 2: Reference architecture;
- ISO/IEC AWI 30140-3, Information technology -- Underwater acoustics sensor network -- Part 3: Entities and interface;
- ISO/IEC AWI 30140-4, Information technology -- Underwater acoustics sensor network -- Part 4: Interoperability.

7.10. GOVERNANCE OF IT

Corporate governance involves a set of relationships between a company's management, its board, its shareholders and other stakeholders. Corporate governance also provides the structure through which the objectives of the company are set, and the means of attaining those objectives and monitoring performance are determined[116].

The governance of IT is thus a component or a subset of organization governance, which is one key element in improving economic efficiency and growth as well as enhancing investors' confidence. Governance of IT can be defined as the system by which the current and future use of IT is directed and controlled[117].

[116] *OECD principles of corporate Governance*

[117] *Based on ISO/IEC TR 38502:2014, Information Technology -- Governance of IT -- Framework and model (developed by ISO/IEC JTC 1/SC 40)*

7.10.1. ISO/IEC JTC 1/SC 40

<table>
<tr><th colspan="4">General information</th></tr>
<tr><td>Committee</td><td>ISO/IEC JTC 1/SC 40</td><td>Title</td><td>IT Service Management and IT Governance</td></tr>
<tr><td>Creation date</td><td>2013</td><td rowspan="5">MEMBERS
  </td><td rowspan="5">Participating Countries (32):
Australia, Brazil, Canada, China, Côte d'Ivoire, Denmark, Finland, France, Germany, India, Ireland, Italy, Japan, Republic of Korea, Luxembourg, Malaysia, Mexico, Netherlands, New Zealand, Panama, Peru, Poland, Portugal, Romania, Russian Federation, Rwanda, Singapore, South Africa, Spain, Sweden, United Kingdom, United States

Observing Countries (10):
Argentina, Austria, Belgium, Bulgaria, Czech Republic, Hong Kong, Islamic Republic of Iran, Kenya, Switzerland, Uruguay</td></tr>
<tr><td>Secretariat</td><td>SA (Australia)</td></tr>
<tr><td>Secretary</td><td>Ms. Suba Ananth</td></tr>
<tr><td>Chairperson</td><td>Mr. John Sheridan</td></tr>
<tr><td>Organizations in liaison</td><td>IEEE, ISACA, OASIS, itSMFI, IAF</td></tr>
<tr><td>Web site</td><td colspan="3">http://www.iso.org/iso/standards_development/technical_committees/list_of_iso_technical_committees/iso_technical_committee.htm?commid=5013818</td></tr>
<tr><td>Scope</td><td colspan="3">Standardization of IT Service Management and IT Governance.

Develop standards, tools, frameworks, best practices and related documents for IT Service Management and IT Governance, including areas of IT activity such as audit, digital forensics, governance, risk management, outsourcing, service operations and service maintenance, but excluding subject matter covered under the scope and existing work programs of JTC 1/SC 27 and JTC 1/SC 38.

The work will initially cover:
- Governance of IT, including the development of the ISO/IEC 38500 series standards and related documents;
- Operational aspects of Governance of IT, including ISO/IEC 30121 Information Technology — Governance of digital forensic risk framework, and interfaces with the management of IT as well as the role of governance in the area of business innovation;
- All aspects relating to IT service management, including the development of the ISO/IEC 20000 series standards and related documents;
- All aspects relating to IT-Enabled Services — Business Process Outsourcing, including the development of the ISO/IEC 30105 series standards and related documents.</td></tr>
<tr><td>Structure</td><td colspan="3">JTC 1/SC 40/CAG 1 Chairman Advisory Group
JTC 1/SC 40/SG 1 General Study Group on Future Work
JTC 1/SC 40/SG 3 Study Group on the governance and service management of IT and IT-enabled services/Business process outsourcing
JTC 1/SC 40/WG 1 Governance of Information Technology
JTC 1/SC 40/WG 2 IT service management
JTC 1/SC 40/WG 3 IT-enabled services / Business process outsourcing</td></tr>
<tr><th colspan="4">Standardization work</th></tr>
<tr><td>Published standards</td><td colspan="3">Number of published ISO/IEC standards under the direct responsibility of JTC 1/SC 40 (number includes updates): 12</td></tr>
</table>

Standards under development	14

Involvement of Luxembourg

7 delegates

- Mrs. Béatrix Barafort (Chairwoman)	Luxembourg Institute of Science and Technology (LIST)
- Mr. Alain Renault	LIST
- Mr. Stéphane Cortina	LIST
- Mr. Michel Picard	LIST
- Mr. Christophe Feltus	LIST
- Mr. Jean-Michel Remiche	POST Telecom S.A.
- Mr. Pierre-Olivier Portmann	

Comments

ISO/IEC JTC 1/SC 40 has been created during the 2013 JTC 1 Plenary Meeting. It pursues the work of three working groups which have been disbanded on December 1, 2013:

- ISO/IEC JTC 1/WG 8: Governance of IT;
- ISO/IEC JTC 1/SC 7/WG 25: IT Service Management;
- ISO/IEC JTC 1/SC 7/WG 27: IT Enabled Services/Business Process Outsourcing Lifecycle Processes (ITES/BPO).

JTC 1/SC 40 is in charge of the ISO/IEC 38500 family of standards on Governance of IT and has recently published three related standards:

- ISO/IEC 38500:2015, Information technology -- Governance of IT for the organization;
- ISO/IEC TS 38501:2015, Information technology -- Governance of IT -- Implementation guide;
- ISO/IEC TR 38502:2014, Information technology -- Governance of IT -- Framework and model.

The following standards are currently under development:

- ISO/IEC PDTR 38503, Information technology -- governance of IT -- Guidance on the audit of the governance of IT;
- ISO/IEC PDTR 38504, Information technology -- Governance of IT -- The structure of principles-based standards in the governance of information technology;
- ISO/IEC DIS 38505-1, Information Technology -- Governance of IT -- Part 1: The application of ISO/IEC 38500 to the governance of data;
- ISO/IEC WD TR 38505-2, Information Technology -- Governance of IT -- Part 2: Implications of 38505-1 for data management;
- ISO/IEC AWI 38506, Information technology -- Governance of IT -- Governance of IT enabled investments;
- Several standards in the ISO/IEC 20000 series standards on IT service management (parts 1, 6, 8 and 12);
- ISO/IEC 30105 series standards on ITES-BPO (parts 1 to 5).

7.11. INTERNET OF THINGS

The final study report of ISO/IEC JTC 1/SWG 5[118] defined Internet of Things (IoT) as: "An infrastructure of interconnected objects, people, systems and information resources together with intelligent services to allow them to process information of the physical and the virtual world and react".

Many services can be envisioned as a result of technological progress and all objects can play an active role thanks to their connection to the Internet: real-time traffic updates (thanks to mobile tracking), building automation and controls, automatic energy management, intelligent shopping applications, vehicle auto-diagnosis, assistance for elderly or disabled people to help them living independently, etc.

In this frame, standardization is essential to define a universal approach and thus ensure interoperability of IoT infrastructure.

[118] *Based on the Study Report on Internet of Things (IoT) submitted to the 2014 ISO/IEC JTC 1 Plenary by the ISO/IEC JTC 1/SWG 5 on IoT. This SWG has been replaced at the end of 2014 by the new WG 10 on IoT*

7.11.1. ISO/IEC JTC 1/WG 10

<table>
<tr><th colspan="4">General information</th></tr>
<tr><td>Committee</td><td>ISO/IEC JTC 1/WG 10</td><td>Title</td><td>Internet of Things (IoT)</td></tr>
<tr><td>Creation date</td><td>2014</td><td rowspan="5">MEMBERS
  </td><td rowspan="5">Participating countries (25):
Republic of Korea, Australia, Austria, Belgium, Canada, China, Czech Republic, Denmark, Finland, France, Germany, India, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Russian Federation, Singapore, Spain, Sweden, United Kingdom, United States</td></tr>
<tr><td>Secretariat</td><td>KATS (Republic of Korea)</td></tr>
<tr><td>Secretary</td><td>Ms. Yaeseul Park</td></tr>
<tr><td>Chairperson</td><td>Mr. Sangkeun Yoo</td></tr>
<tr><td>Organizations in liaison</td><td>AIM Global, AIOTI/WG 3, ETSI, GS1, IEEE P2413, IIC, ITU, OGC, OMA DM, oneM2M, OMG, The Open Group, UPnP Forum, W3C</td></tr>
<tr><td>Web site</td><td colspan="3">http://isotc.iso.org/livelink/livelink?func=ll&objId=16911907</td></tr>
<tr><td>Scope</td><td colspan="3">The ISO/IEC JTC 1/WG 10 has been established with the following Terms of Reference:
- Serve as a focus of and proponent for JTC 1's IoT standardization program.
- Develop foundational standards for IoT related to JTC 1 for guiding IoT efforts throughout JTC 1 upon which other standards can be developed.
- The work will cover:
o Developing Terms and Definitions for JTC 1 IoT Vocabulary
o Developing IoT Reference Architecture and other foundational specifications as JTC 1 standards
o Continuing the work begun in SWG on IoT on standardization gaps
o Establishing a liaison with JTC 1, ISO, IEC or other entities undertaking work related to IoT
o Encouraging the prompt and efficient exchange of information within JTC 1 and with ISO, IEC, or other entities working on IoT, as appropriate
o Monitoring the ongoing IoT regulatory, market, business and technology requirements
o Developing other IoT standards that build on the foundational standards when relevant JTC 1 subgroups that could address these standards do not exist or are unable to develop them.</td></tr>
<tr><td>Structure</td><td colspan="3">/</td></tr>
<tr><th colspan="4">Standardization work</th></tr>
<tr><td>Published standards</td><td colspan="3">Number of published ISO/IEC standards under the direct responsibility of JTC 1/SC 38 (number includes updates): 0</td></tr>
<tr><td>Standards under development</td><td colspan="3">5</td></tr>
<tr><th colspan="4">Involvement of Luxembourg</th></tr>
<tr><td colspan="4">2 delegate

- Mr. Joseph Emeras ANEC GIE
- Mr. Sune Nielsen ANEC GIE</td></tr>
</table>

Comments

This WG been established during the 2014 ISO/IEC JTC 1 plenary meeting.

The current WG 10 work program includes the following projects:

- ISO/IEC NP 20924, Information technology -- Internet of Things -- Definition and Vocabulary;
- ISO/IEC WD 30141, Information technology -- Internet of Things -- Internet of Things Reference Architecture (IoT RA).

Moreover, the working group is currently studying the possibility to develop a new International Standard on the IoT interoperability.

Note: ISO/IEC JTC 1/SC 31 is currently developing International Standards for the IoT in the supply chain, in liaison with ISO/IEC JTC 1/WG 10.

7.11.2. ETSI/TC SmartM2M

General information			
Committee	**SmartM2M**	**Title**	**Smart Machine-to-Machine Communication**
Creation date	/	**MEMBERS** 	/
Chairperson	Mr. Enrico Scarrone		
Organizations in liaison	ATIS, Broadband Forum, CCC, CCSA, CEN, CENELEC, Continua Health Alliance, ESMIG, GCF, GIFSI, GSMA, HGI, IEEE, IPSO Alliance, ISO/IETF, ITU, NIST, OASIS, OMA, T&D Europe, TIA, TSDSI, TTA, TTC, ULE Alliance		
Web site	http://portal.etsi.org/portal/server.pt/community/SmartM2M		
Scope	TC Smart M2M aims at referring to existing work done elsewhere, or encouraging existing groups to fulfil SmartM2M requirements. The TC undertakes necessary work that is not being provided for elsewhere. The activities of TC Smart M2M include: - Be a center of expertise in the area of M2M and Internet of Things (IoT) to support M2M services and applications; - Maintain ETSI M2M published specifications; - Produce specifications as needed for regulatory purposes; - Transpose the output of oneM2M to TC M2M.		
Structure	/		
Standardization work			
Published standards	31		
Standards under development	14		
Involvement of Luxembourg			
NO (no registered delegate)			
Comments			
/			

7.12. BIG DATA

The Big Data Preliminary Report published by ISO/IEC JTC 1[119] defines Big Data as "a data set(s) with characteristics (e.g. volume, velocity, variety, variability, veracity, etc.) that for a particular problem domain at a given point in time cannot be efficiently processed using current/existing/established/traditional technologies and techniques in order to extract value."

Big Data is at the top of the agenda of numbers of ICT stakeholders. Analytical functions that will be performed on these large amounts of data will allow the production of new knowledge, offering great promises in terms of applications in all the economic sectors.

[119] *Based on the Preliminary Report on Big Data submitted to the 2014 ISO/IEC JTC 1 Plenary by the ISO/IEC JTC 1/SG 2 on Big Data. This SG has been replaced at the end of 2014 by the WG 9 on Big Data*

7.12.1. ISO/IEC JTC 1/WG 9

General information			
Committee	**ISO/IEC JTC 1/WG 9**	**Title**	**Big Data**
Creation date	2014	**MEMBERS** 	**Participating countries (22):** United States, Australia, Austria, Brazil, Canada, China, Finland, France, Germany, India, Ireland, Italy, Japan, Republic of Korea, **Luxembourg**, Netherlands, Norway , Russian Federation, Singapore, Spain, Sweden, United Kingdom
Secretariat	United States (ANSI)		
Secretary	Ms. Jennifer Garner		
Chairperson	Mr. Wo Chang		
Organizations in liaison	IIC, ITU		
Web site	http://isotc.iso.org/livelink/livelink/open/jtc1wg9		
Scope	The ISO/IEC JTC 1/WG 10 has been established with the following Terms of Reference: - Serve as the focus of and proponent for JTC 1's Big Data standardization program. - Develop foundational standards for Big Data ---including reference architecture and vocabulary standards---for guiding Big Data efforts throughout JTC 1 upon which other standards can be developed. - Develop other Big Data standards that build on the foundational standards when relevant JTC 1 subgroups that could address these standards do not exist or are unable to develop them. - Identify gaps in Big Data standardization. - Develop and maintain liaisons with all relevant JTC 1 entities as well as with any other JTC 1 subgroup that may propose work related to Big Data in the future. - Identify JTC 1 (and other organization) entities that are developing standards and related material that contribute to Big Data, and where appropriate, investigate ongoing and potential new work that contributes to Big Data. - Engage with the community outside of JTC 1 to grow the awareness of and encourage engagement in JTC 1 Big Data standardization efforts within JTC 1, forming liaisons as is needed.		
Structure	/		
Standardization work			
Published standards	Number of published ISO/IEC standards under the direct responsibility of JTC 1/WG 9 (number includes updates): 0		
Standards under development	6		
Involvement of Luxembourg			
6 delegates - Mr. Johnatan Pecero ANEC GIE - Mr. Joseph Emeras ANEC GIE - Mr. Sune Nielsen ANEC GIE - Mr. Emmanuel Kieffer University of Luxembourg - Mrs. Aida Horaniet Docler Holding S.à r.l. - Mrs. Natalia Cassagnes Actimage			

Comments

The current WG 9 work program includes the development of two foundational International Standard:

- ISO/IEC NP 20546, Big Data -- Definition and Vocabulary;
- ISO/IEC NP 20547, which specifies the Big Data Reference Architecture (BDRA) and includes the Big Data roles, activities, and functional components and their relationships. It is composed of 5 parts:
    - ISO/IEC AWI TR 20547-1, Information technology -- Big Data Reference Architecture -- Part 1: Framework and Application Process;
    - ISO/IEC AWI TR 20547-2, Information technology -- Big Data Reference Architecture -- Part 2: Use Cases and Derived Requirements;
    - ISO/IEC AWI 20547-3, Information technology -- Big Data Reference Architecture -- Part 3: Reference Architecture;
    - ISO/IEC AWI 20547-4, Information technology -- Big Data Reference Architecture -- Part 4: Security and Privacy Fabric (under the responsibility of ISO/IEC JTC 1/SC 27);
    - ISO/IEC NP TR 20547-5, Information technology -- Big Data Reference Architecture -- Part 5: Standards Roadmap.

7.13. SMART CITIES

There are many definitions of a smart city and many designations that rely to the same concept. ISO/TC 268 prefers the expression "smart community infrastructure". It proposes the following definition of this concept: "a community infrastructure with enhanced technological performance that is designed, operated, and maintained to contribute to sustainable development and resilience of the community"[120].

Smart Cities have many dimensions and encompass many economic sectors and technologies. Different dimensions are proposed for a smart city (e.g.: smart economy, smart mobility, smart environment, smart people, smart living, smart governance, etc.). In this frame we can consider a smart city as a system of systems, meaning it is a complex construction that requires the development of many other technologies (e.g.: Internet of Things, Big Data, Intelligent Transport Systems, etc.).

The standardization issues are thus numerous and do not only concern ICT, which can be seen as a facilitator to help the city to become smart.

[120] *Definition available in ISO/TS 37151:2015, Smart community infrastructures -- Principles and requirements for performance metrics*

7.13.1. ISO/IEC JTC 1/WG 11

<table>
<tr><th colspan="4">General information</th></tr>
<tr><td>Committee</td><td>ISO/IEC JTC 1/WG 11</td><td>Title</td><td>Smart Cities</td></tr>
<tr><td>Creation date</td><td>2016</td><td rowspan="5">MEMBERS
  </td><td rowspan="5">Participating countries (15):
China, Austria, Canada, Finland, Germany, Italy, Japan, Luxembourg, Netherlands, Norway, Russian Federation, Singapore, Sweden, United Kingdom, United States</td></tr>
<tr><td>Secretariat</td><td>SAC (China)</td></tr>
<tr><td>Secretary</td><td>Ms. Tangli Liu</td></tr>
<tr><td>Chairperson</td><td>Mr. Yuan Yuan</td></tr>
<tr><td>Organizations in liaison</td><td>/</td></tr>
<tr><td>Web site</td><td colspan="3">http://isotc.iso.org/livelink/livelink?func=ll&objId=17573020</td></tr>
<tr><td>Scope</td><td colspan="3">ISO/IEC JTC 1/WG 11 has the following terms of reference:
- Serve as the focus of and proponent for JTC 1's Smart Cities standardization program;
- Develop foundational standards for the use of ICT in Smart Cities - including the Smart City ICT Reference Framework and an Upper Level Ontology for Smart Cities - for guiding Smart Cities efforts throughout JTC 1 upon which other standards can be developed;
- Develop a set of ICT related indicators for Smart Cities in collaboration with ISO/TC 268;
- Develop additional Smart Cities' standards and other deliverables that build on these foundational standards;
- Identify JTC 1 (and other organization) subgroups that are developing standards and related material that contribute to Smart Cities, and where appropriate, investigate ongoing and potential new work that contributes to Smart Cities;
- Develop and maintain liaisons with all relevant JTC 1 subgroups;
- Engage with the community outside of JTC 1 to grow the awareness of, and encourage engagement in, JTC 1 Smart Cities standardization efforts within JTC 1, forming liaisons as is needed;
- Ensure a strong relationship with Smart Cities activities in ISO and IEC.</td></tr>
<tr><td>Structure</td><td colspan="3">/</td></tr>
<tr><th colspan="4">Standardization work</th></tr>
<tr><td>Published standards</td><td colspan="3">Number of published ISO/IEC standards under the direct responsibility of JTC 1/WG 11 (number includes updates): 0</td></tr>
<tr><td>Standards under development</td><td colspan="3">2</td></tr>
<tr><th colspan="4">Involvement of Luxembourg</th></tr>
<tr><td colspan="4">3 delegates

- Mr. Joseph Emeras ANEC GIE
- Mr. Sune Nielsen ANEC GIE
- Mr. José Garcia Saez Wizata S.A.</td></tr>
</table>

Comments

The creation of ISO/IEC JTC 1/WG 11 "Smart Cities" has been decided during the last ISO/IEC JTC 1 Plenary Meeting (October 2015) and approved in March 2016.

The working group has already approved two first projects of International Standards:

- ISO/IEC AWI 30145, Smart city ICT reference framework. This project of International Standard would help in the management of a smart city from the viewpoint of a city CIO.
- ISO/IEC AWI 30146, Smart city ICT indicators. This project is to develop an evaluation indicator system and an evaluation model of Smart City from the ICT perspective to help the stakeholders to measure the process and outcome of Smart City construction.

Moreover, another project under the direct responsibility of ISO/IEC JTC 1 is currently under approbation: ISO/IEC DIS 30182, Smart city concept model -- Guidance for establishing a model for data interoperability.

7.13.2. ISO/TC 268

General information			
Committee	**ISO/TC 268**	**Title**	**Sustainable Cities and communities**
Creation date	2012	**MEMBERS** 	**Participating countries (26):** France, Austria, Barbados, Canada, Chile, China, Czech Republic, Denmark, Egypt, Germany, India, Israel, Japan, Kazakhstan, Kenya, Mauritius, Mexico, Netherlands, Norway, Russian Federation, South Africa, Spain, Sri Lanka, Sweden, United Kingdom, United States **Observing Countries (22):** Argentina, Belgium, Brazil, Colombia, Cyprus, Finland, Islamic Republic of Iran, Republic of Korea, Lebanon, **Luxembourg**, Macao, Malaysia, Mongolia, Poland, Portugal, Senegal, Singapore, Switzerland, Thailand, Trinidad and Tobago, Turkey, United Arab Emirates
Secretariat	AFNOR (France)		
Secretary	Mr. Bernard Leservoisier		
Chairperson	Mr. Jacques Lair		
Organizations in liaison	FIDIC, GCIF, ICLEI, UNEP, APEC		
Web site	http://www.iso.org/iso/home/standards_development/list_of_iso_technical_committees/iso_technical_committee.htm?commid=656906		
Scope	Standardization in the field of Sustainable Cities and Communities will include the development of requirements, frameworks, guidance and supporting techniques and tools related to the achievement of sustainable development considering smartness and resilience, to help all Cities and Communities and their interested parties in both rural and urban areas become more sustainable. Note: TC 268 will contribute to the UN Sustainable Development Goals through its standardization work The proposed series of International Standards will encourage the development and implementation of holistic and integrated approaches to sustainable development and sustainability.		
Structure	ISO/TC 268/CAG 1 — Chairman Advisory Group ISO/TC 268/TG 1 — Awareness-raising, communication and promotion ISO/TC 268/WG 1 — Management System Standards ISO/TC 268/WG 2 — City indicators ISO/TC 268/WG 3 — Vocabulary ISO/TC 268/WG 4 — Strategies for smart cities and communities ISO/TC 268/SC 1 — Smart community infrastructures		
Standardization work			
Published standards	3		
Standards under development	9		

Involvement of Luxembourg

1 delegate

- Mr. Claudio Fiandrino University of Luxembourg

Comments

ISO/TC 268 has already published three standards:

- ISO 37120:2014, Sustainable development of communities -- Indicators for city services and quality of life;
- ISO/TR 37150:2014, Smart community infrastructures -- Review of existing activities relevant to metrics;
- ISO/TS 37151:2015, Smart community infrastructures -- Principles and requirements for performance metrics.

Standards under development:

- ISO/PRF 37101, Sustainable development in communities -- Management system for sustainable development -- Requirements with guidance for use;
- ISO/DIS 37102, Sustainable development and resilience of communities – Vocabulary;
- ISO/AWI 37104, Sustainable development in communities -- Guide to establishing strategies for smart cities and communities;
- ISO/WD 37120, Sustainable development of communities -- Indicators for city services and quality of life;
- ISO/DTR 37121, Sustainable development in communities -- Inventory and review of existing indicators on sustainable development and resilience in cities;
- ISO/NP 37122, Sustainable development in communities -- Indicators for Smart Cities;
- ISO/NP 37123, Sustainable Development in Communities -- Indicators for Resilient Cities;
- ISO/PRF TR 37152, Smart community infrastructures -- Common framework for development and operation (under the responsibility of ISO/TC 268/SC 1);
- ISO/CD 37154, Smart community infrastructures -- Best practice guidelines for transportation (under the responsibility of ISO/TC 268/SC 1).

7.14. TECHNICAL COMMITTEES NOT RELATED TO SUBSECTORS

The standards watch has identified 11 technical committees that are focused on ICT standardization but that are not related to any defined subsector. Although these committees are not related to the current subsectors, they might be of interest for the stakeholders.

7.14.1. ISO/IEC JTC 1

<table>
<tr><th colspan="4">General information</th></tr>
<tr><td>Committee</td><td>ISO/IEC JTC 1</td><td>Title</td><td>Information technology</td></tr>
<tr><td>Creation date</td><td>1987</td><td rowspan="6">MEMBERS
  </td><td rowspan="6">Participating countries (32):
United States, Australia, Austria, Belgium, Canada, China, Czech Republic, Côte d'Ivoire, Denmark, Finland, France, Germany, India, Ireland, Italy, Japan, Kazakhstan, Republic of Korea, Lebanon, Malaysia, Malta, Netherlands, Nigeria, Norway, Russian Federation, Singapore, South Africa, Spain, Sweden, Switzerland, United Arab Emirates, United Kingdom

Observing countries (63):
Algeria, Argentina, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Brazil, Bulgaria, Chile, Colombia, The Democratic Republic of Congo, Costa Rica, Croatia, Cuba, Cyprus, Egypt, El Salvador, Estonia, Ethiopia, Ghana, Greece, Hong Kong, Hungary, Iceland, Indonesia, Islamic Republic of Iran, Israel, Kenya, Democratic People's Republic of Korea, Libya, Lithuania, Luxembourg, Mauritius, Mexico, Republic of Moldova, Mongolia, Montenegro, Morocco, New Zealand, Pakistan, State of Palestine, Peru, Philippines, Poland, Portugal, Romania, Rwanda, Saudi Arabia, Serbia, Slovakia, Slovenia, Sri Lanka, Swaziland, Thailand, The former Yugoslav Republic of Macedonia, Tunisia, Turkey, Uganda, Ukraine, Uruguay, Uzbekistan, Viet Nam, Zimbabwe</td></tr>
<tr><td>Secretariat</td><td>ANSI (United States)</td></tr>
<tr><td>Secretary</td><td>Ms. Lisa Rajchel</td></tr>
<tr><td>Chairperson</td><td>Ms. Karen Higginbottom</td></tr>
<tr><td>Organizations in liaison</td><td>EC, Ecma International, ITU, AIM Global, W3C, DEWI, OGC, OMG, GS1, IEEE, The Open Group</td></tr>
<tr><td>Web site</td><td colspan="3">http://www.iso.org/iso/fr/jtc1_home</td></tr>
<tr><td>Scope</td><td colspan="3">Standardization in the field of information technology</td></tr>
<tr><td>Structure</td><td colspan="3">ISO/IEC JTC 1/JAG — JTC 1 Advisory Group
ISO/IEC JTC 1/WG 7 — Sensor Networks
ISO/IEC JTC 1/WG 9 — Big Data
ISO/IEC JTC 1/WG 10 — Internet of Things (IoT)
ISO/IEC JTC 1/WG 11 — Smart Cities
ISO/IEC JTC 1/SC 2 — Coded character sets
ISO/IEC JTC 1/SC 6 — Telecommunications and information exchange between systems
ISO/IEC JTC 1/SC 7 — Software and systems engineering
ISO/IEC JTC 1/SC 17 — Cards and personal identification
ISO/IEC JTC 1/SC 22 — Programming languages, their environments, and system software interfaces
ISO/IEC JTC 1/SC 23 — Digitally Recorded Media for Information Interchange and Storage
ISO/IEC JTC 1/SC 24 — Computer graphics, image processing, and environmental data representation
ISO/IEC JTC 1/SC 25 — Interconnection of information technology equipment
ISO/IEC JTC 1/SC 27 — IT Security techniques
ISO/IEC JTC 1/SC 28 — Office equipment
ISO/IEC JTC 1/SC 29 — Coding of audio, picture, multimedia and hypermedia information</td></tr>
</table>

	ISO/IEC JTC 1/SC 31	Automatic identification and data capture techniques
	ISO/IEC JTC 1/SC 32	Data management and interchange
	ISO/IEC JTC 1/SC 34	Document description and processing languages
	ISO/IEC JTC 1/SC 35	User interfaces
	ISO/IEC JTC 1/SC 36	Information technology for learning, education and training
	ISO/IEC JTC 1/SC 37	Biometrics
	ISO/IEC JTC 1/SC 38	Cloud Computing and Distributed Platforms
	ISO/IEC JTC 1/SC 39	Sustainability for and by Information Technology
	ISO/IEC JTC 1/SC 40	IT Service Management and IT Governance

Standardization work

Published standards	Total number of published ISO/IEC standards related to the technical committee and its SCs (number includes updates): 2947 Number of published ISO/IEC standards under the direct responsibility of JTC 1 (number includes updates): 446
Standards under development	Total number of standards under development related to the technical committee and its SCs: 548 Number of standards under development under the direct responsibility of JTC 1: 67

Involvement of Luxembourg

4 delegates

- Mr. Nicolas Domenjoud	ANEC GIE
- Mr. Johnatan Pecero	ANEC GIE
- Mr. Joseph Emeras	ANEC GIE
- Mr. Sune Nielsen	ANEC GIE

Comments

ISO/IEC JTC 1 is currently the main standardization committee in the information and communication technology domain, regarding the number of published standards and the number of standards users. Among the standards developed by ISO/IEC JTC 1, the following standards are the best-selling at the ISO level[121] (and at ILNAS level concerning the top 3) and therefore particularly relevant for the economic market:

- ISO/IEC 27001:2015, Information technology -- Security techniques -- Information security management systems – Requirements;
- ISO/IEC 27002:2013, Information technology -- Security techniques -- Code of practice for information security management;
- ISO/IEC 27005:2011, Information technology -- Security techniques -- Information security risk management;
- ISO/IEC 27018:2014, Information technology -- Security techniques -- Code of practice for protection of personally identifiable information (PII) in public clouds acting as PII processors;
- ISO/IEC 20000-1:2011, Information technology -- Service management -- Part 1: Service management system requirements;
- ISO/IEC 27000:2014, Information technology -- Security techniques -- Information security management systems – Overview and vocabulary;
- ISO/IEC 27003:2010, Information technology -- Security techniques -- Information security management system implementation guidance;
- ISO/IEC 27004:2009, Information technology -- Security techniques -- Information security management – Measurement;
- ISO/IEC 25010:2011, Systems and software engineering -- Systems and software Quality Requirements

[121] Source: ISO Customer Services

and Evaluation (SQuaRE) -- System and software quality models;
- ISO/IEC 27035:2011, Information technology -- Security techniques -- Information security incident management.

ISO/IEC JTC 1 also benefits from the rapid, market-driven work of *de facto* standards-setting organizations and industry *consortia*. This is amplified by having many technical experts participating not only in national standardization bodies but also in key *de facto* standards-setting bodies and industrial *fora*. Liaising and cooperating extends the expertise of ISO/IEC JTC 1's subcommittees and provides feedback on how ISO/IEC JTC 1 standards are being used. It also helps identify any gaps or inconsistencies that need to be addressed. By working with other standards-setting organizations (SDOs), ISO/IEC JTC 1's ability to serve an integration function is enhanced[122].

ISO/IEC JTC 1/JAG – JTC 1 Advisory Group

The JAG has been established with Resolution 11 of the JTC 1 Plenary meeting in 2015. Its role is to advise and support the JTC 1 Chair in pursuit of the JTC 1 mission and objectives. It replaces the former SWG of JTC 1 (ISO/IEC JTC 1/SWG 2 - Directives, ISO/IEC JTC 1/SWG 3 - Planning and ISO/IEC JTC 1/SWG 6 – Management).

The work of the JTC 1 Advisory Group is expected to have four major components:
1. Strategic: Strategic deals with longer term issues of JTC 1 strategic planning, work program and mandate;
2. Managerial/steering: Managerial deals with the review and evaluation of JTC 1's near-term organizational effectiveness, and the structure and scope of JTC 1 entities;
3. Operational: Operational deals with day-to-day functioning of JTC 1 and its entities in support of their current objectives, and in particular with evolution of the Consolidated JTC 1 Supplement and Standing Documents to provide clear and consistent rules for JTC 1 standardization;
4. Communications/outreach/marketing: Outreach deals with external communications and promotion of JTC 1.

The 2015 JTC 1 Plenary established the JAG with the following Terms of Reference:

1. Strategic activities
1) Review JTC 1's strategic objectives and relationships with ISO, IEC and the broader ICT community and revise the JTC 1 Strategic Business Plan accordingly
    a. socialize the JTC 1 Strategic Business Plan with the SCs for incorporation in the SC Business Plans where appropriate
    b. socialize the JTC 1 Strategic Business Plan and SC Business Plans with external entities
2) Develop forward-looking concepts for standards development and identify future work areas of interest to JTC 1 (e.g., through the environmental scan exercise), and provide recommendations to JTC 1
3) Monitor, evaluate and interact with strategy development activities of liaison organizations and other SDOs
4) Work with SC chairs and management teams to identify business areas within or close to the scope of an SC that may be suitable for standards development
5) Identify and recommend entities outside of JTC 1 for JTC 1 participation, such as IEC Systems activities, TMB SAGs, regional organizations or standards events, etc.

2.Managerial and steering activities
1) Monitor the implementation of existing procedures, evaluating their effectiveness and make proposals for changes where found necessary.
2) Review and evaluate the JTC 1 structure on a regular basis
3) Develop recommendations on management aspects of JTC 1 and recommend actions to JTC 1 to successfully execute the JTC 1 strategic business plan
4) Review issues arising from overlapping/conflicting scopes, activities and projects as well as disagreements over project assignments and work with JTC 1 subgroup chairs and convenors to reach acceptable resolutions
5) Quantitatively monitor the health of the organization with metrics (e.g., NP submissions, P-

[122] JTC1 Vision, Mission and Principles, 2014

memberships etc.)

6) Maintain the JTC 1 Incubator Operating Principles document,, support the JTC 1 Incubator function and perform the operational functions of a Parent Group, in cases where JTC 1 is designated as the Parent Group of an Incubator Group
7) Coordinate JTC 1 participation in approved activities outside of JTC 1, provide briefs and disseminate reports
8) Develop and maintain the JTC 1 Systems Integration guidelines document
9) Facilitate JTC 1 projects in the Systems Integration domain and interact with system integration activities in SDOs such as ISO, IEC or ITU-T
10) Manage the relationship with JTC 1 liaison organizations and officers and PAS relationships (mentors etc.)

3.Operational efficiency activities

1) Cooperate with ISO and IEC in the development of harmonized procedures, bring innovative concepts forward for their consideration and represent JTC 1 at the Joint Directives Maintenance Team
2) Align the Consolidated JTC 1 Supplement and JTC 1 Standing Documents with ISO/IEC procedures as much as possible, provide clear and consistent rules for JTC 1 operations where ISO and IEC have divergent procedures
3) Provide advice on matters of operational efficiency and management to JTC 1, in particular recommend improvements to the JTC 1 procedural documents (Consolidated JTC 1 Supplement and Standing Documents)
4) Maintain the JTC 1 forms and templates

4.Communications, outreach and marketing activities

1) Grow the awareness of those outside JTC 1 in standardization efforts within JTC 1, including system integration activities
2) Seek and engage the wider community where relevant expertise is outside JTC 1
3) Provide education and mentoring on JTC 1 operations and training on the procedures, review the effective distribution of public information on JTC 1 activities and make suggestions for improvements
4) Engage in marketing activities and outreach

7.14.2. ISO/IEC JTC 1/SC 28

General information			
Committee	**ISO/IEC JTC 1/SC 28**	**Title**	**Office equipment**
Creation date	1989	**MEMBERS** 	**Participating Countries (11):** Japan, Austria, China, Germany, Italy, Republic of Korea, Netherlands, Philippines, Russian Federation, United Kingdom, United States **Observing Countries (20):** Argentina, Belgium, Bosnia and Herzegovina, Czech Republic, Finland, France, Ghana, Hungary, India, Indonesia, Islamic Republic of Iran, Kazakhstan, Kenya, Poland, Romania, Saudi Arabia, Serbia, South Africa, Switzerland, Thailand
Secretariat	JISC (Japan)		
Secretary	Mr. Takashi Ito		
Chairperson	Mr. Akira Saito		
Organizations in liaison	CIE, Ecma International, ICC, WMO		
Web site	http://www.iso.org/iso/standards_development/technical_committees/list_of_iso_technical_committees/iso_technical_committee.htm?commid=45314		
Scope	Standardization of basic characteristics, test methods and other related items of products such as 2D and 3D Printers/Scanners, Copiers, Projectors, Fax and Systems composed of their combinations, excluding such interfaces as user system interfaces, communication interfaces and protocols.		
Structure	JTC 1/SC 28/AG Advisory Group JTC 1/SC 28/WG 2 Consumables JTC 1/SC 28/WG 3 Productivity JTC 1/SC 28/WG 4 Image quality assessment JTC 1/SC 28/WG 5 Office Colour		
Standardization work			
Published standards	Number of published ISO/IEC standards under the direct responsibility of JTC 1/SC 28 (number includes updates): 50		
Standards under development	5		
Involvement of Luxembourg			
NO (no registered delegate)			
Comments			

Inventory of published ISO/IEC JTC 1/SC 28 standards concerns specification sheets descriptors, productivity (throughput) measurement methods, printed image quality evaluation methods, toner/ink cartridges yield measurement methods, declaration of quality of product made of reused parts and accessibility guidelines for office equipment.

The fact that the frontier of ISO/IEC JTC 1/SC 28 is contiguous with scopes of ISO/TC 42, TC 130 necessitates tight liaisons with those technical committees among others. Also, ISO/IEC JTC 1/SC 28 is member of the ISO/TC 130/JWG 14 (Joint ISO/TC 130 - ISO/TC 42 - ISO/IEC JTC 1/SC 28 WG: Print quality measurement methods).

7.14.3. ISO/IEC JTC 1/SC 35

General information			
Committee	**ISO/IEC JTC 1/SC 35**	**Title**	**User interfaces**
Creation date	1998	**MEMBERS** 	**Participating Countries (20):** France, Canada, China, Denmark, Finland, Germany, Greece, India, Italy, Japan, Republic of Korea, Netherlands, Russian Federation, South Africa, Spain, Sweden, Switzerland, Ukraine, United Kingdom, United States **Observing Countries (16):** Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Czech Republic, Ghana, Hungary, Indonesia, Islamic Republic of Iran, Ireland, Israel, Kenya, New Zealand, Poland, Romania, Serbia
Secretariat	AFNOR (France)		
Secretary	Mrs. Laurence Douvillé		
Chairperson	Dr. Khalid Choukri		
Organizations in liaison	ITU, W3C		
Web site	http://www.iso.org/iso/standards_development/technical_committees/list_of_iso_technical_committees/iso_technical_committee.htm?commid=45382		
Scope	Standardization in the field of user-system interfaces in information and communication technology (ICT) environments and support for these interfaces to serve all users, including people having accessibility or other specific needs, with a priority of meeting the JTC 1 requirements for cultural and linguistic adaptability. This includes: - User interface accessibility (requirements, needs, methods, techniques and enablers); - Cultural and linguistic adaptability and accessibility (such as evaluation of cultural and linguistic adaptability of ICT products, harmonized human language equivalents, localization parameters, voice messaging menus, etc.); - User interface objects, actions and attributes; - Methods and technologies for controlling and navigating within systems, devices and applications in visual, auditory, tactile and other sensorial modalities (such as by voice, vision, movement, gestures, etc.); - Symbols, functionality and interactions of user interfaces (such as graphical, tactile and auditory icons, graphical symbols and other user interface elements); - Visual, auditory, tactile and other sensorial input and output devices and methods in ICT environments (for devices such as keyboards, displays, mice, etc.); - User interfaces for mobile devices, hand-held devices and remote interactions.		
Structure	JTC 1/SC 35/WG 1 Keyboards and input interfaces JTC 1/SC 35/WG 2 Graphical user interface and interaction JTC 1/SC 35/WG 4 User interfaces for mobile devices JTC 1/SC 35/WG 5 Cultural and linguistic adaptability JTC 1/SC 35/WG 6 User interfaces accessibility JTC 1/SC 35/WG 7 User interfaces object, actions and attributes JTC 1/SC 35/WG 8 User interfaces for remote interactions		
Standardization work			
Published standards	Number of published ISO/IEC standards under the direct responsibility of JTC 1/SC 35 (number includes updates): 61		
Standards under development	15		

Involvement of Luxembourg
NO (no registered delegate)
Comments
SC 35 is currently increasing its activity in the field of Voice commands (ISO/IEC 30122 series) and Gesture-based interfaces (ISO/IEC 30113 series), while considering further development in the field of User interface components accessibility (ISO/IEC 20071 series). Examples of standards developed by ISO/IEC JTC 1/SC 35 are: - ISO/IEC 9995-1:2009, Information technology -- Keyboard layouts for text and office systems -- Part 1: General principles governing keyboard layouts; - ISO/IEC TR 11581-1:2011, Information technology -- User interface icons -- Part 1: Introduction to and overview of icon standards; - ISO/IEC 18036:2003, Information technology -- Icon symbols and functions for World Wide Web browser toolbars; - ISO/IEC 30113-1:2015, Information technology -- User interface -- Gesture-based interfaces across devices and methods -- Part 1: Framework.

7.14.4. ISO/IEC JTC 1/SC 36

<table>
<tr><th colspan="4">General information</th></tr>
<tr><td>Committee</td><td>ISO/IEC JTC 1/SC 36</td><td>Title</td><td>Information technology for learning, education, and training</td></tr>
<tr><td>Creation date</td><td>1999</td><td rowspan="5">MEMBERS
  </td><td rowspan="5">Participating Countries (25):
Republic of Korea, Algeria, Australia, Canada, China, Denmark, Finland, France, Germany, India, Italy, Japan, Kenya, Netherlands, Norway, Portugal, Russian Federation, Slovakia, South Africa, Spain, Sweden, Tunisia, Uganda, Ukraine, United Kingdom

Observing Countries (20):
Argentina, Belgium, Bosnia and Herzegovina, Colombia, Czech Republic, Ghana, Hong Kong, Hungary, Indonesia, Islamic Republic of Iran, Ireland, Kazakhstan, Luxembourg, New Zealand, Romania, Saudi Arabia, Serbia, Switzerland, Turkey, United States</td></tr>
<tr><td>Secretariat</td><td>KATS (Republic of Korea)</td></tr>
<tr><td>Secretary</td><td>Ms. Eunsook Kim</td></tr>
<tr><td>Chairperson</td><td>Mr. Erlend Øverby</td></tr>
<tr><td>Organizations in liaison</td><td>ADL, AICC, AUF, IMS, Infoterm, LETSI, LTSC, Cartago Alliance, INLAC</td></tr>
<tr><td>Web site</td><td colspan="3">http://www.iso.org/iso/standards_development/technical_committees/list_of_iso_technical_committees/iso_technical_committee.htm?commid=45392</td></tr>
<tr><td>Scope</td><td colspan="3">Standardization in the field of information technologies for learning, education, and training to support individuals, groups, or organizations, and to enable interoperability and reusability of resources and tools.

Excluded from this scope are:
- Standards or technical reports that define educational standards (competencies), culturalconventions, learning objectives, or specific learning content;
- Work done by other ISO or IEC TCs, SCs, or WGs with respect to their component, specialty, or domain. Instead, when appropriate, normative or informative references to other standards shall be included. Examples include documents on special topics such as multimedia, web content, cultural adaptation, and security.</td></tr>
<tr><td>Structure</td><td colspan="3">JTC 1/SC 36/AG 1 Business planning and communications
JTC 1/SC 36/WG 1 Vocabulary
JTC 1/SC 36/WG 2 Collaborative technology
JTC 1/SC 36/WG 3 Learner information
JTC 1/SC 36/WG 4 Management and delivery of learning, education and training
JTC 1/SC 36/WG 5 Quality assurance and descriptive frameworks
JTC 1/SC 36/WG 6 Platform, Services, and specification integration
JTC 1/SC 36/WG 7 ITLET - Culture, language and individual needs
JTC 1/SC 36/WG 8 Learning Analytics Interoperability</td></tr>
<tr><th colspan="4">Standardization work</th></tr>
<tr><td>Published standards</td><td colspan="3">Number of published ISO/IEC standards under the direct responsibility of JTC 1/SC 36 (number includes updates): 40</td></tr>
<tr><td>Standards under development</td><td colspan="3">13</td></tr>
</table>

Involvement of Luxembourg

1 delegate

- Mrs. Marie-Rose Decker Luxair S.A.

Comments

The current work program of ISO/IEC JTC 1/SC 36 notably includes:

- ISO/IEC PRF TR 18120, Information technology -- Learning, education, and training -- The requirements for e-Textbooks in education;
- ISO/IEC PDTR 20821, Learning environment components for automated contents adaptation;
- ISO/IEC DIS 40180, Information technology -- Learning, education and training -- Quality for learning, education and training -- Fundamentals and reference framework;
- ISO/IEC NP 40183, Information technology -- Learning, education and training -- Quality management, assurance and metrics.

7.14.5. CEN/TC 247

General information			
Committee	**CEN/TC 247**	**Title**	**Building Automation, Controls and Building Management**
Creation date	1990	**MEMBERS** 	33 members of CEN/CENELEC
Secretariat	SNV (Switzerland)		
Secretary	Ms. Barbara Mullis		
Chairperson	Mr. Roland Ullmann		
Organizations in liaison	/		
Web site	http://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP_ORG_ID:6228&cs=1B5974C9B3FD83E512BE27B1A4221DC20		
Scope	CEN/TC247 is responsible for the standardization of Building Automation and Controls (BAC) and Building Management (BM) including Open Data Communication for residential and non-residential buildings. These standards include the definitions, requirements, functionality and test methods of building automation products and systems for automatic control of building services installations and the primary integration measures including application interfaces, systems and services to ensure an efficient technical, commercial and infrastructural building management.		
Structure	CEN/TC 247/WG 3 CEN/TC 247/WG 4 CEN/TC 247/WG 6	Building Automation and Control and Building Management Systems Open System Data Transmission Electronic control equipment for HVAC applications, integrated room automation, controls and management systems	
Standardization work			
Published standards	22		
Standards under development	17		
Involvement of Luxembourg			
NO (no registered delegate)			
Comments			

The structure of the CEN/TC 247 and its working group covers all the standardization needs and requirements in the field of Building Automation, Controls and Building Management.

The CEN/TC 247 has currently the following work program:

- At international level the standard series EN ISO 16484 is carried out by CEN/TC 247, ISO/TC205 "Building environment design" and ISO/TC 205/WG3 "Building control systems design". CEN/TC 247 has an efficient liaison with ISO/TC 205 and the work of both TCs is covered by the Vienna Agreement. The lead of most work items are taken by CEN;
- For standardizing in the field of Home Automation CEN/TC 247 has an efficient liaison with CENELEC/TC 205 "Home and Building Electronic Systems (HBES)" especially for Home and Building Control Networks;

- Standards for requirements of electromagnetic compatibility, electrical safety and environmental conditions in BACS and HBES have been developed by the Joint Working Group "General Technical Requirements" of CEN/TC 247 and CENELEC /TC205;
- The CEN/TC 247 standardization activities, reflecting the requirements and test set ups, especially for energy efficient products and systems, supports the European certification schema and quality assurance system of the Building Automation Industry;
- CEN/TC 247 is also strongly involved in the development of standards under the Mandate M/480 for the elaboration and adoption of standards for a methodology calculating the integrated energy performance of buildings and promoting the energy efficiency of buildings.

7.14.6. CEN/TC 251

General information			
Committee	**CEN/TC 251**	**Title**	**Health Informatics**
Creation date	1990	**MEMBERS** 	33 members of CEN/CENELEC
Secretariat	NEN (Netherlands)		
Secretary	Mrs. Shirin Golyardi		
Chairperson	Mr. Robert Stegwee		
Organizations in liaison	COCIR, EC, GS1, HL7, EN13606 Association		
Web site	http://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP_ORG_ID:6232&cs=18CA078392807EDD402B798AAEF1644E1		
Scope	Standardization in the field of Health Information and Communications Technology (ICT) to achieve compatibility and interoperability between independent systems and to enable modularity. This includes requirements on health information structure to support clinical and administrative procedures, technical methods to support interoperable systems, as well as requirements regarding safety, security and quality.		
Structure	CEN/TC 251/WG 1 Information models CEN/TC 251/WG 2 Terminology and knowledge representation		
Standardization work			
Published standards	99		
Standards under development	38		
Involvement of Luxembourg			
NO (no registered delegate)			
Comments			

The CEN/TC 251 Health Informatics participates in the development of ISO standards (transposing them into European Standards) in areas where there is specific need and in doing so ensure they meet European requirements. Where necessary it may develop European standards to address regional legislative demands. For example, the existing success which has seen Identification of Medicinal Products (IDMP) be adopted after the EU initiative, and seed-corn resource; which has shown active collaboration between regulators, industry and other SDO's such as HL7 on the 'Individual case safety reporting' and the input to the EU OpenMedicine project.

Specifically, CEN/ TC 251 works in and around EU Directives as there is great need for this in European healthcare enterprises, and these Directives differentiate CEN/TC 251 work and should characterize its contribution to the member states.

7.14.7. CEN/TC 287

General information			
Committee	**CEN/TC 287**	**Title**	**Geographic Information**
Creation date	1991	**MEMBERS** 	33 members of CEN/CENELEC
Secretariat	BSI (United Kingdom)		
Secretary	Mr. Martin Ford		
Chairperson	Dr. Robert Walker		
Organizations in liaison	EU INSPIRE, GEOSS, GMES, ISO, OGC		
Web site	http://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP_ORG_ID:6268&cs=1463041AEB6C5E614A612D0C224DCB350		
Scope	Standardization in the field of digital geographic information for Europe: The committee will produce a structured framework of standards and guidelines, which specify a methodology to define, describe and transfer geographic data and services. This work will be carried out in close cooperation with ISO/TC 211 in order to avoid duplication of work. The standards will support the consistent use of geographic information throughout Europe in a manner that is compatible with international usage. They will support a spatial data infrastructure at all levels in Europe.		
Structure	CEN/TC 287/WG 5	Spatial Data Infrastructure	
Standardization work			
Published standards	48		
Standards under development	11		
Involvement of Luxembourg			
NO (no registered delegate)			
Comments			

The main objective is to facilitate the development and usage of geographical information in Europe by:

- Adopting, when appropriate, the ISO/TC 211 standards series as CEN standards since CEN/TC 287 is the European counterpart of ISO/TC 211 (Geographic information/Geomatics);
- Developing and maintaining standards, specifications and profiles of standards;
- Developing technical guidance and best practice documentation;
- Collaborating with other standards related initiatives;
- Educating the user community and promoting the use of standards for geographic information.

7.14.8. CEN/TC 294

General information			
Committee	**CEN/TC 294**	**Title**	**Communication systems for meters**
Creation date	1991	**MEMBERS** 	33 members of CEN/CENELEC
Secretariat	DIN (Germany)		
Secretary	Mr. Benjamin Hein		
Chairperson	Mr. Ortwin Pfaff		
Organizations in liaison	AQUA, ECOS, ETSI, Marcogaz, ZigBee Alliance		
Web site	http://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP_ORG_ID:6275&cs=142047F7359698DA6A5B4BE4DE6571AF8		
Scope	Standardization of communication interfaces for systems with meters and remote reading of meters for all kind of fluids and energies distributed by network. Secure communication covering data privacy as an inherent property, providing a scalable mechanism for security services, data integrity, authentication and confidentiality.		
Structure	CEN/TC 294/WG 2 CEN/TC 294/WG 4 CEN/TC 294/WG 5 CEN/TC 294/WG 6	Application layer for communication systems for and remote reading of all meters within the scope Data exchange for meters on bus-systems and interface Radio meter data exchange Wireless mesh networking - Communication systems for meter data exchange	
Standardization work			
Published standards	7		
Standards under development	8		
Involvement of Luxembourg			
NO (no registered delegate)			
Comments			

The suite of CEN/TC 294 standards shall guide Member States in the implementation of their national smart metering programs taking into account distinctions between battery and mains-powered meters and differences between architectures that are linked to the particularities regarding the distribution in Member States.

CEN/TC 294 is also responsible for the support of secure communication covering data privacy as an inherent property, providing a scalable mechanism for security services, data integrity, authentication and confidentiality. At the moment CEN/TC 294 responds in its work to the EC/EFTA mandate M/441 in the fields of measuring instruments for the development of an open architecture for utility meters involving communication protocols enabling interoperability.

7.14.9. CEN/TC 428

General information			
Committee	**CEN/TC 428**	**Title**	**e-competences and ICT Professionalism**
Creation date	2007	**MEMBERS** 	33 members of CEN/CENELEC
Secretariat	UNI (Italy)		
Secretary	Ms. Veronica Salsano		
Chairperson	Mr. Fabio Massimo		
Organizations in liaison	/		
Web site	http://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP_ORG_ID:1218399&cs=1600F0DD849DA04F3E3B900863CB58F72		
Scope	Standardization of ICT competences (demonstrated ability to apply knowledge, skills and attitudes to achieve observable results) as needed by organizations, professions and professionals in the ICT domain. The competences are designed for application by ICT service, demand and supply organizations, companies, managers and HR departments, for education institutions and training bodies including higher education, for market watchers and policy makers, for public and private sectors.		
Structure	/		
Standardization work			
Published standards	1		
Standards under development	2		
Involvement of Luxembourg			
NO (no registered delegate)			
Comments			

CEN/TC 428 has recently published a first standard, EN 16234-1, *E-Competence Framework (e-CF) - A common European Framework for ICT Professionals in all industry sectors – Part 1: Framework*. It provides a reference of 40 competences as required and applied at the ICT business related workplace, using a common language for competences, skills and proficiency levels that can be understood across Europe. It is the first sector-specific implementation of the European Qualifications Framework (EQF), a translation tool that helps communication and comparison between qualifications systems in Europe.

It is currently developing two Technical Reports related to this standard:

- FprCEN/TR 16234-2, E-Competence Framework (e-CF) - A common European Framework for ICT Professionals in all industry sectors – Part 2: User guide;
- prCEN/TR 16234-3, E-Competence Framework (e-CF) - A common European Framework for ICT Professionals in all industry sectors - Part 3: Methodology.

7.14.10. CEN/TC 434

General information			
Committee	**CEN/TC 434**	**Title**	**Electronic Invoicing**
Creation date	2014	**MEMBERS** 	33 members of CEN/CENELEC
Secretariat	NEN (Netherlands)		
Secretary	Mr. Jaap van der Marel		
Chairperson	Mr. Andrea Caccia		
Organizations in liaison	/		
Web site	http://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP_ORG_ID:1883209&cs=1E81C9C833655EEDC7010C8D0A2FB786C		
Scope	The Project Committee on Electronic Invoicing will develop the deliverables that will be described in the (final version of the) standardization request by the European Commission (in support of the implementation of the 'proposal for a Directive on electronic invoicing in public procurement'). These deliverables are needed to support the exchange of information by electronic means in support of business processes in the trade of goods and services		
Structure	CEN/TC 434/WG 1 Definition CEN/TC 434/WG 2 Standards CEN/TC 434/WG 3 EU projects input and evaluation of requirements list CEN/TC 434/WG 4 List of syntaxes CEN/TC 434/WG 5 Syntax bindings CEN/TC 434/WG 6 Guidelines at transmission level CEN/TC 434/WG 7 Extension methodology CEN/TC 434/WG 8 Test methodology and test results		
Standardization work			
Published standards	0		
Standards under development	1		
Involvement of Luxembourg			
NO (no registered delegate)			
Comments			

On 6 May 2014, the Directive 2014/55/EU[123] of the European Parliament and of the Council of 16 April 2014 on electronic invoicing in public procurement was published in the Official Journal, which *"request that the relevant European standardization organization draft a European standard for the semantic data model of the core elements of an electronic invoice (the 'European standard on electronic invoicing')*".

In this context, CEN/TC 434 has been created. The draft standardization request contains a very tight timeframe - end of 2016 at the latest - for the development and the adoption the European standard and its ancillary

[123] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014L0055

European standardization deliverables.

CEN/TC 434 is currently developing the European Standard prEN 16931 “Electronic invoicing - Semantic data model of the core elements of an electronic invoice” to answer the standardization request and provide the essential information elements that an electronic invoice needs to ensure legal (including fiscal) compliance and to enable interoperability for cross-border, cross sector and for domestic trade.

7.14.11. CEN/TC 440

General information			
Committee	**CEN/TC 440**	**Title**	**Electronic Public Procurement**
Creation date	2015	**MEMBERS** 	33 members of CEN/CENELEC
Secretariat	DS (Denmark)		
Secretary	Mr. Hans Henrik Køster		
Chairperson	Mr Jostein Fromyr		
Organizations in liaison	/		
Web site	https://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP_ORG_ID:1976650&cs=175E298F320429229DD35C9E22F4E8F76		
Scope	Standardization in the field of e-procurement to support the electronic public procurement processes and their accompanying information flows in the physical and financial supply chain. This is to facilitate end-to-end e-procurement including both Pre-award and Post-award processes for public procurement		
Structure	CEN/TC 440/WG 1 Architecture CEN/TC 440/WG 2 Terminology CEN/TC 440/WG 3 e-Notification CEN/TC 440/WG 4 e-Tendering CEN/TC 440/WG 5 e-Catalogue CEN/TC 440/WG 6 e-Ordering CEN/TC 440/WG 7 e-Fulfillment		
Standardization work			
Published standards	0		
Standards under development	7		
Involvement of Luxembourg			
NO (no registered delegate)			
Comments			

The scope of CEN/TC 440 covers:

- e-notification - Publication of and access to notices related to procurement opportunities such as Prior information Notices, Contract Notices and Contract Award Notices.
- e-access - Electronic access to tender documents and specifications, including electronic access to supporting documents for suppliers in the preparation of a Tender response, e.g. clarifications, questions and answers.
- e-submission - Secure submission of tenders and/or catalogues in electronic format to the contracting body (contracting authority/ contracting entity), which is able to receive and process it in compliance with applicable legal requirements.
- e-evaluation - Evaluation of the electronic tenders and/or catalogues received by the contracting body following the closing deadline of a tender competition, including electronic exchange to support for evaluators to clarify the tender.

- e-awarding - Information exchange regarding award of the contract, including electronic exchange to support tenderers request for additional information about the result of the procedure.
- e-contract - Signing, enactment of a contract / agreement and possibly its related catalogue through electronic means between the contracting authority/entity and the winning tenderer(s), as well as signing of contract amendments and possibly their related catalogue.
- e-sourcing - Activities preparatory to issuing an order. It can consist in exchanging electronic messages with winning tenderers who have signed a framework agreement with the contracting body, a request for quotation and its response (quotation) (e.g. framework agreements with reopening competition), etc. e-ordering - Issuing of an electronic order by the contracting body and its acceptance by the supplier or conversely issuing of an electronic order agreement by the supplier.
- e-fulfilment - Electronic exchange of documents that enable monitoring the execution of the order or the contract.

Deliverables for these processes will support the electronic exchange of information in public procurement as well as in B2B transactions.

Attention will be given to the establishment of a semantic data model and at least one syntax data binding for the application of XML in both pre-award and post-award. The work of CEN/PC 440 will be developed from the deliverables of CEN/BII in alignment with the deliverables of CEN/PC 434. Other initiatives such as ISO/IEC/JTC 1/SC 32, OpenPEPPOL and eSENS will be taken into consideration as appropriate."

7.15. FORA/CONSORTIA

As acknowledged by CEN, many standardization activities in the ICT field are carried out by industry consortia. ICT fora and consortia are developing de facto standards widely spread in the ICT sector.

This work does not pretend to be exhaustive and the fora/consortia analyzed are a selection of the most relevant for the national market. It is important to note that ICT is certainly one of the sectors having the highest number of active SDO. It is thus not realistic to detail and analyze them all.

This section includes:

- *Organizations which have a Category A liaison with ISO/IEC JTC 1. These organizations may propose an existing technical report or technical specification from any source to be submitted for vote as, respectively, a draft technical report or draft technical specification through the fast-track procedure;*
- *The Publicly Available Specifications (PAS) Submitters of ISO/IEC JTC 1. The work quality of these organizations is recognized by ISO/IEC JTC 1, and they are allowed to submit PAS as drafts for review and approval as International ISO/IEC JTC 1 standards[124];*
- *Organizations which have signed a Partner Standards Development Organization (PSDO) Cooperation Agreement (e.g. IEEE-SA). The PSDO cooperation agreement provides opportunities to adopt and jointly develop international standards to serve the global marketplace;*
- *Member organizations of the European Multi-Stakeholder Platform on ICT standardization.*

[124] List of approved JTC 1 PAS Submitters

7.15.1. AIM Global

General information			
Forum / Consortium	**AIM Global**	**Title**	**AIM Global**
Creation date	1972	**MEMBERS** 	93 member companies and organizations
Chairperson	Mr. Chuck Evanhoe		
Involvement of Luxembourg	/		
Web site	http://www.aimglobal.org		
Scope	AIM is dedicated to accelerating the growth and use of Automatic Identification and Mobility technologies and services around the world. Through the years, industry leaders continue to work within AIM to promote innovation and the adoption of emerging technologies. AIM delivers accurate and unbiased information on technologies, standards, and applications.		
Executive summary	Since 1972, AIM has actively led the way in industry standards, education, and outreach. For over 40 years, AIM has served as the international trade association and worldwide authority on automatic identification, data collection and networking in a mobile environment.		
Structure	**Committees:** - Internet of Things (IoT) committee - RAIN RFID Alliance (RAIN) - RFID Experts Group (REG) - Technical Symbology Committee (TSC) - Track & Trace (T&T)		
Standardization work			
Published standards	25		
Standards under development	Unknown		

7.15.2. DMTF - Distributed Management Task Force

<table>
<tr><th colspan="4">General information</th></tr>
<tr><td>Forum / Consortium</td><td>DMTF</td><td>Title</td><td>Distributed Management Task Force</td></tr>
<tr><td>Creation date</td><td>1992</td><td rowspan="3">MEMBERS
  </td><td rowspan="3">166 member companies and organizations</td></tr>
<tr><td>Chairperson</td><td>Mr. Jon Hass</td></tr>
<tr><td>Involvement of Luxembourg</td><td>/</td></tr>
<tr><td>Web site</td><td colspan="3">http://www.dmtf.org/</td></tr>
<tr><td>Scope</td><td colspan="3">The DMTF is an industry standards organization working to simplify the manageability of network-accessible technologies through open and collaborative efforts by leading technology companies. DMTF creates and drives the international adoption of interoperable management standards, supporting implementations that enable the management of diverse traditional and emerging technologies including cloud, virtualization, network and infrastructure.</td></tr>
<tr><td>Executive summary</td><td colspan="3">DMTF's technologies are designed to work together to address the industry's needs and requirements for interoperable distributed management. These standards provide well-defined interfaces that build upon each other, delivering end-to-end management capabilities and interoperability.</td></tr>
<tr><td>Structure</td><td colspan="3"><u>Working Groups:</u>
- Architecture Working Group (Arch)
- Common Information Model for REST Services Working Group (CIM-RS)
- CIM-XML
- Cloud Auditing Data Federation Working Group (CADFWG)
- Cloud Management Working Group (CMWG)
- Diagnostics Working Group (Diag)
- Network Services Management Work Group (NSM)
- Open Virtualization Format Working Group (OVFWG)
- Platform Management Components Intercommunication (PMCI)
- Policy Working Group (Policy)
- Security Working Group (Security)
- Server Desktop Mobile Platforms Working Group (SDMPWG)
- System Management BIOS Working Group (SMBIOS)
- Software Entitlement Working Group (SEWG)

<u>Forums:</u>
- System Management Forum (SMF)
- Scalable Platforms Management Forum (SPMF)
- Virtualization and Cloud Management Forum (VCMF)</td></tr>
<tr><th colspan="4">Standardization work</th></tr>
<tr><td>Published standards</td><td colspan="3">483</td></tr>
<tr><td>Standards under development</td><td colspan="3">52[125]</td></tr>
</table>

[125] The DMTF makes available certain specifications for a limited period of time as a Work in Progress

7.15.3. Ecma International (previously called ECMA)

General information			
Forum / Consortium	**Ecma International**	**Title**	**Ecma International**
Creation date	1961	**MEMBERS** 	69 member organizations
Chairperson	Mr. K. Yamashita		
Involvement of Luxembourg	/		
Web site	http://www.ecma-international.org/		
Scope	Standardization of Information and Communication Technology (ICT) and Consumer Electronics (CE).		
Executive summary	The aims of Ecma are: - To develop, in cooperation with the appropriate national, European and international organizations Standards and Technical Reports in order to facilitate and standardize the use of Information Communication Technology (ICT) and Consumer Electronics (CE); - To encourage the correct use of Standards by influencing the environment in which they are applied; - To publish these Standards and Technical Reports in electronic and printed form; the publications can be freely copied by all interested parties without restrictions. For over forty years Ecma has actively contributed to world-wide standardization in information technology and telecommunications. More than 400 Ecma Standards and 100 Technical Reports of high quality have been published, more than 2/3 of which have also been adopted as International Standards and/or Technical Reports.		
Structure	- TC 12 Product Safety - TC 20 Electromagnetic Compatibility and Electromagnetic Fields (EMC and EMF) - TC 26 Acoustics - TC 31 Information Storage - TC 32 Multimedia Coding and Communications - TC 38 Product-related environmental attributes - TC 39 ECMAScript - TC 43 Universal 3D (U3D) - TC 45 Office Open XML Formats - TC 46 Open XML Paper Specification (OpenXPS) - TC 47 Near Field Communications - TC 48 High Rate Wireless Communications - TC 49 Programming Languages - TC 50 Close Proximity Electric Induction Data Transfer - TC 51 Access Systems - TC 52 Dart		
Standardization work			
Published standards	326		
Standards under development	Unknown		

7.15.4. GS1 - Global Standards

General information			
Forum / Consortium	**GS1**	**Title**	**Global Standards**
Creation date	1973	**MEMBERS** 	More than 1100 individual members representing 424 companies from every corner of the world
Chairperson	Mr. Mike McNamara		
Involvement of Luxembourg	/		
Web site	http://www.gs1.org/		
Scope	GS1 is dedicated to the design and implementation of global standards and solutions to improve the efficiency and visibility of supply and demand chains globally and across sectors. The GS1 system of standards is the most widely used supply chain standards system in the world.		
Executive summary	The GS1 System is an integrated system of global standards that provides for accurate identification and communication of information regarding products, assets, services and locations. It is the most implemented supply chain standards system in the world. It is the foundation of a wide range of efficiency-building supply chain applications and solutions and is composed of the following areas:		
Structure	**Standards Maintenance Groups (SMGs):** - GSMP BarCodes SMG - GSMP Data Accuracy SMG - GSMP EDI SMGGSMP Global Master Data (GMD) SMG - GSMP Global Product Classification (GPC) SMG - GSMP Identification SMG - GSMP Traceability and Event Sharing SMG **Mission-specific Work Groups (MSWGs):** - GSMP Application Standard for MRO Objects in Rail MSWG - GSMP EPC Information Service (EPCIS) 1.1 and Core Business Vocabulary (CBV) MSWG - GSMP GLN Allocation Rules Update MSWG - GSMP High-speed Barcode Printing MSWG - GSMP Tagged Item Performance Protocol (TIPP) MSWG - GSMP UniqueID-GTIN Management MSWG		
Standardization work			
Published standards	Unknown		
Standards under development	Unknown		

7.15.5. IEEE-SA - Institute of Electrical and Electronics Engineers Standards Association

General information			
Forum / Consortium	**IEEE-SA**	**Title**	**Institute of Electrical and Electronics Engineers Standards Association**
Creation date	1963	**MEMBERS** 	About 200 corporate members
Chairperson	Ms. Bruce Kraemer		
Involvement of Luxembourg	/		
Web site	http://standards.ieee.org/		
Scope	IEEE's core purpose is to foster technological innovation and excellence for the benefit of humanity. The IEEE-SA is an organization within IEEE that develops global standards in a broad range of industries, including: power and energy, biomedical and health care, information technology, telecommunication, transportation, nanotechnology, information assurance, and many more.		
Executive summary	The IEEE Standards Association (IEEE-SA) is a leading consensus building organization that nurtures, develops and advances global technologies, through IEEE external link. It brings together a broad range of individuals and organizations from a wide range of technical and geographic points of origin to facilitate standards development and standards related collaboration. With collaborative thought leaders in more than 160 countries, it promotes innovation, enables the creation and expansion of international markets and helps protect health and public safety. Collectively, its work drives the functionality, capabilities and interoperability of a wide range of products and services that transform the way people live, work and communicate. Among the most important standards of IEEE are: IEEE 802 family of standards dealing with local area networks and metropolitan area networks, IEEE P1901 dealing with power line communications, IEEE Standard for Floating-Point Arithmetic (IEEE 754), IEEE 1394 interface ("FireWire"), etc.		
Structure	**Topics:** - Aerospace Electronics - Antennas & Propagation - Batteries - Communications - Computer Technology - Consumer Electronics - Electromagnetic Compatibility - Green & Clean Technology - Healthcare IT - Industry Applications - Instrumentation & Measurement - Nanotechnology - National Electrical Safety Code - Nuclear Power - Power & Energy - Power Electronics - Smart Grid - Software & Systems Engineering - Transportation - Wired & Wireless		

Standardization work	
Published standards	2129
Standards under development	631

7.15.6. IETF - Internet Engineering Task Force

General information			
Forum / Consortium	**IETF**	**Title**	**Internet Engineering Task Force**
Creation date	1986	**MEMBERS** 	No formal membership
Chairperson	Jari Arkko		
Involvement of Luxembourg	No membership		
Web site	http://www.ietf.org/		
Scope	The mission of the IETF is to make the Internet work better by producing high quality, relevant technical documents that influence the way people design, use, and manage the Internet.		
Executive summary	The IETF is a large open international community of network designers, operators, vendors, and researchers concerned with the evolution of the internet architecture and the smooth operation of the internet. The IETF does not standardize transmission hardware (they leave that to organizations like the IEEE and the ITU) and does not standardize specialized application layer protocols. For example, they leave HTML and XML standards to the World-Wide Web Consortium. But the IETF does standardize all the protocol layers in between, from IP itself up to general applications like email and HTTP. Documents published by the IETF are RFC (Request For Comments). Some of the main RFC are: RFC 821 - Simple Mail Transfer Protocol, RFC 2616 - Hypertext Transfer Protocol -- HTTP/1.1, RFC 1738 - Uniform Resource Locators (URL), RFC 959 - File Transfer Protocol, RFC 1510 - The Kerberos Network Authentication Service (V5), etc.		
Structure	**Areas:** - Applications and Real-Time Area (art) - General Area (gen) - Internet Area (int) - Operations and Management Area (ops) - Routing Area (rtg) - Security Area (sec) - Transport Area (tsv)		
Standardization work			
Published standards	**106 Internet Standards** (a specification for which significant implementation and successful operational experience has been obtained may be elevated to the Internet Standard level) **3039 Proposed and Drafts Standards** (a proposed Standard specification is stable, has resolved known design choices, has received significant community review, and appears to enjoy enough community interest to be considered valuable)		
Standards under development	141 draft standards		

7.15.7. ISOC - The Internet Society

General information			
Forum / Consortium	**ISOC**	**Title**	**The Internet Society**
Creation date	1992	**MEMBERS** 	More than 80,000 members and supporters, 110 Chapters around the world, as well as more than 140 Organization members
Chairperson	Ms. Kathryn Brown		
Involvement of Luxembourg	91 members[126]		
Web site	http://www.internetsociety.org/		
Scope	To promote the open development, evolution, and use of the Internet for the benefit of all people throughout the world. To help achieve its mission, the Internet Society: - Facilitates open development of standards, protocols, administration, and the technical infrastructure of the Internet; - Supports education in developing countries specifically, and wherever the need exists; - Promotes professional development and builds community to foster participation and leadership in areas important to the evolution of the Internet; - Provides reliable information about the Internet; - Provides forums for discussion of issues that affect Internet evolution, development and use in technical, commercial, societal, and other contexts; - Fosters an environment for international cooperation, community, and a culture that enables self-governance to work; - Serves as a focal point for cooperative efforts to promote the Internet as a positive tool to benefit all people throughout the world; - Provides management and coordination for on-strategy initiatives and outreach efforts in humanitarian, educational, societal, and other contexts.		
Executive summary	The Internet Engineering Task Force (IETF) is an organized activity of ISOC, which works to facilitate the smooth operation of and growing participation in Internet standards through the IETF. ISOC organizes briefing panels at nearly all IETF meetings, and publish the *IETF Journal* three times a year in advance of each IETF meeting.		
Structure	/		
Standardization work			
Published standards	/		
Standards under development	/		

[126] http://www.isoc.lu/l-association/les-membres

7.15.8. OASIS - Organization for the Advancement of Structured Information Standards

<table>
<tr><th colspan="4">General information</th></tr>
<tr><td>Forum / Consortium</td><td>OASIS</td><td>Title</td><td>Organization for the Advancement of Structured Information Standards</td></tr>
<tr><td>Creation date</td><td>1993</td><td rowspan="3">MEMBERS
  </td><td rowspan="3">More than 5000 participants representing over 600 organizations and individual members in more than 65 countries</td></tr>
<tr><td>Chairperson</td><td>Mr. Frederick Hirsch</td></tr>
<tr><td>Involvement of Luxembourg</td><td>/</td></tr>
<tr><td>Web site</td><td colspan="3">http://www.oasis-open.org/</td></tr>
<tr><td>Scope</td><td colspan="3">OASIS promotes industry consensus and produces worldwide standards for security, Internet of Things, Cloud computing, energy, content technologies, emergency management and other areas.</td></tr>
<tr><td>Executive summary</td><td colspan="3">OASIS is a not-for-profit consortium that drives the development, convergence and adoption of open standards for the global information society. OASIS open standards offer the potential to lower cost, stimulate innovation, grow global markets and protect the right of free choice of technology.

OASIS is distinguished by its transparent governance and operating procedures. Members themselves set the OASIS technical agenda, using a lightweight process expressly designed to promote industry consensus and unite disparate efforts. Completed work is ratified by open ballot. Governance is accountable and unrestricted.</td></tr>
<tr><td>Structure</td><td colspan="3"><u>OASIS Committee Categories:</u>
- Big Data
- Cloud
- Conformance
- Content Technologies
- e-Commerce
- e-Invoicing
- eGov/Legal
- Emergency Management
- Healthcare
- IoT/M2M
- Lyfecycle Integration
- Localization
- Messaging
- Privacy/Identity
- Security
- SOA
- Standards Adoption
- Supply Chain
- Sustainability
- Web Services</td></tr>
<tr><th colspan="4">Standardization work</th></tr>
<tr><td>Published standards</td><td colspan="3">198</td></tr>
<tr><td>Standards under development</td><td colspan="3">Unknown</td></tr>
</table>

7.15.9. OGC - The Open Geospatial Consortium

General information			
Forum / Consortium	**OGC**	**Title**	**The Open Geospatial Consortium**
Creation date	1994	**MEMBERS** 	519 companies, government agencies and universities
Chairperson	Mr. Jeffrey Harris		
Involvement of Luxembourg	**1 member (LIST)**		
Web site	http://www.opengeospatial.org/		
Scope	The OGC provides a consensus process that communities of interest use to solve problems related to the creation, communication and use of spatial information. A community of interest might be those people who are interested in ocean observation, or those who are interested in 3D modeling of urban environments, or those who are interested in volunteered location information during disasters. These communities sort roughly into ten domains: Aviation, Built Environment & 3D, Defence & Intelligence (D&I), Business Intelligence, Emergency Response & Disaster Management, Energy & Utilities, Geosciences & Environment, Government & Spatial Data Infrastructure, Mobile Internet & Location Services, Sensor Webs.		
Executive summary	The Forum's goals are to provide free and openly available standards to the market, tangible value to Members, and measurable benefits to users; to lead worldwide in the creation and establishment of standards that enable global infrastructures for delivery and integration of geospatial content and services into business and civic processes. The OGC wants to facilitate the adoption of open, spatially enabled reference architectures in enterprise environments worldwide; to advance standards to support the formation of new and innovative markets and applications for geospatial technologies and to accelerate market assimilation of interoperability research through collaborative consortium processes. The OGC mission is finally to advance the development and use of international standards and supporting services that promote geospatial interoperability and to meet its mission OGC act as a global forum for the collaboration of developers and users of spatial data products and services.		
Structure	**Standards Working Groups:** - 3D Portrayal SWG (3DP SWG) - Catalogue Services 3.0 SWG (Cat 3.0 SWG) - CityGML SWG (CityGML SWG) - Common DataBase (CDB) SWG (CDB SWG) - CRS Well Known Text SWG (CRS WKT SWG) - Discrete Global Grid Systems SWG (DGGS SWG) - ebRIM AP of CSW SWG (ebRIM AP of CSW) - ebXML RegRep SWG (ebXMLRegRepSWG) - EO Product Metadata and OpenSearch SWG (EO PMOS SWG) - GeoAPI 3.0 SWG (GeoAPI 3.0 SWG) - GeoPackage SWG (GeoPackage SWG) - GeoSciML SWG (GeoSciML SWG) - Geospatial User Feedback SWG (GUFswg) - GeoSynchronization 1.0 SWG (Geosync SWG) - GeoTIFF SWG (GeoTIFF SWG) - GeoXACML SWG (GeoXACML SWG) - GML 3.3 SWG (GML 3.3 SWG) - GMLJP2 SWG (GMLJP2-SWG) - Groundwater SWG (GroundwaterSWG)		

	- Hydrologic Features SWG (HydroFeat SWG) - I15 (Cataloging of ISO19115 Metadata) Extension Package of ebRIM Profile of CS-W 1.0 SWG (I15 SWG) - IndoorGML SWG (IndoorGML SWG) - KML 2.3 SWG (KML SWG) - Land and Infrastructure SWG (LandInfraSWG) - Moving Features SWG (MovFeat SWG) - NetCDF SWG (NetCDFSWG) - O&M 2.0 SWG (OM 2.0 SWG) - OLS 1.3 SWG (OLS 1.3 SWG) - OWS Common 1.2 SWG (OWSCommon1.2SWG) - OWS Context SWG (OWScontextSWG) - PipelineML SWG (PipeML SWG) - Points of Interest SWG (PoI SWG) - PubSub SWG (PubSub SWG) - RESTful Services Policy SWG (RESTful SWG) - Sensor Model Language (SensorML) 2.0 SWG (SensorML2.0SWG) - SensorThings SWG (SensorThings) - Simple Features SWG (SF SWG) - Styled Layer Descriptor and Symbology Encoding 1.2 SWG (SLDSE 1.2 SWG) - Temporal WKT for Calendars SWG (TemporalWKT) - WaterML 2.0 SWG (WaterML2.0SWG) - Web Coverage Service (WCS) SWG (WCS.SWG) - Web Mapping Service 1.4 SWG (WMS 1.4 SWG) - Web Processing Service 2.0 SWG (WPS 2.0 SWG) - WFS Gazetteer Profile 1.0 SWG (WFSgaz1.0 SWG) - WFS/FES SWG (WFS/FES SWG)
Standardization work	
Published standards	46
Standards under development	Unknown

7.15.10. OMA - The Open Mobile Alliance

General information			
Forum / Consortium	**OMA**	**Title**	**The Open Mobile Alliance**
Creation date	2002	**MEMBERS** 	79 organizations
Chairperson	Mr. Gary K. Jones		
Involvement of Luxembourg	/		
Web site	http://openmobilealliance.org/		
Scope	- Deliver high quality, open technical specifications based upon market requirements that drive modularity, extensibility, and consistency amongst enablers to reduce industry implementation efforts; - Ensure OMA service enabler specifications provide interoperability across different devices, geographies, service providers, operators, and networks; facilitate interoperability of the resulting product implementations; - Be the catalyst for the consolidation of standards activity within the mobile data service industry; working in conjunction with other existing standards organizations and industry fora to improve interoperability and decrease operational costs for all involved; - Provide value and benefits to members in OMA from all parts of the value chain including content and service providers, information technology providers, mobile operators and wireless vendors such that they elect to actively participate in the organization.		
Executive summary	OMA is the focal point for the development of mobile service enabler specifications, which support the creation of interoperable end-to-end mobile services. OMA drives service enabler architectures and open enabler interfaces that are independent of the underlying wireless platforms. Toward that end, OMA has developed programs that allow implementers the opportunity to test their products to ensure industry-wide interoperability.		
Structure	Committees: - Release Planning and Management Committee (REL) Working groups: - Architecture (OMA ARC WG) - Communications (OMA COM WG) - Content Delivery (OMA CD WG) - Device Management (OMA DM WG) - Interoperability (OMA IOP WG) - Location (OMA LOC WG) - Requirements (OMA REQ WG)		
Standardization work			
Published standards	130		
Standards under development	69		

7.15.11. OMG - Object Management Group

<table>
<tr><th colspan="4">General information</th></tr>
<tr><td>Forum / Consortium</td><td>OMG</td><td>Title</td><td>Object Management Group</td></tr>
<tr><td>Creation date</td><td>1989</td><td rowspan="3">MEMBERS
  </td><td rowspan="3">265 member organizations</td></tr>
<tr><td>Chairperson</td><td>Mr. Richard Soley</td></tr>
<tr><td>Involvement of Luxembourg</td><td>/</td></tr>
<tr><td>Web site</td><td colspan="3">http://www.omg.org/index.htm</td></tr>
<tr><td>Scope</td><td colspan="3">OMG Task Forces develop enterprise integration standards for a wide range of technologies: Real-time, Embedded and Specialized Systems, Analysis & Design, Architecture-Driven Modernization and Middleware. This also includes an even wider range of industries: Business Modeling and Integration, C4I, Finance, Government, Healthcare, Life Sciences Research, Robotics, Software-Based Communications and Space.</td></tr>
<tr><td>Executive summary</td><td colspan="3">OMG's mission is to develop technology standards that provide real-world value for thousands of vertical industries. OMG is also dedicated to bringing together its international membership of end-users, vendors, government agencies, universities and research institutions to develop and revise these standards as technologies throughout the years. OMG has especially developed the following standards: Unified Modeling Language™ (UML®), Common Object Request Broker Architecture (CORBA®), MOF™, and Interface Definition Language (IDL™).</td></tr>
<tr><td>Structure</td><td colspan="3"><u>Architecture Board</u>
- Intellectual Property Policy Subcommittee
- Liaison AB Subcommittee
- Object and Reference Model AB Subcommittee
- Specification Management AB Subcommittee
- Business Architecture AB SIG
- Model Interchange AB SIG

<u>Domain Technology Committee</u>
- Business Modeling and Integration DTF
- Consultation, Command, Control, Communications & Intelligence (C4I) DTF
- Finance DTF
- Government Information Sharing and Services DTF
- Healthcare DTF
- Manufacturing Technology and Industrial Systems DTF
- Robotics DTF
- Space DTF
- Mathematical Formalism SIG
- Regulatory Compliance DSIG
- Systems Engineering DSIG

<u>Platform Technology Committee</u>
- Analysis and Design PTF
- Architecture-Driven Modernization PTF
- Middleware and Related Services PTF
- System Assurance PTF
- Agent PSIG
- Data Distribution Services PSIG
- Ontology PSIG</td></tr>
</table>

Standardization work	
Published standards	240
Standards under development	Unknown

7.15.12. SNIA - Storage Networking Industry Association

General information			
Forum / Consortium	**SNIA**	**Title**	**Storage Networking Industry Association**
Creation date	1997	**MEMBERS** 	About 400 member companies
Chairperson	Mr. David Dale		
Involvement of Luxembourg	/		
Web site	http://www.snia.org		
Scope	SNIA lead the storage industry worldwide in developing and promoting standards, technologies and educational services to empower organizations in the management of information. Underlying the mission are four supporting vision statements that will help the association deliver value back to the industry: - Be the trusted advisor across all business segments and the recognized authority in storage technologies in support of information management - Be a catalyst for the development and adoption of standards for storage and information technology - Continue to grow a strong international presence to address the needs and requirements of the local storage and information management marketplaces - Address the storage and information management needs of the new community of consumers and providers created by the increasing trend towards Cloud		
Executive summary	As a not-for-profit association, the SNIA enables its members to develop robust solutions for storing and managing the massive volumes of information generated by today's businesses. For more than a decade SNIA has worked to bring recognition of storage issues to the ICT world, making storage less complicated for the end user. As a result, the SNIA has adopted the role of industry catalyst for the development of storage solution specifications and technologies, global standards and storage education. From vendors, to channel partners and to end-users, SNIA members are dedicated to providing the industry with a high level of knowledge exchange and thought-leadership. Its members also share a common goal: to promote acceptance, deployment and confidence in storage-related architectures, systems, services and technologies across ICT and business communities.		
Structure	**Technical Work Groups (TWG)** - Cloud Storage TWG - Green Storage TWG - I/O Traces, Tools & Analysis TWG - Linear Tape File Systems (LTFS) TWG - Long Term Retention TWG - NVM Programming TWG - Object Drive TWG - Scalable Storage Management (SSM) TWG - Security TWG - Storage Management Initiative(SMI) TWG - Solid State Storage TWG - Solid State Storage System TWG		

Standardization work	
Published standards	11
Standards under development	9

7.15.13. SPICE User Group

General information			
Forum / Consortium	**SPICE User Group**	**Title**	**Software Process Improvement and Capability dEtermination User Group**
Creation date	1993	**MEMBERS** 	2328 members
Chairperson	Mr. Alec Dorling		
Involvement of Luxembourg	/		
Web site	http://spiceforum.ning.com/		
Scope	The SPICE User Group: - Acts as a leadership forum for users of ISO/IEC 15504 & 330xx; - Promotes the practical and beneficial use of ISO/IEC 15504 & 330xx; - Contributes to the development of and provides user feedback on the use of ISO/IEC 15504 & 330xx; - Provides an active program of networking, information exchange, conferences, events and support for users of ISO/IEC 15504 & 330xx; - Provides user confidence in claims of compliance and conformance to requirements of ISO/IEC 15504 & 330xx.		
Executive summary	/		
Structure	**Sector initiatives:** - Enterprise SPICE - Banking SPICE - Automotive SPICE - Medi SPICE		
Standardization work			
Published standards	/		
Standards under development	/		

7.15.14. TCG - Trusted Computing Group

General information			
Forum / Consortium	**TCG**	**Title**	**Trusted Computing Group**
Creation date	2003	**MEMBERS** 	86 member organizations
Chairperson	Dr. Joerg Borchert		
Involvement of Luxembourg	/		
Web site	http://www.trustedcomputinggroup.org/		
Scope	TCG develops standards to solve today's enterprise security challenges: - Authentication; - Cloud Security; - Data Protection; - Mobile Security; - Network Access & Identity.		
Executive summary	The Trusted Computing Group (TCG) is a not-for-profit organization formed to develop, define and promote open, vendor-neutral, global industry standards, supportive of a hardware-based root of trust, for interoperable trusted computing platforms. Security is built into an increasing number of general purpose ICT products and security standards are fundamental to the integrity and sustainability of the global ICT infrastructure. TCG believes that open, interoperable and internationally vetted standards are critical for the success of trusted computing and that the multilateral approach to creating such standards is most effective.		
Structure	**Workgroups** - Embedded Systems - Infrastructure - Mobile Platform - PC Client - Server Specific - Software Stack (TSS) - Storage - Trusted Mobility Solutions (TMS) - Trusted Multi-tenant Infrastructure (TMI) - Trusted Network Communications (TNC) - Trusted Platform Module (TPM - Virtualized Platform		
Standardization work			
Published standards	122		
Standards under development	Unknown		

7.15.15. TOG - The Open Group

<table>
<tr><th colspan="4">General information</th></tr>
<tr><td>Forum / Consortium</td><td>TOG</td><td>Title</td><td>The Open Group</td></tr>
<tr><td>Creation date</td><td>1996</td><td rowspan="3">MEMBERS
  </td><td rowspan="3">509 memberships from organizations</td></tr>
<tr><td>Chairperson</td><td>Mr. Darrin P. Johnson</td></tr>
<tr><td>Involvement of Luxembourg</td><td>2 members (LIST, University of Luxembourg)</td></tr>
<tr><td>Web site</td><td colspan="3">http://www.opengroup.org/</td></tr>
<tr><td>Scope</td><td colspan="3">The Open Group works with customers and suppliers of IT products and services as well as with consortia and other standards organizations to capture, clarify and integrate current and emerging requirements, establish standards and policies, and share best practices. TOG standards ensure openness, interoperability and consensus.</td></tr>
<tr><td>Executive summary</td><td colspan="3">The Open Group is a global consortium that enables the achievement of business objectives through ICT standards. With more than 400 member organizations, the Open Group has a diverse membership that spans all sectors of the ICT community — customers, systems and solutions suppliers, tool vendors, integrators and consultants, as well as academics and researchers to:
- Capture, understand and address current and emerging requirements, and establish policies and share best practices;
- Facilitate interoperability, develop consensus, and evolve and integrate specifications and open source technologies;
- Offer a comprehensive set of services to enhance the operational efficiency of consortia;
- Operate the industry's premier certification service.</td></tr>
<tr><td>Structure</td><td colspan="3"><u>Work Groups</u>
- Service-Oriented Architecture (SOA) Work Group
- Certified Architect (Open CA) Work Group
- Certified IT Specialist (Open CITS) Work Group
- Cloud Computing Work Group
- Internet of Things (IoT) Work Group
- Semantic Interoperability Work Group</td></tr>
<tr><th colspan="4">Standardization work</th></tr>
<tr><td>Published standards</td><td colspan="3">223</td></tr>
<tr><td>Standards under development</td><td colspan="3">Unknown</td></tr>
</table>

7.15.16. oneM2M

General information			
Forum / Consortium	**oneM2M**	**Title**	**oneM2M**
Creation date	2012	**MEMBERS** 	200 companies
Chairperson	Fran O'Brien		
Involvement of Luxembourg	/		
Web site	http://www.onem2m.org		
Scope	oneM2M shall prepare, approve and maintain the necessary set of Technical Specifications and Technical Reports for: - Use cases and requirements for a common set of Service Layer capabilities - Service Layer aspects with high level and detailed service architecture, in light of an access independent view of end-to-end services - Protocols/APIs/standard objects based on this architecture (open interfaces & protocols) - Security and privacy aspects (authentication, encryption, integrity verification); - Reachability and discovery of applications - Interoperability, including test and conformance specifications - Collection of data for charging records (to be used for billing and statistical purposes) - Identification and naming of devices and applications - Information models and data management (including store and subscribe/notify functionality) - Management aspects (including remote management of entities); - and Common use cases, terminal/module aspects, including Service Layer interfaces/APIs		
Executive summary	The purpose and goal of oneM2M is to develop technical specifications which address the need for a common M2M Service Layer that can be readily embedded within various hardware and software, and relied upon to connect the myriad of devices in the field with M2M application servers worldwide. A critical objective of oneM2M is to attract and actively involve organizations from M2M-related business domains such as: telematics and intelligent transportation, healthcare, utilities, industrial automation, smart homes, etc.		
Structure	**Work Groups**: - Use Cases & Requirements (REQ) - Architecture (ARC) - Protocols (PRO) - Security (SEC) - Management & Abstraction Semantics (MAS) - Testing (TST)		
Standardization work			
Published standards	25		
Standards under development	28		

7.15.17. OCF - Open Connectivity Foundation

General information			
Forum / Consortium	**OCF**	**Title**	**Open Connectivity Foundation**
Creation date	2016	**MEMBERS** 	167 companies
Chairperson	Mr. Jong-Deok Choi		
Involvement of Luxembourg	/		
Web site	http://openconnectivity.org/		
Scope	The OCF is: - Defining the specification, certification & branding to deliver reliable interoperability -- a connectivity framework that abstracts complexity; - Our open specification allows anyone to implement and it is easy for developers to use; - It includes predictable IP protection & branding for certified devices (via compliance testing) and service-level interoperability; - There is also an Open Source implementation of our specification - IoTivity Project; - This Open Source implementation is designed to enable application developers and device manufacturers to deliver interoperable products across Android, iOS, Windows, Linux, Tizen, and more.		
Executive summary	Billions of connected devices (devices, phones, computers and sensors) should be able to communicate with one another regardless of manufacturer, operating system, chipset or physical transport. The Open Connectivity Foundation (OCF) is creating a specification and sponsoring an open source project to make this possible. OCF will unlock the massive opportunity in the IoT market, accelerate industry innovation and help developers and companies create solutions that map to a single open specification. OCF will help ensure secure interoperability for consumers, business, and industry. Note: UPnP Forum transferred its activities into OIC. Many of the concepts and technology choices implemented by UPnP Forum have been adopted within OIC, leading to alignment on the standardization of the IoT. The UPnP Forum has assigned its assets, including contract rights, to OIC effective December 31, 2015 and subsequently dissolved. UPnP resources remain available on the OCF website: http://openconnectivity.org/upnp		
Structure	**Work Groups**: - Certification Work Group (Cert WG) - Marketing Communications Work Group (MCWG) - Membership Work Group (MWG) - Open Source Work Group (OSWG) - Standards Work Group (SWG) - Technology Planning Work Group (TPWG) - UPnP Work Group (UPnP WG)		
Standardization work			
Published standards	Unknown		
Standards under development	Unknown		

7.15.18. W3C - World Wide Web Consortium

General information			
Forum / Consortium	**W3C**	**Title**	**World Wide Web Consortium**
Creation date	1994	**MEMBERS** 	415 members
Chairperson	Mr. Tim Berners-Lee		
Involvement of Luxembourg	/		
Web site	http://www.w3.org/		
Scope	The W3C is an international community which mission is to lead the World Wide Web to its full potential by developing open standards (protocols and guidelines) that ensure the long-term growth of the Web.		
Executive summary	W3C standards define an Open Web Platform for application development that has the unprecedented potential to enable developers to build rich interactive experiences, powered by vast data stores, which are available on any device. Although the boundaries of the platform continue to evolve, industry leaders speak nearly in unison about how HTML5 will be the cornerstone for this platform. But the full strength of the platform relies on many more technologies that W3C and its partners are creating, including CSS, SVG, WOFF, the Semantic Web stack, XML and a variety of APIs.		
Structure	**Working Groups:** - Accessible Platform Architectures - Accessible Rich Internet Applications - Audio - Automotive - Browser Testing and Tools - Cascading Style Sheets (CSS) - Data on the Web Best Practices - Device APIs - Education and Outreach - Efficient XML Interchange - Evaluation and Repair Tools - Geolocation - HTML Media Extensions - Internationalization - Math - Multimodal Interaction - Permissions and Obligations Expression - Pointer Events - RDF Data Shapes - Second Screen Presentation - Social Web - Spatial Data on the Web - SVG - Timed Text - Tracking Protection - Web Annotation - Web Application Security - Web Authentication - Web Content Accessibility Guidelines - Web Cryptography - Web Payments		

	- Web Performance - Web Platform - Web Real-Time Communications - WebFonts - XML Core - XML Processing Model - XML Query - XML Security - XSLT **Interest Groups :** - Digital Publishing - HTML5 Chinese - Internationalization Tag Set (ITS) - Patents and Standards - Privacy - Semantic Web Health Care and Life Sciences - Semantic Web - Social - WAI - Web and TV - Web of Things - Web Payments - Web Security **Community and Business Groups:** W3C has created Community and Business Groups to meet the needs of a growing community of Web stakeholders. Community Groups enable anyone to socialize their ideas for the Web at the W3C for possible future standardization. There are currently 246 community and business groups. **Permanent Groups :** - Technical Architecture Group (TAG) - Advisory Board (AB)
Standardization work	
Published standards	262
Standards under development	288

8. FOCUS ON SMART ICT STANDARDIZATION

The ICT technology is evolving to "smarter" services and devices. This technology has become an essential driver in business, education, government and others. Technology adoption and development can improve performance and productivity in an innovative way, while potentially delivering economic, environmental and social benefits. In the last years, high-speed communication networks, the development of smart devices, the affordability of Internet services, and the emergence of innovative applications have made the impact of ICT even stronger. To support the adoption of Smart ICT, technical standardization plays an important role and is a key enabler in the innovation and the development of the ICT domain.

This chapter complements the ICT standards watch by presenting a more detailed overview of the standards landscape for some selected Smart ICT domains. The chapter aims to facilitate the identification of relevant standards and projects in valuable areas of interest from a national perspective.

In this frame, this chapter firstly provides an overview of the university certificate "*Smart ICT for Business Innovation*", a pilot project lead at the national level from September 2015 to September 2016. This university certificate is closely related to the concepts developed in the national standards analysis. Then, for each selected Smart ICT domain, a dedicated subsection provides an overview of the standards published and/or under development by the recognized SDOs and lists the relevant technical committees or other organizational initiatives.

8.1. UNIVERSITY CERTIFICATE *SMART ICT FOR BUSINESS INNOVATION*

8.1.1. General presentation

Technical standardization plays an important role in smart Information and Communication Technology. First, standardization provides relevant insights of the latest developments and by this means supports innovation. Standardization also contributes to the harmonization of systems and procedures, opens access to external markets and ensures a constant technological progress. Therefore, in the scope of developing a standardization culture at national level, specifically in an economically meaningful field, ILNAS, in partnership with the University of Luxembourg, has developed a pilot project based on a certificate oriented towards Smart ICT (in the context of the lifelong learning program).

Intended for ICT professionals, the *Smart ICT for Business Innovation* certificate[127] offers to its students a broad view of Smart ICT concepts along with business innovation and development strategies, so as to develop their innovative competencies. The focus of the certificate lies on important aspects of Smart ICT and their applications, including development of Cloud Computing, Big Data and Analytics, Smart Cities, and environmental issues related to ICT. Digital trust and ICT governance issues are also addressed by international experts during the course. Technical standardization remains at the core of the curriculum as an important source of knowledge and propagation vector, bringing a frame to a sector in constant evolution. Moreover, standardization committees constituting the basis of Smart ICT developments are considered in this context as the unique platforms gathering manufacturers, researchers, business innovators and other stakeholders,

[127] http://www.portail-qualite.public.lu/fr/normes-normalisation/education-recherche/projets-phares-dans-l_education-a-la-normalisation/index.html

making them the beating heart of ICT progress, and thus creating a conducive technical "ecosystem" for the students.

The *Smart ICT for Business Innovation* certificate includes six different modules and an internship:

- **Smart ICT concepts**: foundations of Smart ICT, review of the existing smart technologies and how they interact and integrate in a globally connected world;
- **Business innovation**: fundamental knowledge and tools concerning business innovation;
- **Technical standardization**: overview of ICT standardization and its economic benefits;
- **Digital intelligence**: inputs on technology trends, opportunities and challenges for Smart ICT
- **Smart platforms**: introduces a broad range of technological platforms that enable the creation of products and processes supporting current and future developments in the digital world (Cloud computing, Smart cities, Green ICT);
- **Smart interactions**: focuses on interactions which enable smart interfaces taking into account environmental factors (Internet of Things and Sensor networks, Big data and Analytics, Digital trust);
- **Internship and Certificate report**: provides a concrete learning outcome for the student that will be to transfer Smart ICT knowledge (from the six modules above) directly into business innovation. This will be accomplished through the prism of the competitive and innovative tool of technical standardization, during the internship (inside the enterprise), and by presenting a related final report based on a business case and a business plan.

8.1.2. Common thread

The university certificate program relies on an innovative approach addressing two main dimensions.

The first dimension of this matrix concentrates on a horizontal convergence that combines information technologies, consumer electronics and telecommunications, also known as ICT. As we can foresee, the future of ICT will be "smart", therefore the university certificate focuses on a holistic approach through technical standardization as an enabler of the horizontal development of ICT. Indeed, this "engine" will strengthen the horizontal convergence by bringing mainly: interoperability, compatibility, quality and compliance (specifications, requirements, common components, etc.). Moreover, ICT technical standardization provides the state of the art in each of the aforementioned Smart ICT domains. In this context, standardization carries the knowledge expansion of the latest research and innovation developments answering directly to market needs in a completely business driven approach and based on a broad consensus.

The second dimension of the matrix corresponds to a vertical convergence in order to address each of the economic sectors that can benefit from ICT. The point of interaction between these two dimensions relies on technical standardization. More particularly, technical committee(s) and current and/or under development technical standards are presented as a leverage to this interaction.

In this framework, "technical standardization" is not only one specific module in the university certificate, but is present inside each module as a reference and as a key factor in support of innovation. This domain represents the general keystone of the university certificate.

From the ICT for Business matrix, that is the backbone of the different courses of the university certificate, the students are requested to transfer "Smart ICT" concepts (through the information "received" from one or more specific technical standardization committees) into business innovation, in order to provide a real added value for the enterprise concerned (the outcome could be a new service, a new product, a new internal development, a new market to address, a new part of knowledge development for the enterprise, e.g. technology watch, a new certification scheme or a

certification project, etc.). In this framework, each student can be registered by ILNAS as a national technical standardization delegate, in one or more dedicated technical committees (the point of interaction of the matrix).

8.2. CLOUD COMPUTING

The standards landscape for Cloud Computing is extent, many standards developing organizations are active in the Cloud Computing subsector and many standards and specifications have been developed. As specified by the European commission in its European Cloud Computing Strategy[128], it is necessary to "cutting through the jungle of standards" in order to identify existing solutions, market needs and, finally, to increase Cloud Computing adoption.

Standards developing organizations have already analyzed the standards landscape and identified standardization gaps for Cloud Computing. This preparatory work allowed the definition of standards development priorities. Several reports have been published with this objective:

- ISO/IEC JTC 1/SC 38 Study Group on Cloud Computing (SGCC), Study Group Report on Cloud Computing (09/2011);
- ETSI Cloud Standards Coordination Final Report (11/2013).

Moreover, at the beginning of 2016, ETSI has published a new set of reports in the frame of the Cloud Standards Coordination (CSC) Phase 2, which intends to investigate some specific aspects of the Cloud Computing Standardization landscape, in particular from the point of view of users. It also offers a new "snapshot" of the state of standards.

- ETSI SR 003 381 V2.1.1, Cloud Standards Coordination Phase 2; Identification of Cloud user needs (02/2016);
- ETSI SR 003 382 V2.1.1, Cloud Standards Coordination Phase 2; Cloud Computing Standards and Open Source; Optimizing the relationship between standards and Open Source in Cloud Computing (02/2016);
- ETSI SR 003 391 V2.1.1, Cloud Standards Coordination Phase 2; Interoperability and Security in Cloud Computing (02/2016);
- ETSI SR 003 392 V2.1.1, Cloud Standards Coordination Phase 2; Cloud Computing Standards Maturity Assessment; A new snapshot of Cloud Computing Standards (02/2016).

Standards developing organizations outlined priority topics for standardization and as a starting point they need to develop a common set of reference. It notably concerns terminology (e.g.: ISO/IEC 17788:2014) or reference architecture (e.g.: ISO/IEC 17789:2014). The main topics identified with a lack of standards and thus added at the top of standardization work programs are the following:

- Service Level Agreement (SLA) is a critical topic for the cloud and some of the main current challenges are to determine a common terminology and to define metrics to measure the service level objectives. Therefore, standards organizations are currently developing a framework (e.g.: ISO/IEC FDIS 19086-1) to help avoid confusion and facilitate common understanding between cloud service providers and cloud service customers;
- Security and privacy standards are also essential in the context of Cloud Computing. On one hand they will allow to ensure the confidentiality, integrity, and availability of information and information systems (e.g.: ITU-T Draft X.1641). On the other hand, these developments are necessary to improve the confidence of cloud consumers and facilitate the adoption of the cloud across the world;
- Interoperability and portability standards constitute fundamental challenge in the cloud. Standardization organizations have launched several projects in order to define

[128] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52012DC0529&from=EN

unambiguously the terminology needed (e.g.: ISO/IEC CD 19941). It will participate to the broad adoption of the cloud by enhancing its flexibility and automation.

8.2.1. Published standards

This section details the standards already published by the recognized SDO regarding Cloud Computing. The linked standards below are publicly available.

SDO	Reference	Title
ISO/IEC JTC 1 / ITU-T	ISO/IEC 17788:2014 / ITU-T Rec. Y.3500 (08/2014)	Information technology -- Cloud computing -- Overview and vocabulary
ISO/IEC JTC 1 / ITU-T	ISO/IEC 17789:2014 / ITU-T Y.3502 (08/2014)	Information technology -- Cloud computing -- Reference architecture
ISO/IEC JTC 1 / ITU-T	ISO/IEC 27017:2015 ITU-T X.1631 (07/2015)	Information technology -- Security techniques -- Code of practice for information security controls based on ISO/IEC 27002 for cloud services
ISO/IEC JTC 1	ISO/IEC 17203:2011	Information technology -- Open Virtualization Format (OVF) specification
ISO/IEC JTC 1	ISO/IEC 17826:2012	Information technology -- Cloud Data Management Interface (CDMI)
ISO/IEC JTC 1	ISO/IEC 19831:2015	Cloud Infrastructure Management Interface (CIMI) Model and RESTful HTTP-based Protocol -- An Interface for Managing Cloud Infrastructure
ISO/IEC JTC 1	ISO/IEC TR 20000-9:2015	Information technology -- Service management -- Part 9: Guidance on the application of ISO/IEC 20000-1 to cloud services
ISO/IEC JTC 1	ISO/IEC 27018:2014	Information technology -- Security techniques -- Code of practice for protection of personally identifiable information (PII) in public clouds acting as PII processors
ITU-T	ITU-T FG Cloud TR Part 1 (02/2012)	Technical Report: Part 1: Introduction to the cloud ecosystem: definitions, taxonomies, use cases and high-level requirements
ITU-T	ITU-T FG Cloud TR Part 2 (02/2012)	Technical Report: Part 2: Functional requirements and reference architecture
ITU-T	ITU-T FG Cloud TR Part 3 (02/2012)	Technical Report: Part 3: Requirements and framework architecture of cloud infrastructure
ITU-T	ITU-T FG Cloud TR Part 4 (02/2012)	Technical Report: Part 4: Cloud Resource Management Gap Analysis
ITU-T	ITU-T FG Cloud TR Part 5 (02/2012)	Technical Report: Part 5: Cloud security
ITU-T	ITU-T FG Cloud TR Part 6 (02/2012)	Technical Report: Part 6: Overview of SDOs involved in cloud computing
ITU-T	ITU-T FG Cloud TR Part 7 (02/2012)	Technical Report: Part 7: Cloud computing benefits from telecommunication and ICT perspectives
ITU-T	ITU-T Q.4040 (02/2016)	The framework and overview of Cloud Computing interoperability testing
ITU-T	ITU-T Y.3501 (06/2016)	Cloud computing framework and high-level requirements
ITU-T	ITU-T Y.3503 (05/2014)	Requirements for desktop as a service

SDO	Reference	Title
ITU-T	ITU-T Y.3504 (06/2016)	Functional Architecture for Desktop as a Service
ITU-T	ITU-T Y.3510 (02/2016)	Cloud computing infrastructure requirements
ITU-T	ITU-T Y.3511 (03/2014)	Framework of inter-cloud computing
ITU-T	ITU-T Y.3512 (08/2014)	Cloud computing - Functional requirements of Network as a Service
ITU-T	ITU-T Y.3513 (08/2014)	Cloud computing - Functional requirements of Infrastructure as a Service
ITU-T	ITU-T Y.3520 Rev.1 (09/2015)	Cloud computing framework for end to end resource management
ITU-T	ITU-T Y.3521 / ITU-T M.3070	Overview of end-to-end cloud computing management
ITU-T	ITU-T Y.3600 (11/2015)	Big data – Cloud computing based requirements and capabilities
ITU-T	ITU-T X.1601 (10/2015)	Security framework for cloud computing (edition 2 under development)
ITU-T	ITU-T X.1602 (03/2016)	Security requirements for software as a service application environments
ITU-T	ITU-T X.1642 (03/2016)	Guidelines for the operational security of cloud computing
ITU-T	ITU-T Q Suppl. 65 (07/2014)	Draft Q Supplement 65 to Q.39xx-series Recommendations (Q.Supp-CCI) Cloud computing interoperability activities
ETSI	ETSI TR 102 997 V1.1.1 (04/2010)	CLOUD; Initial analysis of standardization requirements for Cloud services
ETSI	ETSI TS 103 125 V1.1.1 (11/2012)	CLOUD; SLAs for Cloud services
ETSI	ETSI TR 103 126 V1.1.1 (11/2012)	CLOUD; Cloud private-sector user recommendations
ETSI	ETSI TS 103 142 V1.1.1 (04/2013)	CLOUD; Test Descriptions for Cloud Interoperability
ETSI	ETSI SR 003 381 V2.1.1 (02/2016)	Cloud Standards Coordination Phase 2; Identification of Cloud user needs
ETSI	ETSI SR 003 382 V2.1.1 (02/2016)	Cloud Standards Coordination Phase 2; Cloud Computing Standards and Open Source; Optimizing the relationship between standards and Open Source in Cloud Computing
ETSI	ETSI SR 003 391 V2.1.1 (02/2016)	Cloud Standards Coordination Phase 2; Interoperability and Security in Cloud Computing
ETSI	ETSI SR 003 392 V2.1.1 (02/2016)	Cloud Standards Coordination Phase 2; Cloud Computing Standards Maturity Assessment; A new snapshot of Cloud Computing Standards

8.2.2. Standards under development

This section details the standards under development regarding Cloud Computing in the recognized SDO.

SDO	Reference	Title
ISO/IEC JTC 1	ISO/IEC FDIS 19086-1	Information technology -- Cloud computing -- Service Level agreement (SLA) framework and Technology -- Part 1: Overview and concepts

SDO	Reference	Title
ISO/IEC JTC 1	ISO/IEC NP 19086-2	Information technology -- Cloud computing -- Service Level agreement (SLA) framework and Technology -- Part 2: Metrics
ISO/IEC JTC 1	ISO/IEC DIS 19086-3	Information Technology - Cloud Computing – Service Level Agreement (SLA) Framework – Part 3: Core Requirements
ISO/IEC JTC 1	ISO/IEC NP 19086-4	Information technology -- Cloud computing -- Service Level agreement (SLA) framework and Technology -- Part 4: Security and privacy
ISO/IEC JTC 1	ISO/IEC CD 19941	Information Technology -- Cloud Computing -- Interoperability and Portability
ISO/IEC JTC 1	ISO/IEC CD 19944	Information Technology - Cloud Computing - Data and their Flow across Devices and Cloud Services
ISO/IEC JTC 1	ISO/IEC FDIS 27036-4	Information technology -- Information security for supplier relationships -- Part 4: Guidelines for security of Cloud services
ITU-T	ITU-T Draft Y.CCNaaS-arch	Cloud computing - Functional architecture of Network as a Service
ITU-T	ITU-T Draft Y.CCIC-arch	Cloud computing - Functional Architecture of inter-cloud computing
ITU-T	ITU-T Draft Y.BDaaS-arch	Functional architecture of Big Data as a Service
ITU-T	ITU-T Draft Y.cccm-reqts	Cloud Computing - Requirements for Containers and Micro-services
ITU-T	ITU-T Draft M.occm	Overview of Cloud Computing Management
ITU-T	ITU-T Draft M.rcsm	Requirements for Cloud Service Management
ITU-T	ITU-T Draft M.mivrcc	Requirements and analysis for management interface of virtualized resources in cloud computing
ITU-T	ITU-T Draft M.cbnmsa	Cloud-based network management system architecture
ITU-T	ITU-T Draft Y.e2ecslm-Req	End-to-end cloud service lifecycle management requirements
ITU-T	ITU-T Draft X1641	Guidelines for cloud service customer data security
ITU-T	ITU-T Draft X.dsms	Data security requirements for the monitoring service of cloud computing
ITU-T	ITU-T Draft X.SRIaaS	Security requirements of public infrastructure as a service (IaaS) in cloud computing
ITU-T	ITU-T Draft Y.cctic	Cloud computing - Trusted inter-cloud computing framework and requirements
ITU-T	ITU-T Draft F.743.2	Requirements for cloud storage of visual surveillance
ITU-T	ITU-T Draft H.CSVSArch	Architectural requirements for cloud storage in video surveillance
ITU-T	ITU-T Draft H.248.CLOUD	Gateway control protocol: Cloudification of packet gateways
ITU-T	ITU-T Draft Q.CCP	Set of parameters of cloud computing for monitoring
ITU-T	ITU-T Draft Q.wa-iop	Cloud Interoperability testing about Web Application
ITU-T	ITU-T Draft Supp-Y.Cloud Computing Scenarios for Developing Countries	Scenarios of Implementing Cloud Computing in networks of developing countries

8.2.3. Technical committees and other initiatives

This section lists the main technical committees and organizations that are working on Cloud Computing standardization.

International level

Technical committees

ISO/IEC JTC 1/SC 27 - IT Security techniques
ISO/IEC JTC 1/SC 38 - Cloud Computing and Distributed Platforms
ITU-T/SG 2 - Operational aspects
ITU-T/SG 11 - Protocols and test specifications
ITU-T/SG 13 - Future networks including cloud computing, mobile and next-generation networks
ITU-T/SG 16 - Multimedia coding, systems and applications
ITU-T/SG 17 – Security

Other initiatives

ITU-T FG CLOUD – ITU-T Focus Group on Cloud Computing (terminated)
ATIS - Alliance for Telecommunications Industry Solutions
CSA - Cloud Security Alliance
CSCC - Cloud Standards Customer Council
DMTF - Distributed Management Task Force
IEEE - Institute for Electrical and Electronics Engineers
IETF - Internet Engineering Task Force
NIST - National Institute of Standards and Technology
OASIS - Organization for the Advancement of Structured Information Standards
ODCA - Open Data Center Alliance
OGF - Open Grid Forum
OMG - Object Management Group
SNIA – Storage Networking Industry Association
TIA - Telecommunications Industry Association
TMF - TeleManagement Forum
TOG - The Open Group

European level

Technical committees

ETSI/TC CLOUD – Technical Committee Cloud Computing (terminated)
ETSI/TC NTECH - Technical Committee Network Technologies

Other initiatives

CSC – Cloud Standard Cooperation initiative (EC and ETSI)

8.3. BIG DATA

ISO/IEC JTC 1 defines Big Data as "*a data set(s) with characteristics (e.g. volume, velocity, variety, variability, veracity, etc.) that for a particular problem domain at a given point in time cannot be efficiently processed using current/existing/established/traditional technologies and techniques in order to extract value*" (ISO/IEC JTC 1 Big Data – Preliminary Report 2014). Indeed, the exponential growing of data, particularly generated by an increasing number of connected things, offers new challenges and possibilities in the ICT sector. Big Data has the potential to benefit to all economic stakeholders through an increasing of productivity and competitiveness but also with prospective analysis possibilities offer by the new analytics tools.

Big Data is still an emerging topic from the standardization point of view. Standards for Big Data are important to improve, for example, the interoperability between the various applications and prevent vendor lock in. Different standard initiatives are being developed by recognized SDOs and industry *consortia*. For example, a new working group on Big Data has been created in ISO/IEC JTC 1 in November 2014 (ISO/IEC JTC 1/WG 9) and reports have been published to identify existing standards and potential standardization gaps:

- ISO/IEC JTC 1 Big data – Preliminary Report 2014 (02/2015);
- ISO/IEC JTC 1/SC 32 Report of study group on next generation analytics and big data (06/2013);
- ITU-T Technology Watch Report - Big Data: Big today, normal tomorrow (11/2013).

Moreover, in 2016, ILNAS has published a White Paper "Big Data". This document aims at surveying current advances in Big Data and Big Data Analytics from two complementary points of view: a technical analysis perspective and a business and economic prospective analysis. Therefore, the document is intended for those professionals seeking guidance in one or both domains and can be used in its whole as a compendium where technical and IT governance aspects of Big Data are equally treated. Standards and technical standardization is also presented as an essential tool to improve the interoperability between various applications and prevent vendor lock in, to provide interfaces between relational and non-relational data stores and to support the large diversity of current data types and structures. Finally, some conclusions on Big Data are presented with an outlook on how to integrate them in the business environment to create value.

The definition of Big Data reference architecture (e.g.: ISO/IEC AWI TR 20547) is currently one of the most important standardization topic due to the broad variety of frameworks and ecosystems already associated with Big Data and the need to make them become interoperable. It will provide a technical reference to facilitate a common understanding of the concept. This work will also be completed by the definition of a common vocabulary (e.g.: ISO/IEC CD 20546).

At the same time, ITU-T has defined relationships between Cloud Computing and Big Data and identifies its requirements, capabilities and use cases (ITU-T Y.3600). ITU-T also develops a standard to engage discussions on challenges of Big Data in the context of IoT (ITU-T Draft Y.IoT-BigData-reqts), and notably the specific requirements and capabilities that the IoT is expected to support in order to address the challenges related to Big Data. This work will constitute a basis for further standardization work concerning Big Data in the IoT.

Other potential standardization gaps that should be quickly addressed by SDO in the context of Big Data concern for example security and privacy, query languages, interfaces between SQL and NoSQL data stores, etc.

8.3.1. Published standards

This section details the standards already published by the recognized SDO regarding Big Data. The linked standards below are publicly available.

SDO	Reference	Title
ITU-T	ITU-T Rec. Y.3600 (07/2015)	Big data – cloud computing based requirements and capabilities

8.3.2. Standards under development

This section details the standards under development regarding Big Data in the recognized SDO.

SDO	Reference	Title
ISO/IEC JTC 1	ISO/IEC CD 20546	Information technology -- Big Data -- Definition and Vocabulary
ISO/IEC JTC 1	ISO/IEC AWI TR 20547-1	Information technology -- Big Data -- Reference Architecture -- Part 1: Framework and Application Process
ISO/IEC JTC 1	ISO/IEC AWI TR 20547-2	Information technology – Big Data Reference Architecture -- Part 2: Use Cases and Derived Requirements
ISO/IEC JTC 1	ISO/IEC AWI 20547-3	Information technology -- Big Data Reference Architecture – Part 3: Reference Architecture
ISO/IEC JTC 1	ISO/IEC AWI 20547-4	Information technology -- Big Data Reference Architecture – Part 4: Security and Privacy Fabric
ISO/IEC JTC 1	ISO/IEC NP 20547-5	Information technology – Big Data Reference Architecture -- Part 5: Standards Roadmap
ITU-T	ITU-T Draft Y.BigDataEX-reqts	Big data exchange framework and requirements
ITU-T	ITU-T Draft Y.Suppl.BigData-RoadMap	Supplement on Big Data Standardization Roadmap
ITU-T	ITU-T Draft Y.BDaaS-arch	Cloud computing - Functional architecture of Big Data as a Service
ITU-T	ITU-T Draft Y.IoT-BigData-reqts	Specific requirements and capabilities of the IoT for Big Data
ITU-T	ITU-T Draft Y.bDDN-fr	Framework of big data driven networking based on Deep Packet Inspection
ITU-T	ITU-T Draft Y.bDDN-req	Requirement of big data-driven networking
ITU-T	ITU-T Draft Y.Sup-bDDN-usecase	Supplement for use cases and application scenarios of big data driven networking
ITU-T	ITU-T Draft Y.bDPI-Mec	Mechanism of deep packet inspection applied in network big data context

8.3.3. Technical committees and other initiatives

This section lists the main technical committees and organizations that are working on Big Data standardization.

International level

Technical committees

ISO/IEC JTC 1/WG 9 - Big Data
ISO/IEC JTC 1/SC 32 - Data Management and Interchange
ITU-T/SG 13 - Future networks including cloud computing, mobile and next-generation networks

Other initiatives

CSA / BDWG - Cloud Security Alliance / Big Data Working Group
CSCC / BDWG- Cloud Standards Customer Council / Big Data in the Cloud Working Group
NBD-PWG - NIST Big Data Public Working Group
OASIS - Organization for the Advancement of Structured Information Standards
OGC Big Data DWG – Open Geospatial Consortium Big Data Domain Working Group
W3C - World Wide Web Consortium

8.4. GREEN DATA CENTERS

Data centers are essential for the development of the digital economy, particularly with the ever more important use of Cloud Computing and the development of the Internet of Thing. But correlatively, energy demand is growing increasingly and data centers have an ever stronger impact on the environment. In this context, standards developing organizations are particularly working to improve energy efficiency of data centers or to increase the use of renewable resources. At the European level, the CEN/CENELEC/ETSI Coordination Group on Green Data Centres (CEN/CLC/ETSI CG GDC) is working on this topic and is maintaining valuable reports providing a standards landscape and a gap analysis regarding energy management and environment viability of data centers:

- CEN/CENELEC/ETSI CG GDC Standardization landscape report;
- CEN/CENELEC/ETSI CG GDC brochure on Review of standardization activities: Energy Management and Environmental Viability of Data Centres.

Moreover, in January 2016, ILNAS has published a White Paper "Green Computing". This White Paper surveys, from a holistic perspective, various topics and technologies in the area of sustainability and Information Technology (IT), also known as Green Computing or Green ICT. An investigation is made regarding questions on the environmental impact of current IT usage, energy efficiency of IT products and how IT can contribute to business sustainability. The aim of the document is therefore to present a comprehensive review of the state-of-the-art approaches to help companies in developing sustainable and environmental friendly products and services which are supported or enabled by IT. In this context, standardization is presented as the cornerstone to guide and support organizations to achieve sustainability. A thorough review is conducted on the most relevant standards related to the topic of Green Computing from different standardization bodies such as ISO, IEC, CENELEC, ETSI, and ITU and *consortia* such as ECMA and IEEE. Finally, the Eco-management and Audit Scheme (EMAS) is surveyed as an environmental management system which enables organizations to assess, manage, and continuously improve their environmental performance. Because the requirements of ISO 14001 "Environmental management systems" are an integral part of EMAS, organizations that comply with EMAS automatically comply with the requirements of such standard.

One of the main standardization works currently led by standardization organizations concerns the definition of key performance indicators (KPI), which intends the efficient use of resources by data centers. They will address different aspects such as the minimization of energy consumption (e.g.: ISO/IEC 30134-2:2016), the use of renewable energy (e.g.: ISO/IEC 30134-3:2016) or the effectiveness of the ICT load (e.g.: ISO/IEC CD 30134-5). These standards will allow a measurement and a monitoring of data centers performances regarding environment effectiveness and will thus justify investments and allow a continuous improvement of the environmental performances.

8.4.1. Published standards

This section details the standards already published by the recognized SDO regarding green data centers. The linked standards below are publicly available.

SDO	Reference	Title
ISO/IEC JTC 1	ISO/IEC 19395:2015	Information technology -- Sustainability for and by information technology -- Smart data centre resource monitoring and control
ISO/IEC JTC 1	ISO/IEC 30134-1:2016	Information technology -- Data centres -- Key performance indicators -- Part 1: Overview and general requirements
ISO/IEC	ISO/IEC 30134-2:2016	Information Technology -- Data Centres -- Key performance

SDO	Reference	Title
JTC 1		indicators -- Part 2: Power usage effectiveness (PUE)
ISO/IEC JTC 1	ISO/IEC 30134-3:2016	Information Technology -- Data Centres -- Key Performance Indicators -- Part 3: Renewable Energy Factor (REF)
ITU-T	ITU-T L.1300 (06/2014)	Best practices for green data centres
ITU-T	ITU-T L.1301 (05/2015)	Minimum data set and communication interface requirements for data centre energy management
ITU-T	ITU-T L.1302 (11/2015)	Assessment of energy efficiency on infrastructure in data centre and telecom centre
ITU-T	ITU-T L.1320 (03/2014)	Energy efficiency metrics and measurement for power and cooling equipment for telecommunications and data centres
ITU-T	ITU-T L Suppl. 6 (12/2014)	ITU-T L.1300 - Supplement on a validation test of a data centre cooling method using renewable energy in a cold region
ITU-T	ITU-T L Suppl. 7 (12/2014)	ITU-T L.1300 - Supplement on rationale for minimum data set for evaluating energy efficiency and for controlling data centre equipment in view of power saving
ITU-T	ITU-T L Suppl. 8 (12/2014)	ITU-T L.1300 - Supplement on potential for primary energy savings in TLC/ICT centres through free cooling
ITU-T	ITU-T L Suppl. 9 (12/2014)	ITU-T L.1300 - Supplement on case study of reduction of air-conditioning energy by optical fibre based thermometry
ITU-T	ITU-T L Suppl. 10 (12/2014)	ITU-T L.1300 - Supplement on verification experiments related to increase of efficiency of air-conditioning and control technologies at a data centre
ITU-T	ITU-T L Suppl. 11 (12/2014)	ITU-T L.1300 - Supplement on verification test and feasibility study of energy and space efficient cooling systems for data centres with high density ICT devices
ITU-T	ITU-T L Suppl. 12 (12/2014)	ITU-T L.1300 - Supplement on experimental studies on plates and ducts installed at equipment inlets and outlets
ITU-T	ITU-T L.1410 Suppl. 13 (10/2015)	Case study: A hybrid approach-based comparative analysis of the environmental impact of a baseline data centre and an energy-efficient data centre
CENELEC	EN 50600-1:2012	Information technology - Data centre facilities and infrastructures - Part 1: General concepts
CENELEC	EN 50600-2-1:2012	Information technology - Data centre facilities and infrastructures - Part 2-1: Building construction
CENELEC	EN 50600-2-2:2014	Information technology - Data centre facilities and infrastructures - Part 2-2: Power distribution
CENELEC	EN 50600-2-3:2014	Information technology - Data centre facilities and infrastructures - Part 2-3: Environmental control
CENELEC	EN 50600-2-4:2015	Information technology - Data centre facilities and infrastructures - Part 2-4: Telecommunications cabling infrastructure
CENELEC	EN 50600-2-5:2016	Information technology - Data centre facilities and infrastructures - Part 2-5: Security systems
CENELEC	EN 50600-3-1:2016	Information technology - Data centre facilities and infrastructures - Part 3-1: Management and operational information
CENELEC	CLC/TR 50600-99-1:2016	Information technology - Data centre facilities and infrastructures - Part 99-1: Recommended practices for

SDO	Reference	Title
		energy management
ETSI	ETSI TS 105 174-2-2 (10/2009)	Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment - Energy Efficiency and Key Performance Indicators; Part 2: Network sites; Sub-part 2: Data centres
ETSI	ETSI ES 205 200-1 (03/2014)	Access, Terminals, Transmission and Multiplexing (ATTM); Energy management; Global KPIs; Operational infrastructures; Part 1: General requirements
ETSI	ETSI ES 205 200-2-1 (03/2014)	Access, Terminals, Transmission and Multiplexing (ATTM); Energy management; Global KPIs; Operational infrastructures; Part 2: Specific requirements; Sub-part 1: Data centres
ETSI	ETSI GS OEU 001 (10/2014)	Operational energy Efficiency for Users (OEU); Global KPIs for Data Centres

8.4.2. Standards under development

This section details the standards under development regarding green data centers in the recognized SDO.

SDO	Reference	Title
ISO/IEC JTC 1	ISO/IEC AWI TR 30131	Information technology -- Data Centres -- Taxonomy and Maturity Model
ISO/IEC JTC 1	ISO/IEC PDTR 20913	Information Technology -- Data Centres -- Key Performance Indicators -- Guidelines on holistic investigation methodology for data centre key performance indicators
ISO/IEC JTC 1	ISO/IEC WD TR 30133	Information technology -- Data centres -- Guidelines for resource efficient data centres
ISO/IEC JTC 1	ISO/IEC CD 30134-4	Information Technology -- Data Centres -- Key performance indicators -- Part 4: IT Equipment Energy Efficiency for Servers (ITEE)
ISO/IEC JTC 1	ISO/IEC CD 30134-5	Information Technology -- Data Centres -- Key Performance Indicators -- Part 5: IT Equipment Utilization for Servers (ITEUsv)
ITU-T	ITU-T Draft L.green_mgm_DC	Functionality requirements and framework of green data center energy-saving management system
ITU-T	ITU-T Draft K.idc	Dangerous effects and protective measures against electromagnetic disturbances when internet data centre is co-sited with high-voltage substation
CENELEC	FprEN 50600-4-1	Information technology - Data centre facilities and infrastructures - Part 4-1: Overview and general requirements for key performance indicators (equivalent to ISO/IEC 30134-1)
CENELEC	FprEN 50600-4-2	Information technology - Data centre facilities and infrastructures - Part 4-2: Key performance indicator PUE (equivalent to ISO/IEC 30134-2)
CENELEC	FprEN 50600-4-3	Information technology - Data centre facilities and infrastructures - Part 4-3: Key performance indicator REF (equivalent to ISO/IEC 30134-3)

SDO	Reference	Title
ETSI	ETSI TS 105 174-2	Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment and Energy Management; Part 2: ICT sites
ETSI	ETSI GS OEU 005	Operational energy Efficiency for Users (OEU); Monitoring of Global KPI of Green Data Centres

8.4.3. Technical committees and other initiatives

This section lists the main technical committees and organizations that are working on green data centers standardization.

International level

Technical committees

ISO/IEC JTC 1/SC 39 - Sustainability for and by Information Technology

ITU-T/SG 5 - Environment and climate change

Other initiatives

ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers

TGG - The Green Grid

European level

Technical committees

CLC/TC 215 - Electrotechnical aspects of telecommunication equipment

ETSI/ISG OEU - Industry Specification Group on Operational energy Efficiency for Users

ETSI - TC ATTM/WG AT2 - Technical Committee Access, Terminals, Transmission and Multiplexing / Working Group Infrastructure, Physical Networks & Communication Systems

Other initiatives

CEN/CENELEC/ETSI CG GDC - CEN/CENELEC/ETSI Coordination Group on Green Data Centres

8.5. SMART CITIES

Smart City is a concept that has seen a growing interest these last years and many standards development organizations are now working on this topic to provide a common understanding of the concept and to enable, from an ICT perspective, the integration and interoperability of city systems. Their objective is finally to create value for the city, but also for all the citizens.

A Smart City or "smart community infrastructure" is defined by ISO/TC 268 as *"a community infrastructure with enhanced technological performance that is designed, operated, and maintained to contribute to sustainable development and resilience of the community".*

At the European level, the CEN/CENELEC/ETSI Coordination Group on Smart and Sustainable Cities and Communities (CEN/CLC/ETSI SSCC-CG) is working on this topic and has published, in January 2015, a report providing a first overview of standardization issues at the European level and an overview of ongoing standardization activities.

At the international level, ISO/IEC JTC 1 has published a Preliminary Report on Smart Cities in 2014. This document provides some key concepts concerning Smart Cities and also presents some relevant standardization activities. Based notably on this report, a Working Group (WG 11) on Smart Cities has been created by ISO/IEC JTC 1 at the end of 2014. ITU-T work on Smart Cities was initially led by the Focus Group on Smart Sustainable Cities (FG-SSC) that has published 21 Technical Reports and Specifications regarding this topic. Recently, on the basis of these documents, ITU-T has developed an online compendium providing a comprehensive overview on Smart Sustainable Cities.

All these documents are freely available and constitute a valuable source of information regarding the Smart City concept and the current standardization issues and activities:

- SSCC-CG Final report – Smart and Sustainable Cities and Communities Coordination Group (01/2015);
- ISO/IEC JTC 1 Smart cities – Preliminary Report 2014 (02/2015);
- ITU-T Compendium of the 21 FG-SCC Technical Reports and Specifications on Smart Sustainable Cities.

The IEC has also launched activities in this area, through the IEC System Evaluation Group (SEG) 1 on Smart Cities. This group evaluates relevant works, general use cases, a possible reference architecture model, a standardization roadmap, a collection of terms and definitions, and a mapping of closely related activities in cooperation with ISO and other organizations, *fora* and *consortia*. On the recommendation of IEC SEG 1, a System Committee (SyC) with regard to Smart Cities was established to foster the development of standards in the field of electrotechnology to help with the integration, interoperability and effectiveness of city systems.

An overview of the standardization work of these different organizations is provided in the following subsections.

8.5.1. Published standards

This section details the standards already published by the recognized SDO regarding Smart Cities. The linked standards below are publicly available.

SDO	Reference	Title
ISO	ISO 37120:2014	Sustainable development of communities -- Indicators for city services and quality of life

SDO	Reference	Title
ISO	ISO/TR 37150:2014	Smart community infrastructures -- Review of existing activities relevant to metrics
ISO	ISO/TS 37151:2015	Smart community infrastructures -- Principles and requirements for performance metrics
ITU-T	ITU-T L. Suppl. 16 (10/2015)	Smart water management in cities
ITU-T	ITU-T L Suppl. 17 (10/2015)	Definition for smart sustainable city
ITU-T	ITU-T L Suppl. 18 (10/2015)	Smart sustainable cities: an analysis of definitions
ITU-T	ITU-T L Suppl. 19 (10/2015)	Key performance indicators definitions for smart sustainable cities
ITU-T	ITU-T K Suppl. 4 (10/2015)	Electromagnetic field (EMF) considerations in smart sustainable cities
ITU-T	ITU-T Y Suppl. 27 (01/2016)	Smart Sustainable Cities - Setting the framework for an ICT architecture
ITU-T	ITU-T Y Suppl. 28 (01/2016)	Smart Sustainable Cities - Integrated management
ITU-T	ITU-T Y Suppl. 29 (01/2016)	Smart Sustainable Cities - Multi-service infrastructure in new-development areas
ITU-T	ITU-T Y Suppl. 30 (01/2016)	Smart Sustainable Cities - Overview of smart sustainable cities infrastructure
ITU-T	ITU-T Y Suppl. 31 (01/2016)	Smart Sustainable Cities - Intelligent sustainable buildings
ITU-T	ITU-T Y Suppl. 32 (01/2016)	Smart sustainable cities - A guide for city leaders
ITU-T	ITU-T Y Suppl. 33 (01/2016)	Smart Sustainable Cities - Master plan
ITU-T	ITU-T Y Suppl. 34 (01/2016)	Smart Sustainable Cities - Setting the stage for stakeholders' engagement
ETSI	ETSI TR 103 290 V1.1.1 (04/2015)	Machine-to-Machine communications (M2M); Impact of Smart City Activity on IoT Environment

8.5.2. Standards under development

This section details the standards under development regarding Smart Cities in the recognized SDO.

SDO	Reference	Title
ISO/IEC JTC 1	ISO/IEC AWI 30145	Smart city ICT reference framework
ISO/IEC JTC 1	ISO/IEC AWI 30146	Smart city ICT indicators
ISO/IEC JTC 1	ISO/IEC DIS 30182	Smart city concept model -- Guidance for establishing a model for data interoperability
ISO	ISO/PRF 37101	Sustainable development in communities -- Management system for sustainable development -- Requirements with guidance for use
ISO	ISO/DIS 37102	Sustainable development and resilience of communities – Vocabulary
ISO	ISO/AWI 37104	Sustainable development in communities -- Guide to establishing strategies for smart cities and communities
ISO	ISO/WD 37120	Sustainable development of communities -- Indicators for city services and quality of life
ISO	ISO/DTR 37121	Sustainable development in communities -- Inventory and review of existing indicators on sustainable development and

SDO	Reference	Title
		resilience in cities
ISO	ISO/NP 37122	Sustainable development in communities -- Indicators for Smart Cities
ISO	ISO/NP 37123	Sustainable Development in Communities -- Indicators for Resilient Cities
ISO	ISO/PRF TR 37152	Smart community infrastructures -- Common framework for development and operation
ISO	ISO/CD 37154	Smart community infrastructures -- Best practice guidelines for transportation
ITU-T	ITU-T Draft L.1600	Overview of key performance indicators in smart sustainable cities
ITU-T	ITU-T Draft L.1601	Key performance indicators related to the use of information and communication technology in smart sustainable cities
ITU-T	ITU-T Draft L.1602	Key performance indicators related to the sustainability impacts of information and communication technology in smart sustainable cities
ITU-T	ITU-T Draft L.1603	Key performance indicators for smart sustainable cities to reach sustainable development goals
ITU-T	ITU-T Draft L. Suppl.17	Supplement 17 - ITU-T L.1600 series - Definition for smart sustainable city
ITU-T	ITU-T Draft Supp-Y.IPv6-IoT	IPv6 Potential for the Internet of Things and Smart Cities
ITU-T	ITU-T Draft Y.IPv6RefModel	Reference Model of IPv6 Addressing Plan for Internet of Things Deployment by Smart Cities, Public Administrations and Companies
ITU-T	ITU-T Draft Y.SCC-Terms	Vocabulary for Smart Cities and Communities
ITU-T	ITU-T Draft Y.SC-Interop	Identifier service requirements for the interoperability of Smart City applications
ITU-T	ITU-T Draft Y.SC-OpenData	Framework of Open Data in Smart Cities
ITU-T	ITU-T Draft Y.SC-Overview	An overview of smart cities and communities and the role of information and communication technologies
ITU-T	ITU-T Draft Y.SC-Residential	Requirements of Smart Residential Communities
ITU-T	ITU-T Draft Y.frame-scc	Framework and high-level requirements of smart cities and communities
ITU-T	ITU-T Draft Y.ism-ssc	A Technical Framework of Integrated Sensing & Management for Smart Sustainable Cities
ITU-T	ITU-T Draft Y.isw-ssc	The Integrated Sensor Web Resource Metadata for Smart Sustainable Cities
ITU-T	ITU-T Draft Y.SC-infra-TS	Telecommunication systems as infrastructure in smart cities and communities
ITU-T	ITU-T Draft Y.SC-platform	Platforms interoperability for smart cities and communities
ETSI	ETSI GS OEU 009	Operational energy Efficiency for Users (OEU); Global KPI Modelling for Green Smart Cities
ETSI	ETSI GS OEU 019	OEU; KPIs for Smart Cities

8.5.3. Technical committees and other initiatives

This section lists the main technical committees and organizations that are working on Smart Cities' standardization.

International level

Technical committees

ISO/IEC JTC 1/WG 11 - Smart Cities
ISO/TC 268 - Sustainable development in communities
ITU-T/SG 5 - Environment and climate change
ITU-T/SG 20 - IoT and applications, smart cities

Other initiatives

ITU-T/FG-SCC - Focus Group on Smart Sustainable Cities (terminated)
IEC SEG 1 - Smart Cities
IEC SyC Smart Cities – System Committee on Electrotechnical aspects of Smart Cities
CEN-CLC-ETSI SSCC-CG - CEN-CENELEC-ETSI Coordination Group 'Smart and Sustainable Cities and Communities'

9. TURNING TECHNOLOGY TRENDS INTO STANDARDIZATION

It has long been demonstrated and accepted that ICT contributes to increasing productivity, competitiveness and thus constitutes a major leverage for the modern economy. However, beyond economic stakes, ICT also represents an effective solution to meet current societal and environmental challenges. In this frame, standardization plays a key role in defining the future of ICT as an important source of knowledge and good practices. This chapter focuses on how standardization operates as an incubator of ICT trends and how it transforms these trends into effective standardization activities.

In accordance with the "Luxembourg's Policy on ICT technical standardization 2015-2020"[129], ANEC GIE, participates directly in technical standardization committees and notably in the most innovative ones, dealing with emerging or recent smart ICT concepts, in order to provide the most valuable information to the national ICT standardization community. To achieve this mission, ANEC GIE was particularly involved in the ISO/IEC JTC 1/SWG-P (Special Working Group on Planning), which actively participated in exploring the potential of new technologies and their needs in terms of standards. The keystone mission of the SWG-P was to detect the newly emerging technologies, reporting technology trends and establishing directions for the JTC1 Working Groups according to the technology watch report. The ISO/IEC JTC 1/SWG-P has been replaced by the JTC 1 Advisory Group (JAG), which will pursue the SWG-P work.

❖ ISO/IEC JTC 1/JAG tools

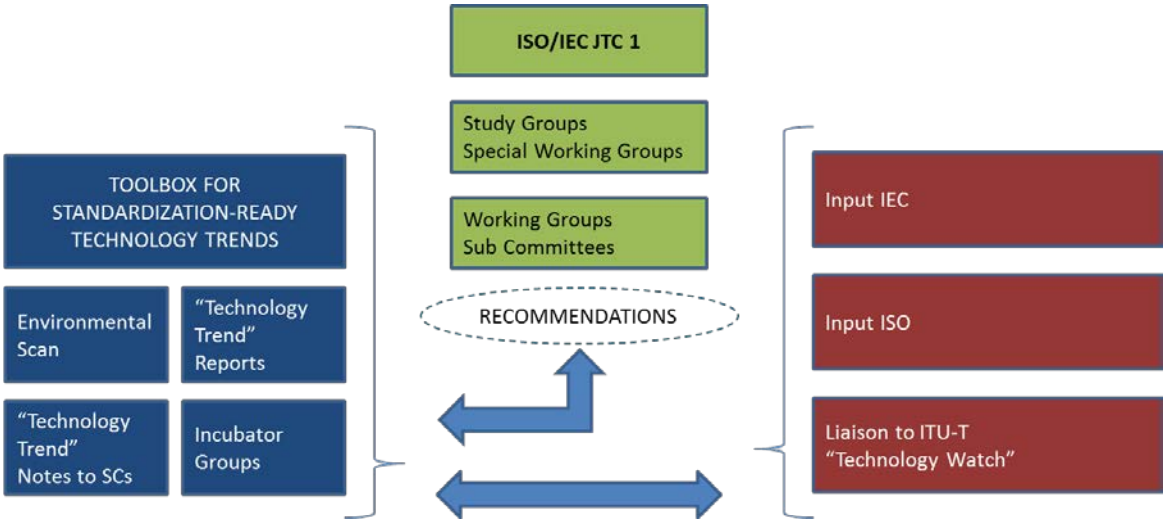
ISO, IEC and ITU-T have developed processes to guarantee a successful standardization roadmap in line with the market needs. In this frame, they have also established working groups intended to identify technology trends defined as "mature" for standardization work. The most relevant group for ICT related works is the ISO/IEC JTC 1/JAG which leads the following activities in this innovation context:

- Perform the Environmental Scanning activity to identify new work areas of interest to ISO/IEC JTC 1;
- Initiate "Technology Trend" reports with regard to dedicated topics to identify standardization environment and gaps;
- Establish and maintain a working relationship with the ITU-T Technology Watch function;
- Support the ISO/IEC JTC 1 Incubator function.

A toolkit has been developed to support perspective setting regarding standardization-ready technology trends, which can be summarized as presented in Figure 6:

[129] http://www.portail-qualite.public.lu/fr/publications/normes-normalisation/orientations-strategiques/politique-luxembourgeoise-pour-la-normalisation-technique-des-TIC-2015-2020/Policy-on-ICT-technical-standardization-_2015-2020_.pdf

Figure 5: ISO/IEC JTC 1 tools to support perspective setting regarding standardization-ready technology trends[130]



- Environmental Scan: by conducting an environmental scan (online survey), JAG is expected to identify relevant technology trends, to highlight challenges and opportunities for ISO/IEC JTC 1 and to make them recommendations on what actions it should pursue;
- Technology Trend Reports: relevant technological areas, identified by Environmental Scan, National Body or expert proposal, could be subject of further research. Maturity aspects and business relevance are important criteria;
- Technology Trend Notes to SCs: JAG provides notes to relevant subcommittees, regarding a studied technological area, in order to obtain feedbacks on effective and needed standardization work;
- Incubator Groups: they can be created to study the standardization potential of a specific technological area based on a minimal set of formal rules to avoid any restriction of collaboration;
- Liaisons between JAG, ISO, IEC and ITU-T ensure the coordination of the future standardization work, thanks to exchanges on technology trends;
- JAG provides recommendations to ISO/IEC JTC 1 and its SCs and SGs in order to develop the standards needed in link with technology trends identified.

❖ Standardization developments

In connection with the process described previously, ISO/IEC JTC 1 has established, during its last Plenary Meeting (in November 2015), a new Working Groups on Smart Cities (ISO/IEC JTC 1/WG 11).

Furthermore, the following areas will be investigated and Technology Trend Reports providing recommendations will be developed until the 2016 JTC 1 Plenary Meeting:

- Wearable electronics and services (new);
- 3D Scanning and Printing (ongoing);
- Smart Machines (ongoing).

Moreover, chapter 10 gives an overview of existing standardization activities in some areas identified by the planning process in the last few years.

[130] Source: ISO/IEC JTC 1/SWG-P

❖ Results of the Environmental Scan 2015

The Environmental Scan 2015 final results have been unveiled and they provide a first indication of possible future developments:

- Cloud Computing / Mobile computing everywhere, Big Data / Advanced Analytics, Risk-Based Security and Self Protection are respectively the three first topics that should be considered for future work in JTC 1;
- Privacy Management Tools, Cloud Computing / Mobile computing everywhere and Risk-Based Security and Self Protection are respectively the three first most relevant trends to JTC 1.

10. HIGH POTENTIAL TECHNOLOGIES AND STANDARDIZATION

This chapter focuses on recent technologies, which could significantly and deeply change our economy and society due to the high impact they will have on our lifestyles: additive manufacturing (3D printing), intelligent transport systems, unmanned aircraft systems (drones) and robotics. A standards watch has been performed on these topics in order to provide a mapping of existing standardization developments and facilitate the implication of all interested parties.

10.1. ADDITIVE MANUFACTURING / 3D PRINTING

Additive manufacturing (AM) or 3D printing consists in the process of joining materials to make objects from 3D model data, usually layer upon layer, as opposed to subtractive manufacturing methodologies.

The American Society for Testing and Materials (ASTM) has been working for several years on additive manufacturing standardization. This effort has been enlarged to develop common ISO and ASTM standards in the technical committee ISO/TC 261. At the European level, a new technical committee, CEN/TC 438, has been created in 2015 in order to develop European standards based, as far as possible, on international standardization work in order to ensure consistency and harmonization, strengthen the link with European research programs and ensure that European stakeholder's needs are taken into account in standards development.

10.1.1. ISO/TC 261

<table>
<tr><th colspan="4">General information</th></tr>
<tr><td>Committee</td><td>ISO/TC 261</td><td>Title</td><td>Additive manufacturing</td></tr>
<tr><td>Creation date</td><td>2011</td><td rowspan="5">MEMBERS
  </td><td rowspan="5">Participating Countries (21):
Germany, Belgium, Canada, China, Denmark, Finland, France, Ireland, Italy, Japan, Republic of Korea, Netherlands, Norway, Poland, Russian Federation, Singapore, Spain, Sweden, Switzerland, United Kingdom, United States

Observing Countries (6):
Czech Republic, Islamic Republic of Iran, Israel, New Zealand, Romania, South Africa</td></tr>
<tr><td>Secretariat</td><td>DIN (Germany)</td></tr>
<tr><td>Secretary</td><td>Mr. Lutz Wrede</td></tr>
<tr><td>Chairperson</td><td>Mr. Jörg Lenz</td></tr>
<tr><td>Organizations in liaison</td><td>/</td></tr>
<tr><td>Web site</td><td colspan="3">http://www.iso.org/iso/home/standards_development/list_of_iso_technical_committees/iso_technical_committee.htm?commid=629086</td></tr>
<tr><td>Scope</td><td colspan="3">Standardization in the field of Additive Manufacturing (AM) concerning their processes, terms and definitions, process chains (Hard- and Software), test procedures, quality parameters, supply agreements and all kind of fundamentals.</td></tr>
<tr><td>Structure</td><td colspan="3">ISO/TC 261/JAG — ISO/TC 261 - ASTM F42 Steering group on JWG activities
ISO/TC 261/AG 1 — Coordination Group on JG activities
ISO/TC 261/AHG 1 — Naming of standards
ISO/TC 261/AHG 2 — AM safety issues
ISO/TC 261/AHG 3 — Monitoring of data representation standards
ISO/TC 261/AHG 4 — Medical requirements on AM
ISO/TC 261/WG 1 — Terminology
ISO/TC 261/WG 2 — Methods, processes and materials</td></tr>
</table>

	ISO/TC 261/WG 3	Test methods
	ISO/TC 261/WG 4	Data and Design
	ISO/TC 261/JG 51	Joint ISO/TC 261-ASTM F 42 Group: Terminology
	ISO/TC 261/JG 52	Joint ISO/TC 261-ASTM F 42 Group: Standard test artifacts
	ISO/TC 261/JG 53	Joint ISO/TC 261-ASTM F 42 Group: Requirements for purchased AM parts
	ISO/TC 261/JG 54	Joint ISO/TC 261-ASTM F 42 Group: Design guidelines
	ISO/TC 261/JG 55	Joint ISO/TC 261-ASTM F 42 Group: Standard Specification for Extrusion Based Additive Manufacturing of Plastic Materials
	ISO/TC 261/JG 56	Joint ISO/TC 261-ASTM F 42 Group: Standard Practice for Metal Powder Bed Fusion to Meet Rigid Quality Requirements
	ISO/TC 261/JG 57	Joint ISO/TC 261-ASTM F 42 Group: Specific design guidelines on powder bed fusion
	ISO/TC 261/JG 58	Joint ISO/TC 261-ASTM F 42 Group: Qualification, quality assurance and post processing of powder bed fusion metallic parts
	ISO/TC 261/JG 59	Joint ISO/TC 261-ASTM F 42 Group: NDT for AM parts
	ISO/TC 261/JG 60	Joint ISO/TC 261-ASTM F 42 Group: Guide for intentionally seeding flaws in additively manufactured (AM) parts
	ISO/TC 261/JG 61	Joint ISO/TC 261-ASTM F 42 Group: Guide for anisotropy effects in mechanical properties of AM part
	ISO/TC 261/JG 62	Joint ISO/TC 261-ASTM F 42 Group: Guide for conducting round robin studies for additive manufacturing
	ISO/TC 261/JG 63	Joint ISO/TC 261-ASTM F 42 Group: Test methods for characterization of powder flow properties for AM applications
	ISO/TC 261/JG 64	Joint ISO/TC 261-ASTM F 42 Group: Specification for AMF support for solid modeling: voxel information, constructive solid geometry representations and solid texturing
	ISO/TC 261/JG 65	Joint ISO/TC 261-ASTM F 42 Group: Specification for additive manufacturing stainless steel alloy with powder bed fusion
	ISO/TC 261/JG 66	Joint ISO/TC 261-ASTM F 42 Group: Technical specification on metal powders
Standardization work		
Published standards	6	
Standards under development	5	
Involvement of Luxembourg		
NO (no registered delegate)		
Comments		

ISO/TC 261 is developing a series of standards to clearly establish the general principles of additive manufacturing (ISO 17296). The technical committee is also working in close cooperation with ASTM to publish common standards, notably regarding additive manufacturing file formats (AMF).
ISO/TC 261 work program includes the following projects:

- ISO/ASTM DIS 52901, Additive manufacturing -- General principles -- Requirements for purchased AM parts;
- ISO/ASTM NP 52902, Additive manufacturing -- General principles -- Standard test artifacts;
- ISO/ASTM DIS 52903-1, Additive Manufacturing -- Standard Specification for Material Extrusion Based Additive Manufacturing of Plastic Materials -- Part 1: Feedstock materials
- ISO/ASTM CD 52903-2, Additive manufacturing -- Standard specification for material extrusion based additive manufacturing of plastic materials -- Part 2: Process -- Equipment
- ISO/ASTM DIS 52910, Standard Practice -- Guide for Design for Additive Manufacturing.

10.1.2. CEN/TC 438

General information			
Committee	**CEN/TC 438**	**Title**	**Additive manufacturing**
Creation date	2015	**MEMBERS** 	33 members of CEN/CENELEC
Secretariat	AFNOR (France)		
Secretary	Mr. Olivier Coissac		
Chairperson	Mr. Eric Baustert		
Organizations in liaison	/		
Web site	http://standards.cen.eu/dyn/www/f?p=204:22:0::::FSP_ORG_ID,FSP_LANG_ID:1961493,25&cs=1DBC499E4A879D8D3D3862EB0C6702EE4		
Scope	Standardization in the field of Additive Manufacturing (AM).		
Structure	/		
Standardization work			
Published standards	0		
Standards under development	4		
Involvement of Luxembourg			
NO (no registered delegate)			
Comments			

CEN/TC 438 has three main goals:

- To provide a complete set of European standards, part of which will be developed based on the international standardization work of ISO;
- To strengthen the link between European research programs and standardization in AM;
- To ensure transparency and visibility of the European standardization in AM.

The proposed work aims at standardizing the processes of Additive Manufacturing, their process chains (Hard- and Software), the test procedures, environmental issues, quality parameters, supply agreements, fundamentals and vocabularies. The CEN/TC 438 intends to develop European standards based, as far as possible, on international standardization work (from ISO/TC 261 'Additive Manufacturing' and ASTM F42) to ensure consistency and harmonization, to strengthen the link with European research programs and ensure European stakeholders needs are taken into account in standards development.

10.1.3. ASTM F42

General information			
Forum / Consortium	**ASTM F42**	**Title**	**Committee F42 on Additive Manufacturing Technologies**
Creation date	2009	**MEMBERS** 	More than 320 members from 22 countries
Chairperson	Mr. Carl Dekker		
Involvement of Luxembourg	/		
Web site	http://www.astm.org/COMMITTEE/F42.htm		
Scope	The promotion of knowledge, stimulation of research and implementation of technology through the development of standards for additive manufacturing technologies. The work of this Committee will be coordinated with other ASTM technical committees and other national and international organizations having mutual or related interests.		
Structure	F42.01 Test Methods F42.04 Design F42.05 Materials and Processes F42.06 Environment, Health, and Safety F42.90 Executive F42.91 Terminology F42.94 Strategic Planning F42.95 US TAG to ISO TC 261		
Standardization work			
Published standards	11		
Standards under development	15		
Comments			

ASTM F42 work program includes the following projects:

- WK49798 New Guide for Intentionally Seeding Flaws in Additively Manufactured (AM) Parts;
- WK49229 New Guide for Anisotropy Effects in Mechanical Properties of AM Parts;
- WK49272 New Test Methods for Characterization of Powder Flow Properties for AM Applications;
- WK38342 New Guide for Design for Additive Manufacturing;
- WK48549 New Specification for AMF Support for Solid Modeling: Voxel Information, Constructive Solid Geometry Representations and Solid Texturing;
- WK51841 Principles of Design Rules in Additive Manufacturing;WK51282 Additive Manufacturing, General Principles, Requirements for Purchased AM Parts;
- WK51329 New Specification for Additive Manufacturing Cobalt-28 Chromium-6 Molybdenum Alloy (UNS R30075) with Powder Bed Fusion1;
- WK37654 New Guide for Directed Energy Deposition of Metals;
- WK48732 New Specification for Additive Manufacturing Stainless Steel Alloy (UNS S31603) with Powder Bed Fusion;
- WK53423 Additive Manufacturing AlSi10Mg with Powder Bed Fusion;
- WK53425 Thermal Post Processing of Metal Powder Bed Fusion Parts;

- WK53878 Additive Manufacturing - Material Extrusion Based Additive Manufacturing of Plastic Materials - Part 1: Feedstock materials;
- WK53879 Additive Manufacturing - Material Extrusion Based Additive Manufacturing of Plastic Materials - Part 2: Process-equipment;
- WK53880 Additive Manufacturing - Material Extrusion Based Additive Manufacturing of Plastic Materials: Final Part Specification.

10.2. INTELLIGENT TRANSPORT SYSTEMS

Intelligent Transport Systems (ITS) are "transport systems in which advanced information, communication, sensor, and control technologies, including the Internet, are applied to increase safety, sustainability, efficiency, and comfort"[131].

Intelligent Transport Systems (ITS) can significantly contribute to a cleaner, safer and more efficient transport system. The most important benefits from ITS are: minimize the impact of traffic on the environment, improve energy efficiency and decrease dependency on fossil fuels; reduce congestion and optimize the use of existing infrastructure; increase the use of environmental friendly transport modes; increase traffic safety and security; increase convenience of transport[132].

10.2.1. ISO/TC 204

<table>
<tr><th colspan="4">General information</th></tr>
<tr><td>Committee</td><td>ISO/TC 204</td><td>Title</td><td>Intelligent Transport Systems</td></tr>
<tr><td>Creation date</td><td>1992</td><td rowspan="5">MEMBERS
  </td><td rowspan="5">Participating Countries (28):
United States, Aus-tralia, Austria, Belarus, Belgium, Canada, China, Czech Republic, France, Germany, Hungary, India, Islamic Republic of Iran, Italy, Japan, Republic of Korea, Malaysia, Netherlands, New Zealand, Norway, Russian Federation, Sierra Leone, South Africa, Spain, Sweden, Switzerland, The Former Yugoslav Republic of Macedonia, United Kingdom

Observing Countries (27):
Algeria, Bulgaria, Chile, Colombia, The Democratic Republic of the Congo, Croatia, Cuba, Cyprus, Denmark, Egypt, Finland, Greece, Hong Kong, Indonesia, Ireland, Israel, Montenegro, Pakistan, Philippines, Poland, Portugal, Romania, Serbia, Singapore, Slovakia, Thailand, Turkey</td></tr>
<tr><td>Secretariat</td><td>ANSI (United States)</td></tr>
<tr><td>Secretary</td><td>Mr. Adrian Guan</td></tr>
<tr><td>Chairperson</td><td>Mr. Dick Schnacke</td></tr>
<tr><td>Organizations in liaison</td><td>APEC, ETSI, IEEE, ISOC, ITU, OGC, TISA, SAE</td></tr>
<tr><td>Web site</td><td colspan="3">http://www.iso.org/iso/home/standards_development/list_of_iso_technical_committees/iso_technical_committee.htm?commid=54706</td></tr>
<tr><td>Scope</td><td colspan="3">Standardization of information, communication and control systems in the field of urban and rural surface transportation, including intermodal and multimodal aspects thereof, traveller information, traffic management, public transport, commercial transport, emergency services and commercial services in the intelligent transport systems (ITS) field.</td></tr>
<tr><td>Structure</td><td colspan="3">ISO/TC 204/WG 1 Architecture
ISO/TC 204/WG 3 ITS database technology
ISO/TC 204/WG 4 Automatic vehicle and equipment identification
ISO/TC 204/WG 5 Fee and toll collection
ISO/TC 204/WG 7 General fleet management and commercial/freight
ISO/TC 204/WG 8 Public transport/emergency</td></tr>
</table>

[131] International Standard ISO 17465-1:2014, Intelligent transport systems -- Cooperative ITS -- Part 1: Terms and definitions (developed by ISO/TC 204)

[132] CEN/TC 278 Brochure (http://www.itsstandards.eu/images/files/CEN%20TC%20278%20Brochure.pdf)

	ISO/TC 204/WG 9 ISO/TC 204/WG 10 ISO/TC 204/WG 14 ISO/TC 204/WG 16 ISO/TC 204/WG 17 ISO/TC 204/WG 18	Integrated transport information, management and control Traveller information systems Vehicle/roadway warning and control systems Communications Nomadic Devices in ITS Systems Cooperative systems
Standardization work		
Published standards	213	
Standards under development	104	
Involvement of Luxembourg		
NO (no registered delegate)		
Comments		
ISO / TC 204 is responsible for the overall system aspects and infrastructure aspects of intelligent transport systems (ITS), as well as the coordination of the overall ISO work programme in this field including the schedule for standards development, taking into account the work of existing international standardization bodies.		

10.2.2. CEN/TC 278

General information			
Committee	**CEN/TC 278**	**Title**	**Intelligent transport systems**
Creation date	1991	**MEMBERS** 	33 members of CEN/CENELEC
Secretariat	NEN (Netherlands)		
Secretary	Mr. Maarten Peelen		
Chairperson	Mr. Lex Eggink		
Organizations in liaison	ETSI, ISO		
Web site	http://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP_ORG_ID:6259&cs=1EA16FFFE1883E02CD366E9E7EADFA6F7		
Scope	Standardization 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 amongst others: 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; traffic and parking management; user fee collection; public transport management; user information.		
Structure	CEN/TC 278/WG 1 CEN/TC 278/WG 2 CEN/TC 278/WG 3	Electronic fee collection and access control (EFC) Freight, Logistics and Commercial Vehicle Operations Public transport (PT)	

	CEN/TC 278/WG 4	Traffic and traveller information (TTI)
	CEN/TC 278/WG 5	Traffic control (TC)
	CEN/TC 278/WG 7	ITS spatial data
	CEN/TC 278/WG 8	Road traffic data (RTD)
	CEN/TC 278/WG 9	Dedicated Short Range Communication (DSRC)
	CEN/TC 278/WG 10	Man-machine interfaces (MMI)
	CEN/TC 278/WG 12	Automatic Vehicle Identification and Automatic Equipment Identification (AVI/AEI)
	CEN/TC 278/WG 13	Architecture and terminology
	CEN/TC 278/WG 14	After theft systems for the recovery of stolen vehicles
	CEN/TC 278/WG 15	eSafety
	CEN/TC 278/WG 16	Cooperative ITS
	CEN/TC 278/WG 17	Ad hoc group U-ITS
Standardization work		
Published standards	139	
Standards under development	49	
Involvement of Luxembourg		
NO (no registered delegate)		
Comments		

CEN/TC 278's vision statement for ITS standardization in Europe in the first quarter of the twenty-first century is: "To provide a family of Standards and related specifications, interoperable on a pan-European basis, that will enable services to be provided to travelers (be they drivers, pedestrians or users of public transport); to provide services to transport and highway managers and operators; to commercial fleet managers and commercial service providers, utilizing information technology to maximize efficiency, safety and the quality of service provided. To ensure that by co-operating in international standardization, International Standards provide the best solutions for European stakeholders."

Based on the considerations above, CEN/TC 278 proposes the following objectives and strategic directions for its future work:

- Electronic fee collection and access control;
- Automatic vehicle and equipment identification;
- Freight and fleet management;
- Telematics in public transport;
- Road and traffic data;
- Parking systems;
- Human-machine interfaces;
- Architecture and terminology;
- Recovery of stolen vehicles;
- eSafety;
- Cooperative ITS.

10.2.3. ETSI/TC ITS

General information			
Committee	**ETSI/TC ITS**	**Title**	**Intelligent Transport Systems**
Creation date	2007	**MEMBERS** 	/
Chairperson	Mr. Andersen Niels Peter Skov		
Organizations in liaison	APT, ARIB, CCC, CCSA, CEN, CENELEC, CEPT, ECC, ENISA, ERA, ERTICO, IEEE, IPv6 Forum, ISO, ISOC/IETF, ITU, OST-R, SAE International, TISA, TTC, UNECE		
Web site	http://portal.etsi.org/portal/server.pt/community/ITS		
Scope	TC ITS is responsible for the development and maintenance of Standards, Specifications and other deliverables to support the development and implementation of ITS Service provision across the network, for transport networks, vehicles and transport users, including interface aspects and multiple modes of transport and interoperability between systems, but not including ITS application standards, radio matters, and EMC. Scope includes communication media, and associated physical layer, transport layer, network layer, security, lawful intercept and the provision of generic web services.		
Structure	TC ITS/WG 1 Application Requirements and Services TC ITS/WG 2 Architecture and Cross Layer TC ITS/WG 3 Transport and Network TC ITS/WG 4 Media and Medium Related TC ITS/WG 5 Security		
Standardization work			
Published standards	177		
Standards under development	41		
Involvement of Luxembourg			
NO (no registered delegate)			
Comments			
ETSI produces globally-applicable standards for ICT. In the area of ITS, these standards are complementary to the ones produced by CEN/TC 278; together they form a coherent set of ITS standards for Europe. The coordination of the work programs is handled by the ITS Coordination Group (ITS-CG).			

10.2.4. IEEE SCC42

General information			
Forum / Consortium	**IEEE SCC42**	**Title**	**IEEE Standards Coordinating Committee on Transportation**
Creation date	2014	**MEMBERS** 	Unknown
Chairperson	Dr. Yu Yuan		
Involvement of Luxembourg	/		
Web site	http://standards.ieee.org/		
Scope	Leads the coordination of IEEE standardization activities for technologies related to transportation, especially in the areas of connected vehicles, autonomous/automated vehicles, inter- and intra-vehicle communications, and other types of transportation electrification. These technologies include but are not limited to Mobile Apps, Sensor Networks, and Communications that allow human to vehicle, vehicle to vehicle, vehicle to infrastructure, vehicle to platform, and vehicle to everything exchange of information and data. Where standardization needs exist, the SCC will develop guides, recommended practices, standards, and common definitions of terms.		
Structure	WG2040 Standard for Connected, Automated and Intelligent Vehicles: Overview and Architecture Working Group WG2040.1 Standard for Connected, Automated and Intelligent Vehicles: Taxonomy and Definitions Working Group WG2040.2 Standard for Connected, Automated and Intelligent Vehicles: Testing and Verification Working Group TF1 Cybersecurity in Transportation Task Force TF2 Road Electrification Task Force TF3 Unmanned Airborne Vehicles in Transportation Task Force AG1 Global Policy Advisory Group		
Standardization work			
Published standards	Unknown		
Standards under development	Unknown		
Comments			
The outlook for transportation combines IT, communications, electric and electronic technologies for connected vehicles, automated vehicles, and transportation electrification. These emerging areas require coordination of standards to increase interoperability and global inclusiveness. Where standardization needs exist, the IEEE SCC42 Transportation will develop guides, recommended practices, standards, and common definitions of terms. The IEEE SCC42 Transportation will work proactively with various communities and companies in these transportation standardization efforts.			

10.3. UNMANNED AIRCRAFT SYSTEMS / DRONES

An Unmanned Aircraft System (UAS), commonly named Drone, is an aircraft and its associated elements which are operated with no pilot on board[133].

In this context, standards are fundamental to create a global commercial market. Standards developing organizations notably need to address the challenge of defining a harmonized and global airspace for UAS access. It will allow the development of the commercial opportunities without compromising on safety and overall airspace efficiency.

10.3.1. ISO/TC 20/SC 16

<table>
<tr><th colspan="4">General information</th></tr>
<tr><td>Committee</td><td>ISO/TC 20/SC 16</td><td>Title</td><td>Unmanned aircraft systems</td></tr>
<tr><td>Creation date</td><td>2014</td><td rowspan="5">MEMBERS
  </td><td rowspan="5">Participating Countries (8):
United States, China, France, Germany, Japan, Russian Federation, Ukraine, United Kingdom

Observing Countries (6):
Belgium, Islamic Republic of Iran, Republic of Korea, Luxembourg, New Zealand, Spain</td></tr>
<tr><td>Secretariat</td><td>ANSI (United States)</td></tr>
<tr><td>Secretary</td><td>Mr. Cortney Robinson</td></tr>
<tr><td>Chairperson</td><td>Mr. John Walker</td></tr>
<tr><td>Organizations in liaison</td><td>/</td></tr>
<tr><td>Web site</td><td colspan="3">http://www.iso.org/iso/iso_technical_committee?commid=5336224</td></tr>
<tr><td>Scope</td><td colspan="3">SC16 scope will cover only commercial and civil UAS, not state UAS. SC16's activity shall consider covering areas not yet being addressed by other international standardization organizations. The subcommittee will address the use of the terms unmanned aircraft system (UAS) and remotely-piloted aircraft system (RPAS).</td></tr>
<tr><td>Structure</td><td colspan="3">ISO/TC 20/SC 16/WG 1 General
ISO/TC 20/SC 16/WG 2 Product manufacturing and maintenance
ISO/TC 20/SC 16/WG 3 Operations and procedures</td></tr>
<tr><th colspan="4">Standardization work</th></tr>
<tr><td>Published standards</td><td colspan="3">0</td></tr>
<tr><td>Standards under development</td><td colspan="3">0</td></tr>
<tr><th colspan="4">Involvement of Luxembourg</th></tr>
<tr><td colspan="4">1 delegate

- Mr. Richard Foersom (Acting as Chairman) Foersom Sàrl</td></tr>
<tr><th colspan="4">Comments</th></tr>
<tr><td colspan="4">ISO/TC 20/SC 16 organized its inaugural meeting in June 2015. The technical committee has clarified its scope, and is currently voting the potential work items to be developed.</td></tr>
</table>

[133] ICAO Cir 328, Unmanned Aircraft Systems (UAS)

10.3.2. ASTM F38

General information			
Forum / Consortium	**ASTM F38**	**Title**	**Committee F38 on Unmanned Aircraft Systems**
Creation date	2009	**MEMBERS** 	More than 320 members from 22 countries
Chairperson	Mr. Carl Dekker		
Involvement of Luxembourg	No		
Web site	http://www.astm.org/COMMITTEE/F38.htm		
Scope	The development of standards and guidance materials for unmanned air vehicle systems. The focus of the committee shall be the development of technical publications including (but not necessarily limited too): - Minimum safety, performance, and flight proficiency requirements. - Quality assurance - to install manufacturing controls that will assure vehicles conform to design criteria. - Productions acceptance test and procedures assuring that the completed vehicle systems meet reported performance as demonstrated in the prototype vehicle system. This includes limits such as: empty weight and center of gravity, performance specifications, controllability and maneuverability trim, stability, stall speed and handling characteristics, engine cooling and operation characteristics, propeller limits, systems functions, and folding or removable lifting surfaces. - A baseline plan for continued airworthiness systems, including methods for monitoring and maintaining continued operational safety, and processes for identifying, reporting, and remedying safety-of-flight issues.		
Structure	F38.01 Airworthiness F38.02 Flight Operations F38.03 Personnel Training, Qualification and Certification F38.90 Executive		
Standardization work			
Published standards	12		
Standards under development	13		
Comments			

ASTM F38 work program includes the following projects:

- WK16285 New Specification for Specification for Design and Performance of an Unmanned Aircraft System-Class 1320 (550# Gross Weight to 1320# Gross Weight);
- WK50655 New Practice for Software Dependability for sUAS;
- WK52962 the Design, Construct and Test of Fixed-Wing Small Unmanned Aircraft Systems (sUAS);
- WK27055 New Practice for the Registration and Marking of Unmanned Aircraft Systems;
- WK31391 New Specification for Testing of a Small Unmanned Aircraft System (sUAS);
- WK52059 New Specification for Extended/Beyond Visual Line of Sight Small Unmanned Aircraft System (sUAS) Operations;
- WK52089 New Specification for Operation over People;

- WK53403 Methods to Safely Bound Flight Behavior of UAS Containing Adaptive Algorithms;
- WK49619 New Practice for Operational Risk Assessment (ORA);
- WK28019 New Practice for Selecting sUAS Launch and Recovery;
- WK37164 New Specification for Operations Over People;
- WK11425 New Practice for Private Unmanned Aircraft System (UAS) Pilot Practical Test Standards for Unmanned Aircraft Single-Engine Land (SEL) Remote Control and Autonomous/Semiautonomous;
- WK29229 New Practice for Certification of Pilots, Visual Observers, and Instructor Pilots and Training courses for Small Unmanned Aircraft Systems (sUAS).

10.4. ROBOTICS

Robotics refers to the science and practice of designing, manufacturing, and applying robots, where robots are actuated mechanism programmable in two or more axes with a degree of autonomy, moving within its environment, to perform intended tasks.

In the context of robotics, this section also includes robotic devices which consist in actuated mechanisms fulfilling the characteristics of an industrial robot or a service robot, but lacking either the number of programmable axes or the degree of autonomy[134].

Several SDO are currently developing standards in the field of robotics and particularly ISO (ISO/TC 299), CEN (CEN/TC 310) and IEEE (IEEE RAS SCSA), which are detailed below through ID-Cards. Moreover, the Standardization Management Board (SMB) of IEC, which is in charge of the management and supervision of the IEC's standardization work, has set up a new Advisory Committee (AG) on Applications of Robotic Technology (ACART)[135] in June 2015. The tasks of ACART include:

- Coordinating common aspects of robotic technology such as vocabulary and symbols;
- Preparing a guideline that outlines the critical aspects of preparing a standard for products that incorporate robotic technology;
- Promoting collaboration between IEC and ISO as it relates to robotic technologies;
- Resolving current overlaps and developing a process to prevent future overlaps, both within the IEC and between IEC and ISO;
- Strong collaboration with the IEC CAB.

10.4.1. ISO/TC 299

<table>
<tr><th colspan="4">General information</th></tr>
<tr><td>Committee</td><td>ISO/TC 299</td><td>Title</td><td>Robots and robotic devices</td></tr>
<tr><td>Creation date</td><td>2015</td><td rowspan="5">MEMBERS
  </td><td rowspan="5">Participating Countries (25):
Sweden, Austria, Canada, China, Czech Republic, Denmark, Finland, France, Germany, Hungary, India, Ireland, Italy, Japan, Republic of Korea, Mexico, Netherlands, Portugal, Romania, Russian Federation, Singapore, Spain, Switzerland, United Kingdom, United States

Observing Countries (8):
Belgium, Bulgaria, Israel, Norway, Pakistan, Poland, Serbia, Slovakia</td></tr>
<tr><td>Secretariat</td><td>SIS (Sweden)</td></tr>
<tr><td>Secretary</td><td>Mrs. Katarina Widström</td></tr>
<tr><td>Chairperson</td><td>Mr. Henrik Jerregård</td></tr>
<tr><td>Organizations in liaison</td><td>/</td></tr>
<tr><td>Web site</td><td colspan="3">http://www.iso.org/iso/home/standards_development/list_of_iso_technical_committees/iso_technical_committee.htm?commid=5915511</td></tr>
<tr><td>Scope</td><td colspan="3">Standardization in the field of automatically controlled, reprogrammable, manipulating robots and robotic devices, programmable in more than one axis and either fixed in place or mobile. Excluded: toys and military applications.</td></tr>
</table>

[134] International Standard ISO 8373:2012, Robots and robotic devices -- Vocabulary (developed by ISO/TC 184/SC 2)

[135] http://www.iec.ch/dyn/www/f?p=103:41:0::::FSP_ORG_ID,FSP_LANG_ID:12602,25

Structure	ISO/TC 299/WG 1 ISO/TC 299/WG 2 ISO/TC 299/WG 3 ISO/TC 299/WG 4 ISO/TC 299/JWG 5 ISO/TC 299/WG 6	Vocabulary and characteristics Personal care robot safety Industrial safety Service robots Joint ISO/TC 299 - IEC/SC 62A - IEC/SC 62D: Medical robot safety Modularity for service robots
Standardization work		
Published standards	13	
Standards under development	8	
Involvement of Luxembourg		
NO (no registered delegate)		
Comments		

ISO/TC 299 has replaced ISO/TC 184/SC 2 in 2015 The TC has notably recently published ISO/TS 15066, a new ISO technical specification for collaborative robot system safety. The work program of the technical committee includes the following projects:

- ISO/DIS 18646-1, Robots and robotic devices -- Performance criteria and related test methods for service robot -- Part 1: Locomotion for wheeled robots;
- ISO/WD 18646-2, Robots and robotic devices -- Performance criteria and related test methods for service robot -- Part 2: Navigation;
- ISO/DIS 19649, Robots and robotic devices --- Vocabulary for mobile robots;
- ISO/NP TR 20218-1, Robots and robotic devices -- Safety requirements for industrial robots -- Part 1: Industrial robot system end of arm tooling (end-effector);
- ISO/NP TR 20218-2, Robots and robotic devices -- Safety requirements for industrial robots -- Part 2: Industrial robot system manual load stations;
- ISO/CD TR 21382, Robots and robotic devices -- Safety-related test methods for ISO 13482;
- IEC/NP 80601-2-77, Medical Electrical Equipment -- Part 2-77: Particular requirements for the basic safety and essential performance of medical robots for surgery;
- IEC/NP 80601-2-78, Medical Electrical Equipment -- Part 2-78: Particular requirements for the basic safety and essential performance of medical robots for rehabilitation, compensation or alleviation of disease, injury or disability.

10.4.2. CEN/TC 310

General information			
Committee	**CEN/TC 310**	**Title**	**Advanced automation technologies and their applications**
Creation date	1993	**MEMBERS** 	33 members of CEN/CENELEC
Secretariat	BSI (United Kingdom)		
Secretary	Dr. Mike Leggett		
Chairperson	Mr. Mason		
Organizations in liaison	/		
Web site	http://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP_ORG_ID:6291&cs=1FB8DE3E2415169C5A629164496F80A52		
Scope	Standardization in the field of automation systems and technologies and their application and integration to ensure the availability of the standards required by industry for design, sourcing, manufacturing and delivery, support, maintenance and disposal of products and their associated services. Areas of standardisation may include enterprise modelling and system architecture, information and its supporting systems, robotics for fixed and mobile robots in industrial and specific non-industrial environments, automation and control equipment and software, human and mechanical aspects, integration technologies and system operational aspects. These standards may utilise other standards and technologies beyond the scope of TC310, such as machines, equipment, information technologies, multi-media capabilities, and multi-modal communications networks.		
Structure	CEN/TC 310/WG 1 Systems architecture		
Standardization work			
Published standards	10		
Standards under development	0		
Involvement of Luxembourg			
1 delegate - Mrs. Wided Guedria Luxembourg Institute of Science and Technology (LIST)			
Comments			
The mission of CEN/TC 310 is to undertake standardization activities in the field of Advanced Manufacturing Technologies (AMT) to ensure the availability of the standards required by European industry for the operation and integration of the elements of AMT systems. The specific objectives of CEN/TC 310 are to: - Act as focal point within Europe for standardization in Advanced Manufacturing Technologies; - Undertake the leading technical responsibility for the general strategy for standardization in the field of AMT and to document an agreed upon European strategy in this Business Plan; - Develop standards for AMT systems and elements that are not included in the work program of other European TCs;		

- Support and accommodate the standardization needs of European industry, if different from, or with a higher priority than, international standards being developed;
- Create a wider understanding and awareness of the importance of AMT standardization driven by market needs for European industry, the European Commission and national Governments;
- Encourage the awareness of AMT standardization by improving the availability of information between interested parties.

10.4.3. IEEE RAS SCSA

General information			
Forum / Consortium	**IEEE RAS SCSA**	**Title**	**IEEE Robotics and Automation Society's Standing Committee for Standards Activities**
Creation date	2007	**MEMBERS** 	Unknown
Chairperson	Mr. Raj Madhavan		
Involvement of Luxembourg	No		
Web site	http://www.ieee-ras.org/industry-government/standards		
Scope	To formally adopt and confirm best practices in robotics and automation as standards. The Standing Committee will work with interested members of RAS in supporting standards defining activities in both established, mature application areas and nascent, emerging technologies related to robotics and automation. Within this scope, the RAS Standing Committee for Standards Activities shall pursue the following objectives: - Promote common measures and definitions in robotics and automation; - Promote measurability and comparability of robotics and automation technology; - Promote integrity, portability, and reusability of robotics and automation technology.		
Structure	IEEE RAS SCSA/ORA WG IEEE RAS SCSA/MDR-WG	Ontologies for Robotics and Automation Map Data Representation	
Standardization work			
Published standards	1		
Standards under development	1		
Comments			
The ORA WG aims to develop a standard ontology and associated methodology for knowledge representation and reasoning in robotics and automation, together with the representation of concepts in an initial set of application domains. The standard will provide a unified way of representing knowledge and will provide a common set of terms and definitions, allowing for unambiguous knowledge transfer among any group of humans, robots, and other artificial systems. The MDR-WG aims to standardize a common representation and encoding for the two-dimensional map data used for navigation by mobile robots. The encoding will be used when exchanging map data with other components and systems. The standard focuses on interchange of map data between components and systems, particularly those that may be supplied by different vendors. As well as the encoding, the standard aims to specify suitable APIs and protocols for the interchange process so that navigation-related components from multiple vendors may inter-operate.		

11. ICT AND ECONOMIC INTERSECTORAL APPROACH

The ICT sector is a keystone of the global economy. Development of ICT infrastructure can attract investment and generate important fiscal revenues and more and more employment opportunities. The ICT service industry also contributes to the economy as another engine of job creation. In addition, by providing access to information, making markets more efficient, the ICT sector offers an innovative tool to benefits economy and society in general. ICT extends to other industry sectors allowing increased productivity. Companies are integrating more and more services and products into global production chains and markets. The examples of sectors where ICT is a cornerstone are numerous: aeronautics, automotive, energy, biomedical, logistics, space, education, public sector management, finance and private sector, etc.

The following sections describe the link established between the ICT sector and other sectors. Sections 11.1 to 11.4 present sectors already analyzed by ANEC GIE, under the supervision of ILNAS, *via* a standards analysis, or carefully studied by the Digital trust department of ILNAS (archiving sector). Finally, section 11.5 is dedicated to potential sectors to be analyzed in the future *via* a standards analysis.

11.1. ICT AS A SUPPORTING SECTOR OF THE ARCHIVING SECTOR

11.1.1. Standardization in the archiving sector and ICT

Archiving can be defined as the process of identifying, indexing, classifying, accessing, selecting, exploiting, communicating, exchanging and preserving, paper-based and digital information[136]. In general, archives consist of documents that have been selected for permanent or long-term preservation on grounds of their enduring cultural, historical or evidentiary value. This analysis focuses on digital archives.

Another important concept of this sector is records that are the evidence of what the organization does or has done in the past. They capture its business activities and transactions, such as contract negotiations, business correspondence, personnel files and financial statements, to name just a few. In order to comply with regulations or for management purpose, records have to keep their legal value. They need therefore to have the following properties: authenticity, reliability, integrity and usability.

"Technical regulation requirements and controls for certifying Digitisation or Archiving Service Providers (PSDCs)"[137] was published as a Grand-Ducal Regulation on July 25, 2015. This technical regulation sets out the requirements and controls required for an organization to set up an information security management system and an operational management system specifically for digitization and e-archiving processes. It is used for conformity assessments on organizations performing digitization or e-archiving processes. Based into the criteria of verification established by the law of July 25, 2015 related to electronic archiving and by the *ad hoc* quality system of ILNAS (Digital trust department), ILNAS proceeds to the registration of the concerned organization in the PSDC list (mentioning the processes related to the supervision), thus establishing the "Qualified PSDC" status.

The "Qualified PSDC" status results from the verification by ILNAS (Digital trust department) of the compliance of the Digitization or Archiving Service Provider with the technical regulation

[136] ILNAS, White Paper "Digital Trust - Towards excellence in ICT", Version 2.0, 2014
[137] http://www.legilux.public.lu/leg/a/archives/2015/0150/a150.pdf

requirements and controls certifying PSDCs. Such a verification being based on, e.g., the results of a conformity assessment performed by an accredited conformity assessment body, involves ILNAS (Digital trust department) granting the related organization one of the following digitization or e-archiving service provider statuses:

- Qualified PSDC-DC: Supervised digitization and e-archiving service provider;
- Qualified PSDC-D: Supervised digitization service provider;
- Qualified PSDC-C: Supervised e-archiving service provider.

11.1.2. Technical Committees related to ICT in the archiving sector

Two technical committees have been identified as very relevant for this subsector, both of them at the international level:

ISO/TC 46/SC 11 - Archives/records management
ISO/TC 171 - Document management applications

Moreover, several organizations participate in these technical committees at the national level.

11.2. ICT AS A SUPPORTING SECTOR OF THE ENERGY SECTOR

11.2.1. Standardization in the energy sector and ICT

In relation with the global current challenges regarding energy and climate policies (e.g.: CO_2 emissions reduction, share of renewable energy, eco-innovation, etc.), the sector of energy has been identified as a carrier for the national economy[138]. In this context, ILNAS conducted a standards watch of the energy sector, and a report was published in October 2013 to provide a standard analysis of the five subsectors defined in this frame:

- Energy management and energy efficiency;
- Fuels;
- Power engineering;
- Renewable energy;
- Smart grids.

Within the different subsectors of the energy sector, Smart Grids are at the intersection between energy and ICT. A Smart Grid "is an electricity network that can intelligently integrate the actions of all users connected to it – generators, consumers and those that do both – in order to efficiently deliver sustainable, economic and secure electricity supplies" [139]. The term smart grid is often associated with the concept of smart meter that provides the consumer a fine-grained monitoring and billing of its energy consumption.

To reduce energy consumption, "smart" technology development is strongly encouraged. Smart Grids should therefore reduce energy loss and improve security of supply by taking into account the behavior of producers and consumers. This is a transverse subsector, which can affect multiple energy sources.

On April 12, 2011, the European Commission published a communication planning to intervene in this area and ensure that standards were put in place by the end of 2012, in the frame of the standardization mandate M/490 issued in March 2011. Besides the definition of a network code, the European Commission intends to ensure that when developing standards, the devices are well suited for Smart Grids. The mandate M/490 conducted the three European Standards Organizations (ESOs) – CEN, CENELEC and ETSI – to establish the Smart Grid Coordination Group (SG-CG) in June 2011.

A first set of reports intending to provide a consistent framework for Smart Grids were published in 2012 but the Smart Grid mandate M/490 was extended at the end of 2012 in order to fine-tune the Smart Grid methodology and to develop an extended set of standards supporting Smart Grid deployment in Europe. It led to the publication of the new mandated reports at the end of 2014, which concluded the work of the SG-CG: E*xtended Set of Standards support Smart Grids deployment*, *Overview Methodology*, *Smart Grid Interoperability* and *Smart Grid Information Security*[140]. Following the conclusion of the SG-CG, a Smart Energy Grid Coordination Group (SEG-CG) has been created to continue the work and specially to consolidate and disseminate the results of the SG-CG.

Moreover, the EC continues to monitor, at national and European level, the development of ICT standards to facilitate the implementation of Smart Grids and encourages greater regional

[138] http://www.portail-qualite.public.lu/fr/publications/normes-normalisation/etudes-nationales/standards-analysis-energy-october-2013/standards-analysis-energy-sector-october-2013.pdf
[139] IEC definition (http://www.iec.ch/smartgrid/background/explained.htm)
[140] http://www.cencenelec.eu/standards/Sectors/SustainableEnergy/SmartGrids/Pages/default.aspx

cooperation and European integration, particularly through the European Network of Transmission System Operators for Electricity (ENTSO-E)[141].

11.2.2. Technical Committees related to ICT in the energy sector

Four technical committees have been selected as relevant for this subsector, respectively three at the international level and one at the European level.

International Level

Technical Committee
IEC/SG 3 - Strategic Group on Smart Grid
IEC/PC 118 - Smart grid user interface
ISO/IEC JTC 1/WG 7 - Sensor Networks

ISO/IEC JTC 1/WG 7 has recently published an International Standard to characterize the requirements for sensor networks to support smart grid technologies for power generation, distribution, networks, energy storage, load efficiency, control and communications and associated environmental challenges:

- *ISO/IEC 30101:2014, Information technology -- Sensor Networks: Sensor Network and its interfaces for smart grid system.*

Furthermore, a multi-part standard (ISO/IEC 29182 - Part 1 to 7) concerning the Sensor Network Reference Architecture (RA) has been published by this WG from 2013 to 2015.

European Level

Technical Committee
CEN/CENELEC/ETSI SEG-CG – Smart Energy Grid Coordination Group

[141] https://www.entsoe.eu/about-entso-e/Pages/default.aspx

11.3. ICT AS A SUPPORTING SECTOR OF THE BIOMEDICAL TECHNOLOGIES SECTOR

11.3.1. Standardization in the biomedical technologies sector and ICT

ILNAS conducted a standards watch on the biomedical technologies sector and published a report in October 2013 to offer a summary of standards development in this sector and thus provide a competitive tool at the disposal of the national economy. Moreover, ICT is one pillar of the national biomedical strategy, particularly in the frame of the development of innovative solutions to store, protect and analyze data issued from biomedical research[142]. ICT is thus a facilitator and a multiplier serving the progress of the biomedical sector.

The biomedical technologies sector covers several areas: from pharmaceutical activities to medical devices and health informatics. Following discussions with public authorities, the scope was slightly reduced for the standards analysis conducted by ILNAS: while dentistry activities continue to be included, veterinary activities were excluded. Finally, the biomedical technologies sector, as defined in the dedicated standards analysis[143], covers five subsectors:

- Medical devices;
- Medical equipment;
- Medical services;
- Diagnostics;
- eHealth.

Within the different subsectors of the biomedical technologies sector, eHealth is at the intersection between biomedical technologies and ICT. It refers to the combined use of electronic communication and information technology in the health sector to enable better health and healthcare[144].The eHealth sector includes many dimensions, such as:

- *Telemedicine/Telehealth*: the use of medical information exchanged from one site to another *via* electronic communications (telecommunication and IT) to improve patients' health status (source: American Telemedicine Association);
- *Electronic health records*: electronic record of patient health information generated by one or more healthcare professionals (general practitioners, specialists, etc.) (source: HIMSS – Healthcare Information and Management Systems Society);
- *mHealth*: Global Observatory for eHealth defined mHealth or mobile health as medical and public health practice supported by mobile devices, such as mobile phones, patient, monitoring devices, personal digital assistants (PDA), and other wireless devices (source: Global Observatory for eHealth/WHO);
- And also Virtual healthcare teams, Consumer health informatics, Health knowledge management, Healthcare Information Systems, Medical research using Grids, etc.

[142] http://www.gouvernement.lu/4167184/technologies-sante

[143] http://www.portail-qualite.public.lu/fr/publications/normes-normalisation/etudes-nationales/standards-analysis-biomedical-october-2013/standards-analysis-biomedical-october-2013.pdf

[144] ISO/TR 14639-1:2012, Health informatics -- Capacity-based eHealth architecture roadmap -- Part 1: Overview of national eHealth initiatives

11.3.2. Technical Committees related to ICT in the biomedical technologies sector

Four technical committees and four other initiatives have been selected as relevant for this subsector, respectively five at international level and three at European level.

International Level

Technical Committees
ISO/TC 215 - Health informatics
ISO/TC 276 - Biotechnology
ITU-T/SG 16 - Multimedia (e-health and standardization)

Other International Initiatives
NEMA / DICOM - Digital imaging and communication in medicine

Health Level Seven International / HL7
HL7 is an ANSI-accredited standards developing organization dedicated to providing a comprehensive framework and related standards for the exchange, integration, sharing and retrieval of electronic health information. It has over 2300 members and includes approximately 500 corporate members, who represent more than 90% of the information systems vendors serving healthcare.

European Level

Technical Committees
CEN/TC 251 - Health informatics *linked with ISO/TC 215*

Other Initiatives
ETSI / eHEALTH - ETSI Project Ehealth *linked with the "eHealth-INTEROP" project*
ETSI Project eHEALTH co-ordinates ETSI's activities in the Information Communication Technology (ICT)

CEN/CENELEC/ETSI Project - eHealth-INTEROP
This joint project addresses the requirements of the European Commission mandate to the European Standardization Organizations (ESOs) on standardization in the field of e-health. This mandate (M/403) aims to provide a consistent set of standards to address the needs of this rapidly evolving field for the benefit of future healthcare provision.

11.4. ICT AS A SUPPORTING SECTOR OF THE SPACE SECTOR

11.4.1. Standardization in the space sector and ICT

The analysis of European and international standards in the space sector has been initiated by ILNAS in order to develop an information and exchange network for space-related standardization knowledge in the Grand-Duchy of Luxembourg. The space sector, as defined in the dedicated standards analysis[145], covers four subsectors:

- Aerospace equipment and infrastructure;
- Earth observation technologies;
- Telecommunications & Broadcasting;
- Space related technologies.

Within the different subsectors of this standards analysis, numerous technical committees of "Telecommunications & Broadcasting" and "Space related technologies" are at the intersection between space sector and ICT.

Indeed, on the one hand, the telecommunication sector, considered as part of ICT, is one of the main type of space application, currently the most important and the most dynamic market for this issue. On the other hand, space related technologies encompass for example the services and value-added products and technologies that are derived from the use of space systems and/or data, and the provision of consulting and engineering services: the main part of these issues are directly linked with ICT.

11.4.2. Technical Committees related to ICT in the space sector

Seven international technical committees have been selected as relevant for this subsector:

ITU-T/SG 13 - Future networks including cloud computing, mobile and next-generation networks
ITU-T/SG 16 - Multimedia
ISO/IEC JTC 1/SC 2 - Coded character sets
ISO/IEC JTC 1/SC 23 - Digitally Recorded Media for Information Interchange and Storage
ISO/IEC JTC 1/SC 24 - Computer graphics, image processing and environmental data representation
ISO/IEC JTC 1/SC 27 - IT Security techniques
ISO/IEC JTC 1/SC 29 - Coding of audio, picture, multimedia and hypermedia information

[145] http://www.portail-qualite.public.lu/fr/publications/normes-normalisation/etudes-nationales/standards-analysis-space-november-2013/standards-analysis-space-sector-november-2013.pdf

11.5. OTHER SECTORS WHERE ICT ACTS AS A SUPPORTING SECTOR

ICT is a supporting sector for other sectors not currently covered by the sector-based standards analysis. After a systematic review of ISO, IEC, CEN and CENELEC technical committees, the following sectors have been identified as being ICT-supported, meaning that technical committees related to this sector develop ICT-related standards:

- **Financial sector**
  - ISO/TC 68 - Financial services
  - CEN/TC 263 - Secure storage of cash, valuables and data media
  - ISO/IEC JTC 1/WG 7 - Sensor Networks (Automation of facilities management and security)

- **Automotive sector**
  - ISO/TC 22 - Road vehicles
  - ISO/TC 23 - Tractors and machinery for agriculture and forestry
  - ISO/TC 184 - Automation systems and integration
  - ISO/TC 204 - Intelligent transport systems
  - CEN/TC 278 - Intelligent transport systems
  - CEN/TC 337 - Road operation equipment and products
  - ETSI/TC ITS - Intelligent Transport Systems
  - ISO/IEC JTC 1/WG 7 - Sensor Networks (Intelligent transportation and traffic)

- **Railway sector**
  - CLC/TC 9X - Electrical and electronic applications for railways
  - ETSI/TC RT - Railways Telecommunications
  - ISO/IEC JTC 1/WG 7 - Sensor Networks (Logistics and Supply Chain Management; Automation of facilities management and security)

- **Cinematography, photography, audio and graphic technology sector**
  - ISO/TC 36 - Cinematography
  - ISO/TC 42 - Photography
  - ISO/TC 130 - Graphic technology
  - IEC/TC 100 - Audio, video and multimedia systems and equipment
  - CLC/SR 100 - Audio, video and multimedia systems and equipment
  - CLC/TC 100X - Audio, video and multimedia systems and equipment and related sub-systems

- **Geographic information/Geomatics sector**
  - ISO/TC 211 - Geographic information/Geomatics
  - CEN/TC 287 - Geographic Information

- **Ergonomics sector**
  - ISO/TC 159 - Ergonomics
  - CEN/TC 122 - Ergonomics

- **Processes, data elements and documents in commerce, industry and administration sector**
  - ISO/TC 154 - Processes, data elements and documents in commerce, industry and administration
  - ISO/IEC JTC 1/WG 7 - Sensor Networks (Automation, monitoring, and control of industrial production processes)

- **Computer-aided design (CAD) sector**
  - ISO/TC 10 - Technical product documentation
  - CEN/SS F01 - Technical drawings

- **Maritime sector**
  - ISO/TC 8 - Ships and marine technology
  - ISO/IEC JTC 1/WG 7 - Sensor Networks (Logistics and Supply Chain Management; Automation of facilities management and security; Ship tracking and container tracking; Ocean observing systems)

- **Manufacturing sector**
  - ISO/TC 29 - Small tools
  - IEC/TC 65 - Industrial-process measurement, control and automation
  - IEC/TC 22 - Power electronic systems and equipment
  - CEN/TC 310 - Advanced Automation Technologies and their Applications
  - CLC/TC 65X - Industrial-process measurement, control and automation
  - ISO/IEC JTC 1/WG 7 - Sensor Networks (Logistics and Supply Chain Management; Automated inventory management; Security systems and theft prevention; Automation, monitoring, and control of industrial production processes)

- **Safety sector**
  - IEC/TC 108 - Safety of electronic equipment within the field of audio/video, information technology and communication technology
  - CLC/TC 108X - Safety of electronic equipment within the fields of Audio/Video, Information Technology and Communication Technology
  - ISO/IEC JTC 1/WG 7 - Sensor Networks (Environment observation, forecasting, and protection)

- **Building sector**
  - CEN/TC 247 - Building Automation, Controls and Building Management
  - ISO/IEC JTC 1/WG 7 - Sensor Networks (Remote habitat monitoring and automation; Smart homes)

- **Public sector**
  - ISO/IEC JTC 1/WG 7 - Sensor Networks (Homeland security; Civil protection and public safety)

- **Agriculture sector**
  - ISO/IEC JTC 1/WG 7 - Sensor Networks (Automation and control of agriculture processes)

- **Research, Development and Innovation sector**
  - ISO/IEC JTC 1/WG 7 - Sensor Networks

- **E-commerce & e-business sector**
  - CEN/WS eCAT - eCataloguing (Multilingual catalogue strategies for ecommerce and ebusiness
  - CEN/ WS eBES - eBusiness European Standardization, EDI and ebXML
  - CEN/WS GITB2 - Global eBusiness test bed methodologies phase2
  - CEN/TC 434 - Project Committee - Electronic Invoicing
  - CEN/TC 440 - Electronic Public Procurement

12. CONCLUSION

Today, ICT is already one of the most active sector, both at national and international level. It is evolving towards smarter technological products and services. Through the development of new and innovative digital products and services, Smart ICT constitutes a major source of economic development and it directly participates in the resolution of current environmental and social concerns. Maybe more importantly, Smart ICT is a horizontal sector and key enabler of development in all sectors (vertical) of the global and national economy, being a source of progress and providing added value to these sectors.

In this context, standards are essential not only to develop ICT, but also to support its interoperability with other sectors. System integration fields, such as IoT, Smart Cities or Smart Grids, which combine several ICT areas, are becoming more and more important. Therefore, there is an increasing interest of standards in these areas. Technical standardization plays an important role not only giving a first-hand insight into latest developments, thus supporting innovation, but also contributing to harmonization of systems and procedures, opening access to external markets and ensuring constant progress.

Moreover, standards contribute to promote and share good practices and techniques available in the ICT sector. They ensure the quality and performance of products, systems and services. They also facilitate dialogue and exchange between various stakeholders. In this sense, standardization represents an important economic lever to improve business productivity. In a nutshell, standards play a key role by facilitating trades and guaranteeing some fundamental characteristics such as interoperability, quality, security and risk management.

As described in the national standardization strategy 2014-2020 [146], ICT is a horizontal sector supporting many innovative or smart developments. ANEC GIE, under the supervision of ILNAS, will therefore constantly analyze these developments and support national stakeholders according to "Luxembourg's Policy on ICT technical standardization 2015-2020" [147]. ICT is indeed one of the most competitive economic sectors in the Grand Duchy of Luxembourg, having communication infrastructures of high quality, hosting European headquarters of several world-leading ICT companies [148] and with a market composed of many companies, associations, administrations and experts.

Finally, this analysis highlights the potential interest for the national stakeholders (Section 5.2) and the opportunities for the national market to participate in the standardization process (Chapter 6). However, standardization is performed on a voluntary basis and each stakeholder is free to get involved and to define his/her level of commitment. Proper understanding of the stakes associated to ICT standardization is necessary to take a sensible position across the standardization landscape.

Driven by the motto of the national standardization strategy 2014-2020: "*Technical standardization as a service*", ILNAS and ANEC GIE stand ready to assist each initiative in this process.

[146] http://www.portail-qualite.public.lu/fr/publications/normes-normalisation/orientations-strategiques/strategie-normative-2014-2020/luxembourg-standardization-strategy-2014-2020.pdf

[147] http://www.portail-qualite.public.lu/fr/publications/normes-normalisation/orientations-strategiques/politique-luxembourgeoise-pour-la-normalisation-technique-des-TIC-2015-2020/Policy-on-ICT-technical-standardization-_2015-2020_.pdf

[148] http://ict.investinluxembourg.lu/sectors/media-entertainment-e-gaming

13. APPENDIX

13.1. PARTICIPATION IN THE STANDARDIZATION PROCESS

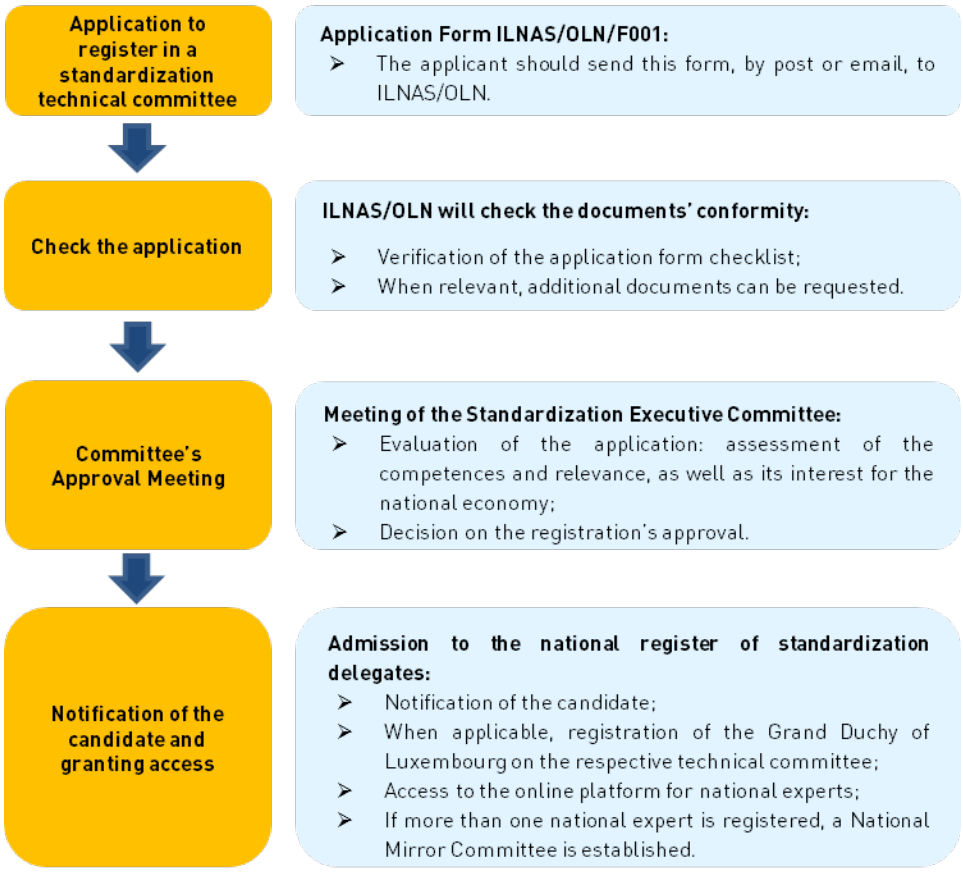
ILNAS, as the national standards body, is a member of European and international standardization organizations. In this frame, ILNAS *via* OLN can count on experts from administrations, public services, professional organizations, groups, associations or institutions interested in standardization, as well as all persons or legal entities interested in participating in standardization. In order to provide all national socio-economic stakeholders access to standardization processes, the registration as national delegate is entirely free of charge in Luxembourg.

To propose a framework for the standardization work of the national delegates and their participation in standardization technical committees, ILNAS has released a policy giving the main specifications and requirements to the delegates regarding standardization processes and activities. This document, entitled "Policy on participation in technical standards committees" is referenced as ILNAS/OLN/P001[149].

❖ Registration process to participate in standardization technical committees

Figure 7 summarizes the process for registering as a national delegate to participate in a standardization technical committee.

Figure 6: Registration process to participate in standardization technical committees



[149] http://www.portail-qualite.public.lu/fr/documentations/normes-normalisation/delegue-normalisation/ilnas-oln-P001-politique-participation-comite-technique/ilnas-oln-P001-politique-participation-comite-technique-en.pdf

Detailed information on the registration process is available through the following link:

http://www.portail-qualite.public.lu/fr/normes-normalisation/developpement-normes/devenir-delegue-national/index.html

❖ Registration of national delegates in standardization

ILNAS publishes regularly the list of the national delegates in standardization. The comprehensive list is available on the following link:

http://www.portail-qualite.public.lu/fr/publications/normes-normalisation/information-sensibilisation/ilnas-oln-registre-national-delegues-normalisation/ilnas-oln-registre-national-delegues-normalisation.pdf

❖ Rights and duties of a national delegate in standardization

National delegates in standardization have the right to:

- Access any documents of the technical committee through a collaborative platform;
- Work on standards under development of a technical committee;
- Take a position during the validation or approval process;
- Participate in European and/or international meetings;
- Give suggestions for improvement to the OLN;
- Use the logo "Member of the ILNAS Network" in technical contributions.

In return, national delegates have to respect some duties, such as:

- Respect of the policy ILNAS/OLN/P001 and the logo charters "Member of the ILNAS Network" (ILNAS/OLN/A003[150]);
- Commitment of nondisclosure of the technical committee's documents to third parties;
- Participating actively in the standardization process is required;
- Inform OLN of the organization of European or international meetings in Luxembourg;
- Provide a periodic activities report to the OLN (personal activities, active participation, comments, etc.).

In conclusion, all the experts in the ICT domain that want to anticipate future requirements and influence the market are welcome to join the standardization process. A simple registration form[151] has to be completed and sent to ILNAS. After the application is approved, ILNAS will grant full access to standardization works and the delegate will become a full member of the standards network.

ILNAS, supported by ANEC GIE, provides assistance to new delegates in order to give them all the necessary information to efficiently participate in the standardization process.

[150] http://www.portail-qualite.public.lu/fr/documentations/normes-normalisation/delegue-normalisation/ilnas-oln-A003-charte-utilisation-logo-ilnas-network/ilnas-oln-A003-charte-utilisation-logo-ilnas-network.pdf

[151] http://www.portail-qualite.public.lu/fr/documentations/normes-normalisation/delegue-normalisation/ilnas-oln-F001-demande-inscription-comite-technique-de-normalisation/ilnas-oln-F001-demande-inscription-comite-technique-de-normalisation-EN.doc

13.2. LIST OF ACRONYMS

ACRONYM	TITLE
3GPP	3rd Generation Partnership Project
AB	Advisory Board
ADL	Advanced Distributed Learning
AEI	Automatic Equipment Identification
AENOR	*Asociación Española de Normalización y Certificación*
AFNOR	*Association Française de Normalisation*
AGICOA	The Association for the International Collective Management of Audiovisual Works
AHG	Ad Hoc Group
AHS	Ad Hoc Group on Structure
AICC	Aviation Industry CBT Committee
AIDC	Automatic Identification and Data Capture
AM	Additive Manufacturing
AMEX	American Express
AMT	Advanced Manufacturing Technologies
ANEC	European Association for the Co-ordination of Consumer Representation in Standardization
ANEC GIE	*Agence pour la Normalisation et l'Economie de la Connaissance*
ANSI	American National Standards Institute
API	Application programming interface
APSI	*Association des Professionnels de la Société de l'Information*
ARC	Augmented Reality Continuum
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASN.1	Abstract Syntax Notation One
ASTM	American Society for Testing and Materials
ATIS	Alliance for Telecommunications Industry Solutions
ATM	Automated Teller Machine
ATSC	The Advanced Television System Committee
AUF	*Agence Universitaire de la Francophonie*
AVI	Automatic Vehicle Identification
AWI	Approved Work Item
BAC	Building Automation and Controls
BM	Building Management
BSI	British Standards Institute
CAB	Conformity Assessment Body
CAD	Computer-Aided Design
CCETT	Common Study Center of Telediffusion and Telecommunication
CCSDS	Consultative Committee for Space Data Systems
CD	Committee Draft
CEC	*Centre Européen des Consommateurs*
CEN	European Committee for Standardization
CENELEC (CLC)	European Committee for Electrotechnical Standardization
CEPT	European Conference of Postal and Telecommunications Administrations
CERN	European Organization for Nuclear Research
CIDOC	International Documentation Committee, International Council of Museums

ACRONYM	TITLE
CIE	International Commission on Illumination
CISAC	International Confederation of Societies of Authors and Composers
CLUSIL	*CLUb de la Sécurité de l'Information – Luxembourg*
CNPD	*Commission Nationale pour la Protection des Données*
COCIR	European Coordination Committee of the Radiological, Electromedical and Healthcare IT Industry
CRP	Public Research Center
CSA	Cloud Security Alliance
CSC	Cloud Standards Coordination
CSCC	Cloud Standards Customer Council
CSS	Cascading Style Sheets
CSSF	*Commission de Surveillance du Secteur Financier*
CWA	CEN Workshop Agreement
DAPS	Distributed Application Platforms and Services
DICOM	Digital Imaging and Communication in Medicine
DIN	*Deutsches Institut für Normung*
DIS	Draft International Standard
DMTF	Distributed Management Task Force
DNS	Domain Name System
DOI	International Digital Object Identifier Foundation
DSRC	Dedicated Short Range Communication
DSSSL	Document Style Semantics and Specification Language
DVD	Digital Versatile Disc
EC	European Commission
ECBS	European Committee for Banking Standards
ECISS	European Committee for Iron and Steel Standardization
ECOS	European Environmental Citizens Organisation for Standardisation
EDCS	Environmental Data Coding Specifications
EDMA	European Diagnostic Manufacturers Association
EETS	European Electronic Toll Services
EFC	Electronic Fee Collection
EFPIA	European Federation of Pharmaceutical Industries and Associations
EFTA	European Free Trade Association
EHIBCC	European Health Industry Business Communications Council
EIG	Economic Interest Grouping
EMC	ElectroMagnetic Compatibility
EMF	ElectroMagnetic field
EN	European Standard
ENISA	European Network and Information Security Agency
ENTSO-E	European Network of Transmission System Operators for Electricity
EPC	*Conseil Européen des Paiements*
EPUB	Electronic Publication
ERFA	European Rail Freight Association
ESI	Electronic Signatures and Infrastructures
ESMIG	European Smart Metering Industry Group
ESO	European Standardization Organizations
ETSI	European Telecommunications Standards Institute

ACRONYM	TITLE
EU	European Union
EUCOMED	The European Medical Technology Industry Association
EUREAU	European federation of national associations of drinking water suppliers and waste water services
FARECOGAZ	The European Association of Manufacturers of Gas Meters, Gas Pressure Regulators and associated Safety Devices and Stations
FedISA	*Fédération de l'ILM (Information Lifecycle Management), du Stockage et de l'Archivage*
FG	Focus Group
FIA	*Fédération Internationale de l'Automobile*
FIAPF	International Federation of Film Producers Associations
FNR	National Research Fund
GDP	Gross Domestic Product
GEO	Group on Earth Observations
GISIG	Geographical Information Systems International Group
GSM	Global System for Mobile Communications
HBES	Home and Building Electronic Systems
HTTP	Hypertext Transfer Protocol
HVAC	Heating, Ventilation and Air-Conditioning
IAEA	International Atomic Energy Agency
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ICC	International Color Consortium
ICMA	International Card Manufacturers Association
ICS	International Classification for Standards
ICSTI	International Council for Scientific and Technical Information
ICT	Information and Communication Technology
IDC	International Data Corporation
ID-Cards	Identification Cards
IEC	International Electrotechnical Commission
IEEE	Institute for Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
IFLA	International Federation of Library Associations and Institutions
IG	Incubator Group
IIF	International Institute of Refrigeration
ILNAS	*Institut Luxembourgeois de la Normalisation, de l'Accréditation, de la Sécurité et qualité des produits et services*
ILO	International Labour Organization
ILR	*Institut Luxembourgeois de Régulation*
INCOSE	International Council on Systems Engineering
INLAC	Latinoamerican Institute for Quality Assurance
IoT	Internet of Things
IP	Internet Protocol
ISACA	Information Systems Audit and Control Association
ISAN	International Standard Audiovisual Number
ISDN	Integrated Services Digital Network
ISMS	Information Security Management System

ACRONYM	TITLE
ISO	International Organization for Standardization
ISOC	Internet Society
ISSEA	International Systems Security Engineering Association
ISSN	International Standard Serial Number
ISUG	The International SGML/XML Users' Group
IT	Information Technology
ITES-BPO	IT Enabled Services-Business Process Outsourcing
ITLET	Information Technology for Learning Education and Training
ITS	Intelligent Transport Systems
ITSO	International Telecommunications Satellite Organization
ITU	International Telecommunication Union
ITU-T	International Telecommunication Union's Telecommunication Standardization Sector
iVDR	Information Versatile Disk for Removable usage
JFIF	JPEG File Interchange Format
JISC	Japanese Industrial Standards Committee
JMIR	Journal of Medical Internet Research
JTC	Joint Technical Committee
JWG	Joint Working Group
KATS	Korean Agency for Technology and Standards
LAN	Local Architecture Network
LDAP	Lightweight Directory Access Protocol
LETSI	International Federation for Learning-Education-Training Systems Interoperability
LTE	Long Term Evolution (4G LTE)
LTSC	IEEE Learning Technology Standards Committee
M2M	Machine-to-Machine communication
MDR	Metadata Registries
MFI	Metadata Framework for Interoperability
MIIM	Mobile Item Identification and Management
MMI	Man-Machine Interface
MoU	Memorandum of Understanding
MSP	European Multi-Stakeholder Platform on ICT Standardization
NB	National Body
NEN	Netherlands Standardization Institute
NFC	Near field communication
NIST	National Institute of Standards and Technology
NP	New Proposal
NWIP	New Work Item Proposal
OASIS	Organization for the Advancement of Structured Information Standards
ODCA	Open Data Center Alliance
ODR	Online Dispute Resolution
OGC	Open Geospatial Consortium
OGF	Open Grid Forum
OLAS	*Office Luxembourgeois d'Accréditation et de Surveillance*
OLN	*Organisme luxembourgeois de normalisation*
OMA	The Open Mobile Alliance

ACRONYM	TITLE
O-member	Observing member
OMG	Open Management Group
OSI	Open systems interconnection
PAS	Public Available Specification
PC	Project Committee
PDA	Personal Digital Assistant
PKI	Public Key Infrastructures
PIA	Privacy Impact Assessment
PLC	Programmable Logic Controller
P-member	Participating member
PMI	Project Management Institute
PSC	*Prestataire de Services de Certification*
PSDC	*Prestataire de Services de Dématérialisation et/ou de Conservation*
PSF	*Prestataire de Services Financiers*
PUE	Power Usage Effectiveness
R&D	Research and Development
REF	Renewable Energy Factor
RFC	Request For Comments
RFID	Radio-Frequency Identification
RITA	Research and Innovative Technology Administration (U.S. Department of Transportation)
RMG	Registration Management Group
RTLS	Real-Time Locating Systems
RTP	Real-time Transport Protocol
SA	Standards Australia
SAML	Security assertion markup language
SC	Subcommittee
SCC	Standards Council of Canada
SCSI	Small Computer System Interface
SD	Standing Document
SDO	Standards Developing Organizations
SEDRIS	The Source for Environmental Data Representation & Interchange
SG	Strategic Group/Study Group
SGML	Standard Generalized Markup Language
SIP	Session Initiation Protocol
SLA	Service Level Agreement
SMB	Standardization Management Board
SMILE	*Security made in Lëtzebuerg*
SMPTE	Society of Motion Picture and Television Engineers
SNCH	*Société Nationale de Certification et d'Homologation*
SNIA	Storage Networking Industry Association
SNRA	Sensor Network Reference Architecture
SOA	Service Oriented Architecture
SQL	Structured Query Language
SSCD	Secure Signature-Creation Device
SVG	Scalable Vector Graphics
SWEBOK	Software Engineering Body of Knowledge

ACRONYM	TITLE
SWG	Special Working Group
SWIFT	Society for Worldwide Interbank Financial Telecommunication
TC	Technical Committee
TCG	Trusted Computing Group
TCP	Transmission Control Protocol
TGG	The Green Grid
TIA	Telecommunications Industry Association
TLS	Transport Layer Security
TMF	TeleManagement Forum
TOG	The Open Group
TR	Technical Report
TS	Technical Specification
TTA	Telecommunications Technology Association
TTC	Telecommunication Technology Committee
UAS	Unmanned Aircraft System
UCS	Universal Character Set
UI	User Interface
UIC	International Union of Railways
UITP	International Association of Public Transport
UL	University of Luxembourg
ULC	*Union Luxembourgeoise des Consommateurs*
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNECE	United Nations Economic Commission for Europe
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNI	*Ente Nazionale Italiano di Unificazione*
USB	Universal Serial Bus
UPnP	Universal Plug and Play
UPU	Universal Postal Union
URL	Uniform Resource Locator
VSE	Virtual Storage Extended
W3C	World Wide Web Consortium
WAI	Web Accessibility Initiative
WD	Working Draft
WG	Working Group
WHO	World Health Organization
WIPO	World Intellectual Property Organization
WMO	World Meteorological Organization
XBRL	eXtensible Business Reporting Language
XMI	XML Metadata Interchange
XML	Extensible Markup Language
XMPP	Extensible Messaging and Presence Protocol

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