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Supporting Europe's effort in Blockchain/DLT Standardisation

Teaching Module 1 (Basic)
ICT standardisation landscape with a focus on blockchain

Funded by the European Union

Contents

General Information

Accompanying textbook:

- **Understanding ICT Standardization: Principles and Practice (Published 2021)**
  - Includes supporting material, e.g. quizzes to prove knowledge
  - More detailed information about the topics
  - Available at: www.etsi.org/standardization-education

ICT Standardisation Landscape

- The learning objectives of this webinar are:
  - To **understand and apply** the different **criteria** for the classifications of **organisations and documents**, especially in the **Information and Communication Technology (ICT)** arena.
  - To be able to **describe** the role in **ICT standardisation of Standards Development Organisations (SDOs), recognised SDOs, and industrial consortia**, as well as their **interplay**.
  - To **identify** the **characteristics** of **formal and de facto standardisation**, and to be aware of the processes through which de **facto standards are adopted by SDOs**.
  - To **identify** the main **categories of ICT standards and documents**, including which type of documents may be produced by each organisation, and to get familiar with the **naming conventions**.
  - To **understand** the differences among **National, Regional and International** organisations, the benefits derived of their **coordination**, and to be aware of the main **agreements** and procedures supporting it.
  - To **understand** why **standards** are usually **referenced by legislation**, and the need to issue **standardisation requests** when a societal need is identified in a specific area.
  - To know the main SDOs dealing with **blockchain**

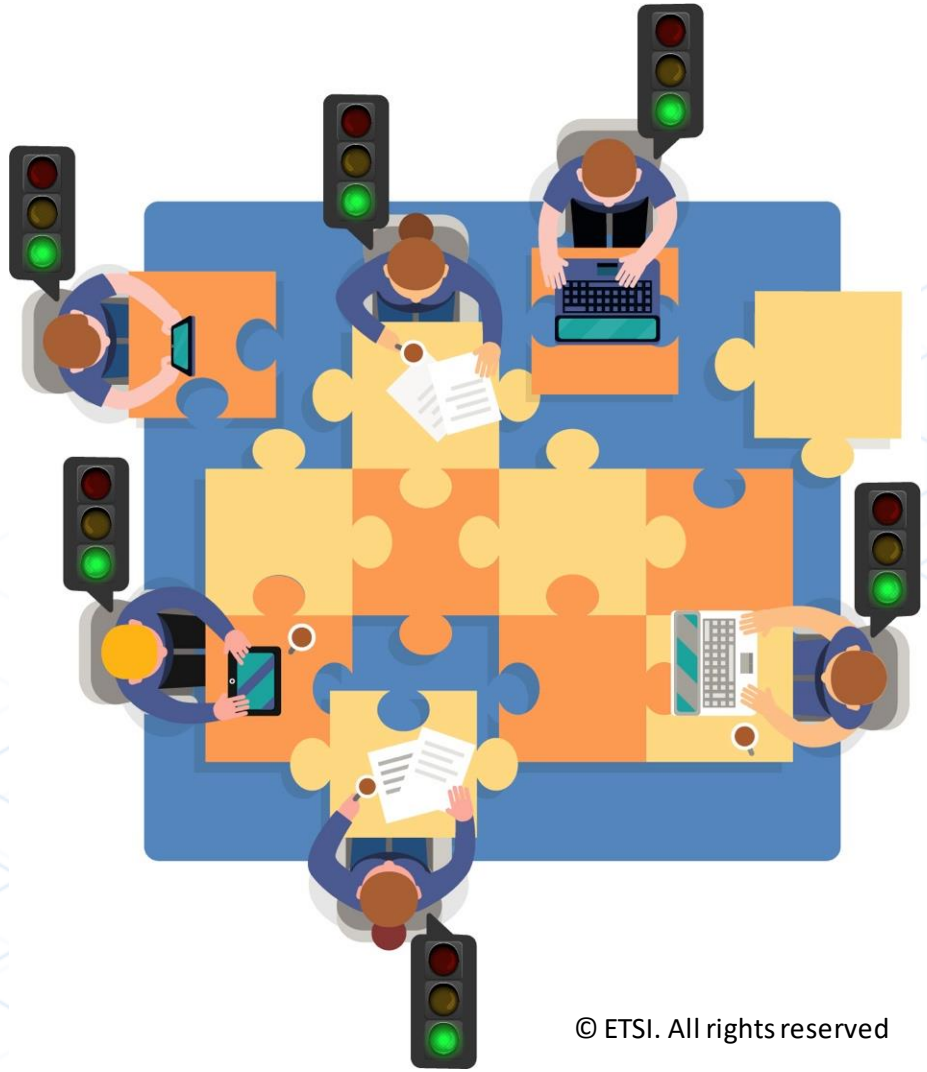
1. Introduction

- The standardisation **landscape is rich and complex**, because of the variety in standard development organisations (SDOs) and the documents they produce…
- The lecture aims to provide some **basic concepts** to help you to **find the way** around the **standards ecosystem also in the area of blockchain**.

2. Basics of standardisation

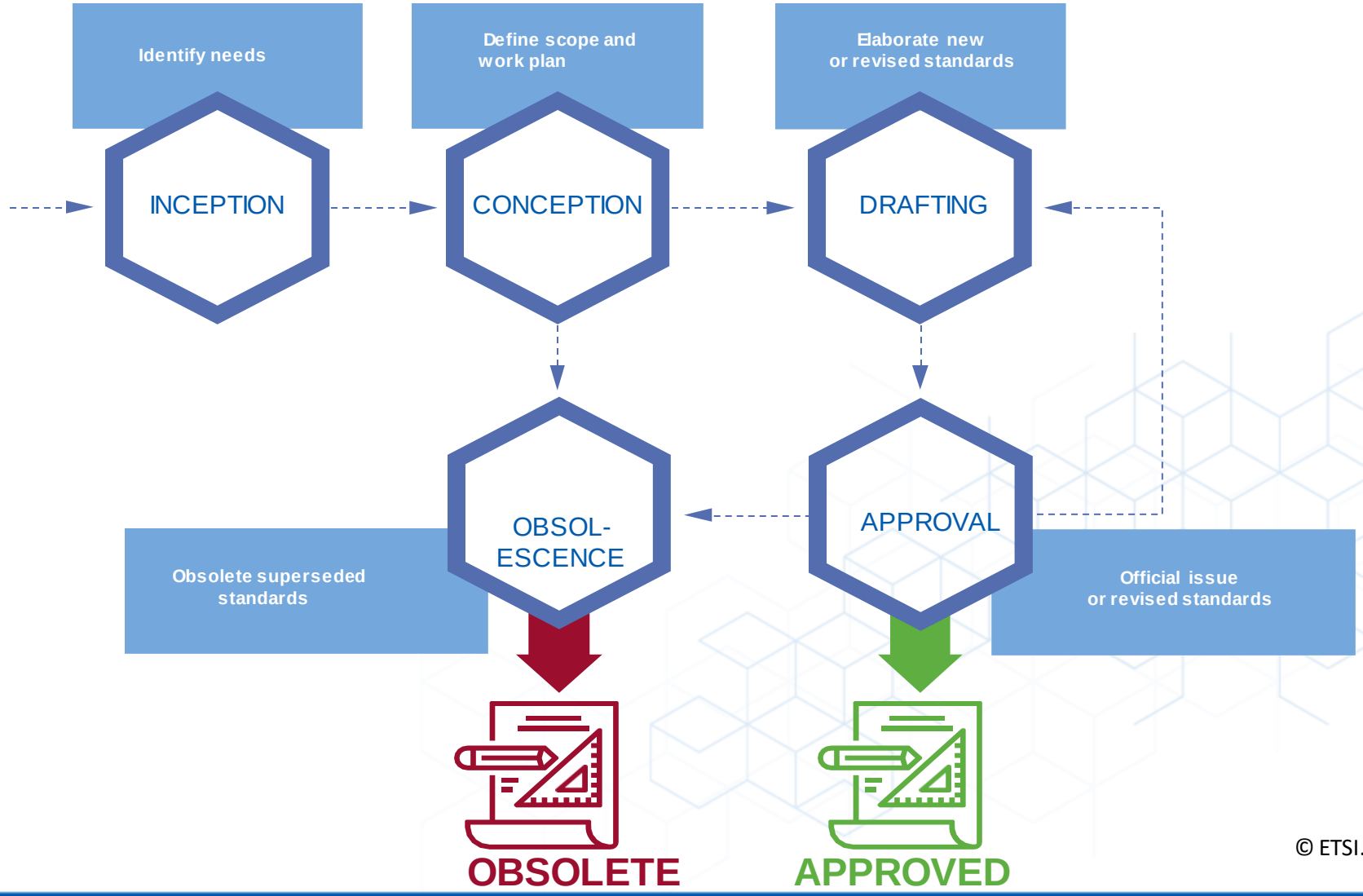
Formal standardisation, SDO standards, and regulation

- Formal standardisation is a well-defined process (see next slide), in general open to any individual or organisation, and its results are produced in consensus with all interested stakeholders (e.g., manufacturers, providers, consumers, and regulators) and guaranteeing the quality of the final deliverables.
- Formal standardisation is inspired by international directives on standardisation, the most important being the principles produced by the Technical Barriers to Trade (TBT) Committee of the World Trade Organization (WTO).
- Formal standardisation is the process adopted by SDOs to produce standards. Hence, we refer to these standards as SDO standards



2. Basics of standardisation

Formal standardisation, SDO standards, and regulation



2. Basics of standardisation

Formal standardisation, SDO standards, and regulation

- Standards address mainly expert technical audiences in order to define some characteristics for a set of a specific items (which may be a product, material, procedure, service or process)

- Standards are not intended to fully specify an item, or to provide a thorough scientific-technical elaboration on a subject, but they’re aimed to define the minimum requirements in order to meet certain well defined objectives (e.g., to guarantee a certain degree of interoperability or a minimum level of performance)

2. Basics of standardisation

Formal standardisation, SDO standards, and regulation

- It shall be clear and unambiguous
  - It shall help readers to clearly understand what is essential to ensure compliance
  - It shall include and clearly separate parts that are
    - Normative, i.e. which describe mandatory standard requirements, i.e. the individual characteristics that the item being standardised must implement if it is to fully comply with the standard
    - Informative, i.e. which help with conceptual understanding
- It shall be written in plain language
  - Simple and short sentences
- Its requirements must be consistent, testable and not be redundant
- It shall have well-defined objectives that meet real needs
  - It has NOT to be fruitlessly over-prescriptive

2. Basics of standardisation

Formal standardisation, SDO standards, and regulation

- Standards are NOT regulations.
- Standards are NOT a set of thorough design rules.
- Standards are voluntary NOT compulsory from a legal perspective
- Yet, they may inspire each other

2. Basics of standardisation

Formal standardisation, SDO standards, and regulation

- Standards are NOT regulations
  - While conformity with standards is voluntary, regulations are compulsory; i.e.
    - An item (product, service, process, etc.) that doesn't fit regulations is not allowed in the territory/market where those regulations apply;
    - On the contrary, non-compliance to standards doesn't limit 'by law' the diffusion of an item (e.g., remember the case of some smartphones' proprietary connectors)
  - Standards are often (fully or partially) captured into regulations, as this simplifies and accelerates regulatory work thanks to the directions of established best practices defined in standards
- Standards are NOT a set of thorough design rules
  - Standards are aimed at defining a minimum set of requirements for an item (product, service, process, etc.) in order to make it meet certain well-defined objectives (e.g., to guarantee a certain degree of interoperability or to define a minimum level of performance)
  - Many 'standard-compliant' implementations are possible

2. Basics of standardisation

Formal standardisation, SDO standards, and regulation

- From here on, we will focus on “SDO standards”; so, in the following and unless otherwise explicitly stated when referring to “standards” we will mean “SDO standards”

ITU
ISO
IEC
CEN CENELEC
W3C®
ETSI
ARSO
IEEE
PASC PACIFIC AREA STANDARDS CONGRESS
oneM2M
IETF®

3. Standards organisations

Formal standardisation and SDOs (1/2)

- **Formal standardisation** is based on **well-defined processes**, open to any individual or organisation, and its results are produced in consensus with all interested parties.
- **It is inspired** mainly by the six principles of the **Technical Barriers to Trade (TBT)** Committee of the Word Trade Organisation (**WTO**): Transparency, Openness, Impartiality and consensus, Effectiveness and relevance, Coherence, and Development dimension.
- Organisations doing formal standardisation are known as **Standard Development Organisations (SDOs)**. They act in response to specific industry or societal needs.

3. Standards organisations

Formal standardisation and SDOs (2/2)

- Some SDOs are officially **recognised by regulatory systems, e.g. the European Commission,** as providers of standards. They are known as **recognised SDOs**.
- Sometimes, the expression **"de jure" standards** is used as an equivalent to **SDO standards**.
  - However, "de jure" fits only in the case of a subset of these standards, i.e., those that are used by legislation.

3. Standards organisations

Recognised European SDOs in the European Union

- Regulation (EU) No 1025/2012 of the European Parliament and of the Council:
  - **Designates CEN, CENELEC and ETSI** as the **European Standardisation Organisations (ESOs).**
  - The aims set out in the EU treaties are achieved by several types of legal act: regulations, directives, decisions and opinions.
  - Example: Directive (EU) 2016/2102 on the accessibility of the websites and mobile applications of public sector bodies makes references to the CEN/CENELEC/ETSI standard EN 301 549.

3. Standards organisations

SDOs that are not officially recognised

- Besides the officially recognised SDOs, there are **well respected and long existing SDOs**,
  - like **W3C, IETF, OASIS, IEEE, OMG.**
- These are **not officially recognised** by the authorities, e.g. being not referenced in public procurement, **but they have well established procedures** to ensure the quality of their standards.

3. Standards organisations

SDOs that are not officially recognised. Examples

- W3C's Web Content Accessibility Guidelines (WCAG) standard is explicitly referenced by CEN/CENELEC/ETSI standard EN 301 549 on ICT accessibility requirements.
- **IEEE** counts on a specific board (the IEEE-SA Standards Board) for coordinating the development and revision of IEEE standards:
  - This includes approving the initiation of standards projects and reviewing them for consensus, due process, openness, and balance.
- **IEEE 802** is just an example of an IEEE family of standards with a significant impact in society.
  - 802 standards deal with local area networks and metropolitan area networks.

3. Standards organisations

Public and private organisations

- Public organisations have been normally created by treaties. This is the case of ITU, which is an agency of the United Nations

- Other standards organisations are private, such as ISO, OMG, ETSI or ANSI.

3. Standards organisations

De facto standards (1/3)

- These **ICT-related items** have in common that they have had a **huge impact** in society…
  - **PDF**: a document format created by Adobe Systems, but meanwhile published as ISO standard.
  - **HTML**: a language for describing the structure of Web pages. It was originally created by Tim Berners-Lee, and it is currently published and maintained by W3C.
  - **Microsoft Windows**: an operating system that became an industry standard due to Microsoft's market power, and so did its specifications (e.g. the Microsoft Web Services Security specification, WS-Security).
- … They are called "**de facto standards**". They are **common practices adopted by the market**, which are initially not the result of a standardisation process.

3. Standards organisations

De facto standards (2/3)

- A **de facto standard** is a **custom or convention** that has achieved a **dominant position, like Windows,** by public acceptance or market forces, and that usually has the attractive characteristic of having been **validated by market processes** (Maxwell 2006)
- Abernathy and Utterback (1978) introduced the '**dominant design**' concept.
  - Dominant designs may not be better than other designs; they simply incorporate a set of key features that sometimes emerge due to technological path- dependence and not necessarily strict customer preferences.

3. Standards organisations

De facto standards (3/3)

- De facto standards may be adopted as formal standards by recognised SDOs:
  - ISO/IEC 15445:2000 Information technology -- Document description and processing languages -- HyperText Markup Language (HTML).
  - ISO 32000-1:2008 (reviewed and confirmed in 2023) Document management -- Portable document format -- Part 1: PDF.

3. Standard development organisations

De facto standards vs SDO standards (Blind 2008)

SDO STANDARD	DE FACTO STANDARD
▪ Developed in SDOs	▪ Dominant design through a standard war or natural selection. A company achieves a dominant position by public acceptance or market forces, e.g. Windows
▪ Open and consensus oriented with the option of opposition, which may sometimes lead to lengthy decision procedures	▪ Standardisation process with restricted access; homogeneous environment may allow fast decisions
▪ Clear and transparent participation and voting rules	▪ Direct participation of company alliances (e.g. consortia) and individual companies

3. Standards development organisations

Industrial consortia

- **Some standards organisations** were created as **industrial consortia**, e.g.:
  - The Home Gateway Initiative (HGI) developed a smart home architecture that enables applications to connect with devices on any home network interface.
  - The EnOcean Alliance created a wireless standard to develop self-powered wireless monitoring and control systems for sustainable buildings as well as energy harvesting solutions.
- In the ICT context of rapid developments, consortia benefit from a **lighter process** and a **lower level of consensus** of document approval than SDO standards go through.
- Documents developed by a **single company** (e.g. Windows as as Microsoft standard) **do not fall into this category**.

4. ICT Standardisation Landscape

Classification of SDOs

- ICT standardisation landscape is rather diverse (see Teubner et al.. 2021) and includes multiple SDOs that may differ in
  - Geographical coverage
  - Technical scope of activities (as per each SDO's statute)
  - Level of recognition from regulatory or political organisations

- SDOs often establish liaisons or set up common working groups to generically coordinate their activities or to join forces on specific items

4. ICT Standardisation Landscape

Classification of SDOs

- International SDOs
  - These have members worldwide, which sometimes also include national or regional standard bodies, and their deliverables have worldwide coverage.

- Regional SDOs
  - These have members (industries, academia and national SDOs) from well defined geographic regions that usually share, or are interested in promoting common practices and regulations.

4. ICT Standardisation Landscape

Classification of SDOs – International SDOs (examples)

- ITU
  - Since 1947 it's a specialised agency of UN, with study group members comprising state members, sector members, associates from industry, international and regional standard organisations, and academia.
  - ITU sectors: ITU-T (telecommunication standardisation), ITU-R (global radio spectrum, satellite orbits), ITU-D (promotion of fair and affordable access to telecommunications)
- ISO
  - Independent, international non-governmental organisation founded in 1946
  - Members from 160 countries work in hundreds of technical committees and subcommittees
  - ISO standards cover ICT, healthcare, energy and automotive, etc.
- IETF
  - Governing body of the Internet as part of the Internet society (ISOC)
  - It is controlled by the Internet Architecture Board (IAB), which is both a committee of the IETF and an advisory body of the Internet Society

4. ICT Standardisation Landscape

Classification of SDOs – International SDOs (examples)

- ETSI
  - ETSI is a European Standards Organisation (ESO), recognized regional standards body dealing with telecommunications, broadcasting and other electronic communications networks and services.
  - ETSI supports European regulations and legislation through the creation of Harmonised European Standards. Only standards developed by the three ESOs (CEN, CENELEC and ETSI) are recognized as European Standards.
- ARSO
  - Main goals: harmonize national and/or sub-regional standards as African Standards, to initiate and coordinate the development of African Standards (ARS) with reference to products that are of particular interest to Africa, such as agriculture and food, civil engineering, chemistry, and chemical engineering, and to encourage and facilitate the adoption of international standards by member bodies.
- PASC
  - main objectives: to strengthen ISO and IEC international standardization programmes, to improve the ability of Pacific Rim SDOs to participate in these programmes effectively, to improve the quality and capacity of standardization and to promote standardization

4. ICT Standardisation Landscape

Classification of SDOs – Geographical coverage

- National Standard Bodies (NSBs)
  - NSBs operate at the single country level and issue country-specific standards; they often collaborate with International and Regional SDOs.
  - Some relevant NSBs outside Europe are:

ANSI American National Standards Institute
Standards that connect the world. JAPANESE STANDARDS ASSOCIATION SINCE 1945
मानकः पथप्रदर्शकः
ARIB
tsdsi
CCSA
Standards Council of Canada
Conseil canadien des normes
SAC
中国国家标准化管理委员会
Standardization Administration of the P.R.C.
TTA
atis
TTC Telecommunication Technology Committee
NSAI
National Standards Authority of Ireland
Údarás Um Chaighdeáin Náisiúnta na hÉireann

4. ICT Standardisation Landscape

Classification of SDOs – Examples of scope of activities

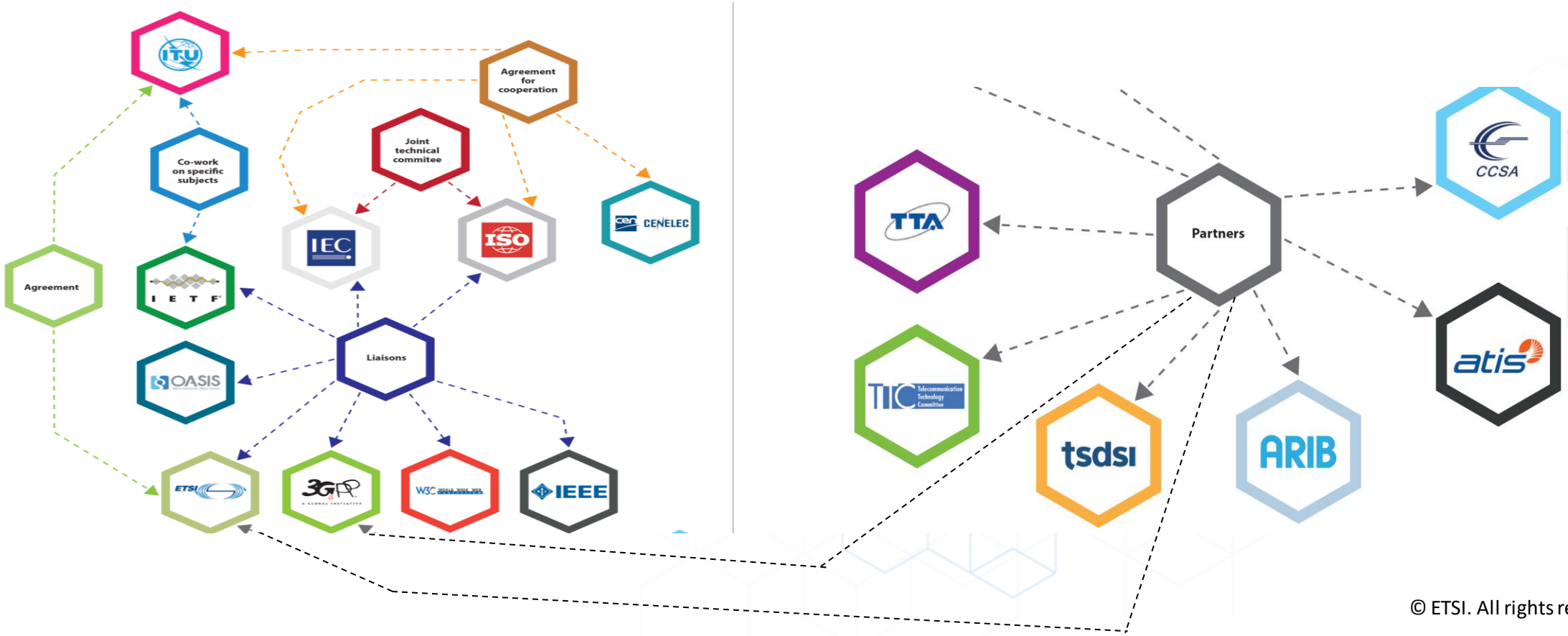
- A non exhaustive overview of the ICT ecosystem, where International, Regional and National SDOs, professional organisations and industrial consortia operate

Organisation	Typical technical scope of activity
ITU	Interoperable telecom specifications incl. architecture, services, protocols, addressing / numbering plans
ISO	ICT architecture (OSI model) services, protocols incl. application protocols
IEC	Electrotechnical standards, incl. connectors, electrical safety and tests
ETSI	Standards for ICT-enabled systems, applications and services
CEN	Household appliances, Intelligent Transportation and Mobility, Smart Grids and Smart Metering, Cybersecurity, Blockchains
CENELEC	Electrotechnical standards, incl. connectors, electrical safety and tests, ECM
IEEE	All LAN specifications: IEEE 802.xx, including cabled LANs, Token Ring and Bus, MAN Wireless LANs, e.g. WiFi)
IETF	All internet related specifications including protocols, generic applications, addressing rules (IP, url)

4. ICT Standardisation Landscape

Classification of SDOs – Examples of liaisons among SDOs

- A non-exhaustive overview of the ICT ecosystem, where International, Regional and National SDOs, professional organisations and industrial consortia collaborate through liaisons and standard initiatives



4. ICT Standardisation Landscape

Classification of SDOs

- Recognised SDOs
  - These are officially recognised by regulation systems or political bodies
  - ITU, UN specialised agency for information and communication
  - EU regulation 1025/2012 rules the standardisation at an European level and lists a set of reference SDOs with either an international (ISO, IEC, and ITU) or European scope (CEN, CENELEC, and ETSI)
- Not Recognised Organisations
  - These are not recognised by any political bodies in the EU
  - The Institute of Electrical and Electronics Engineers (IEEE), the American association of Electrical and Electronics Engineer, brings together and organises members from all over the world. IEEE is a primary SDO with a large number of active technical standards, ranging from wireless communications and digital health to cloud computing, power and energy, 3D video, electrical vehicle standards, and the Internet of Things.

4. ICT Standardisation Landscape

Classification of SDOs

- SDOs can create groups/projects, possibly also involving industries, for cooperating in the definition of specific standards
  - 3GPP
    - It consists of SDOs operating in the telecommunication field in countries and regions across the globe
    - Shared environment in which to produce the reports and specifications that define mobile radio technologies (radio access, core transport network, service capabilities and hooks for non-radio access to the core network, and for interworking with Wi-Fi networks)
  - OneM2M
    - Purpose is to develop technical specifications, which address the need for a reference Machine-to-Machine Service Layer that can be embedded within various hardware and software.
    - One of the main goal is to involve organisations from M2M-related business domains, such as telematics and intelligent transportation, healthcare, utilities, industrial automation, smart homes, etc.

4. ICT Standardisation Landscape

Classification of SDOs - Affiliation

- In addition to SDOs, there are other organisations that do not strictly or entirely use the formal standardisation procedures but aim at defining standard in a specific area
  - Example Industrial Fora/ Consortia: they are composed of groups of companies that temporarily join their efforts on specific subjects to realise, accelerate, complement, or promote the development of standards on them

broadband forum
ecma INTERNATIONAL
zigbee
Energy@home
Safer. Smarter. Z-WAVE
JEDEC
PICMG
THE Open GROUP
SNIA

5. Links between standard development organisations

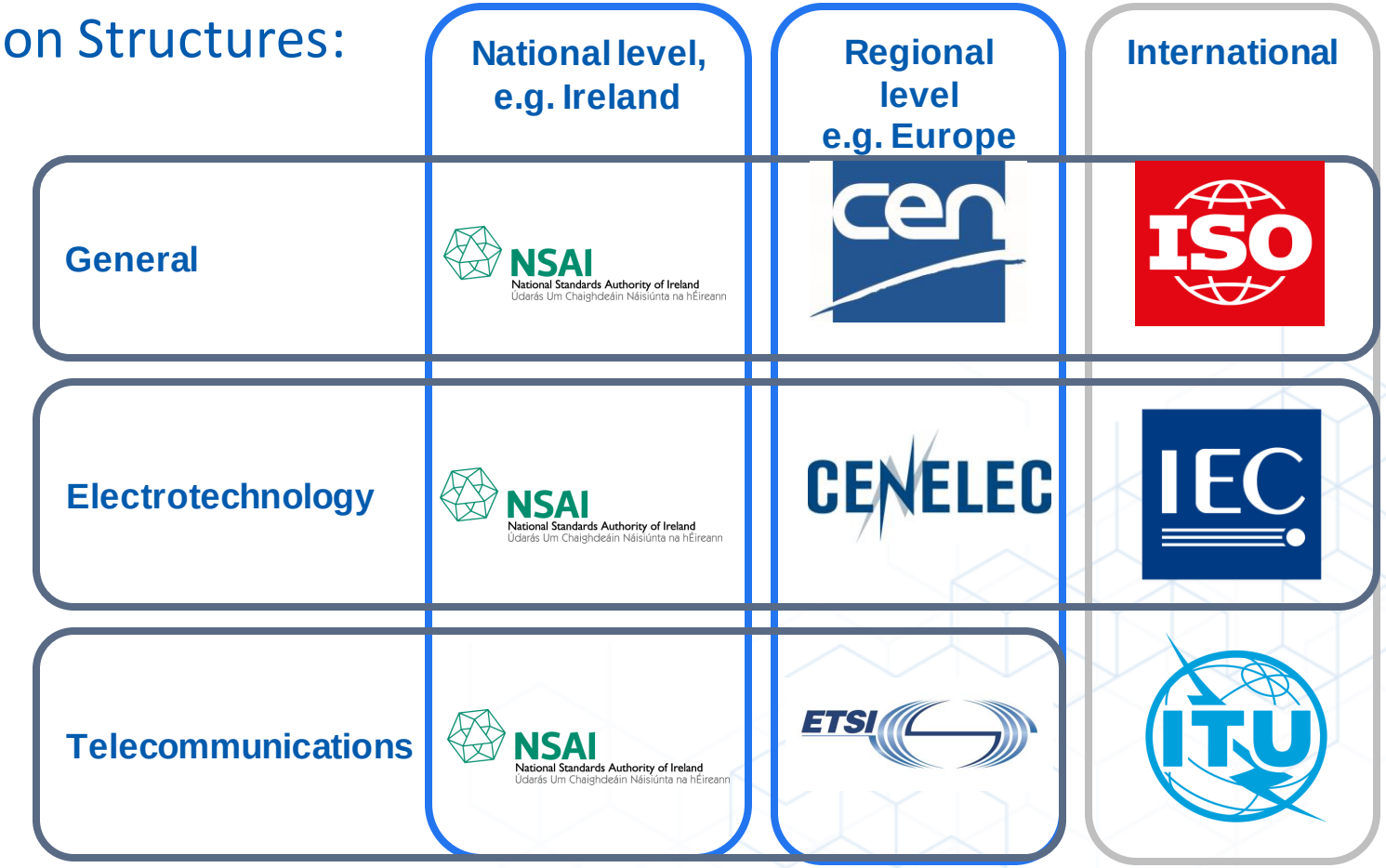
Geographical scope of organisations and standards (1/2)

- Recognised SDOs have **national, regional or international geographical** scope, and so do the formal standards they produce:
  - ISO, IEC and ITU are official **international** standard organisations, with a worldwide scope.
  - CEN, CENELEC and ETSI are officially recognised as **European** bodies for standardisation.
  - PASC is a regional SDO the **Pacific** area.
  - DIN, UNE, ANSI, and BIS are national SDOs in, respectively, **Germany, Spain, USA, and India.**

5. Links between standard development organisations

Geographical scope of organisations and standards (2/2)

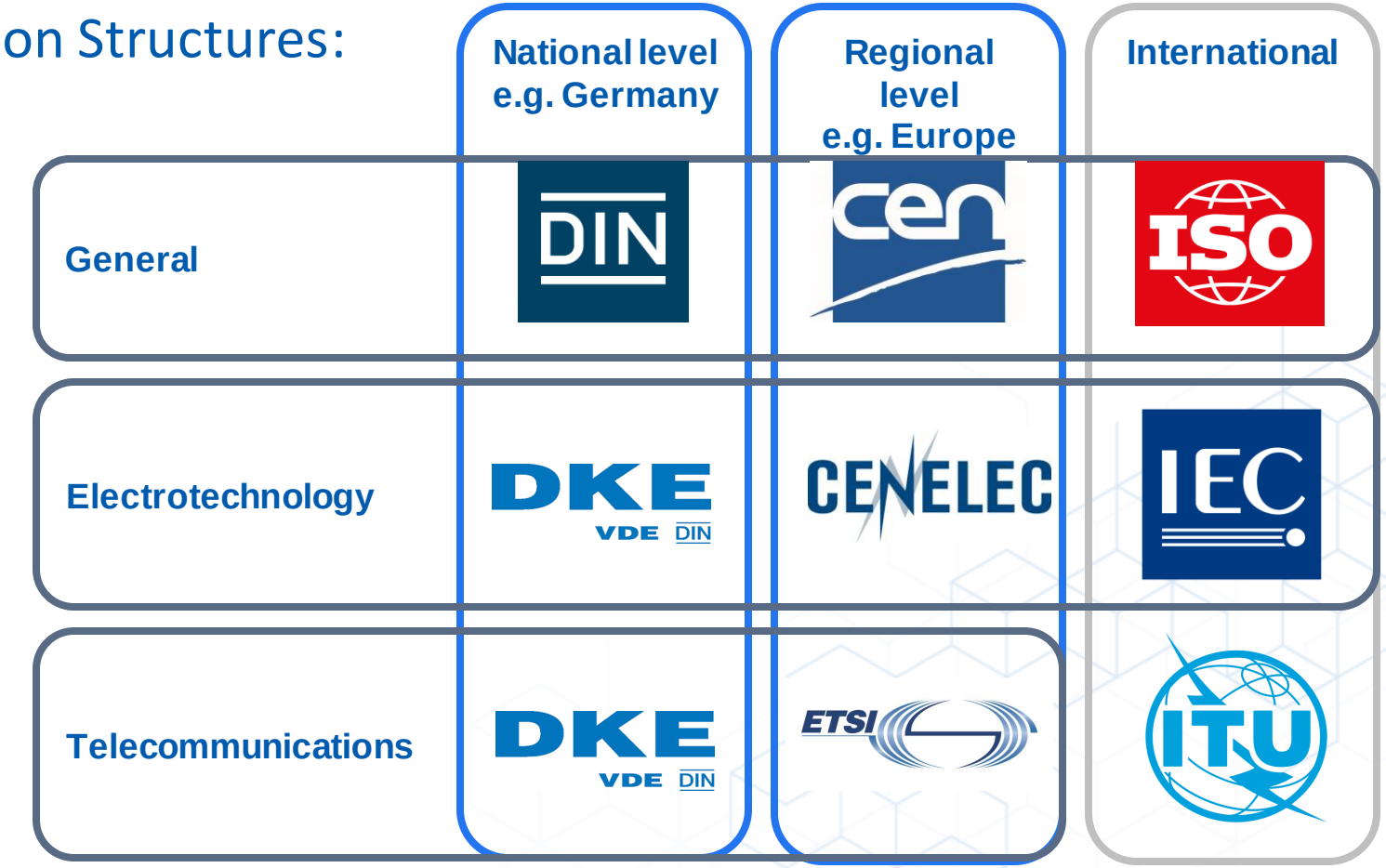
- Standardisation Structures:



5. Links between standard development organisations

Geographical scope of organisations and standards (2/2)

- Standardisation Structures:

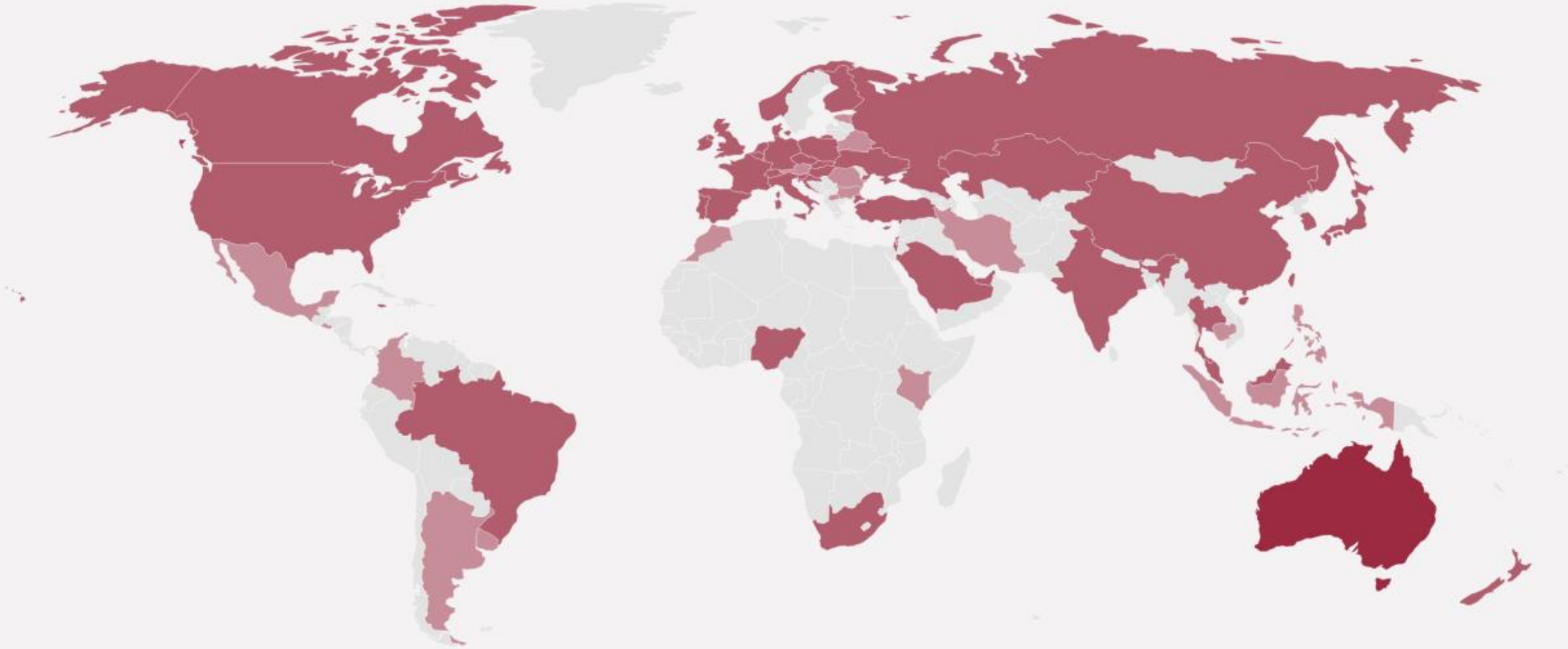


6. Standardisation organisations active in Blockchain

- Blockchain standardisation activities are mainly take place at the international level
  - ISO/TC 307 Blockchain and distributed ledger technologies
    - WG 1 Foundations;
    - WG 2 Security, privacy and identity;
    - WG 3 Smart contracts and their applications;
    - WG 4 Joint ISO/TC 307 - ISO/IEC JTC 1/SC 27 WG: Security, privacy and identity for Blockchain and DLT
    - WG 5 Governance;
    - WG 6 Use cases;
    - WG 7 Interoperability;
    - WG 8 Tokenization of assets.
  - ITU Focus Group on Application of Distributed Ledger Technology
  - CEN-CLC/JTC 19 Blockchain and Distributed Ledger Technologies
    - CEN/CLC/JTC 19/WG 1 Decentralised identity management;
    - CEN/CLC/JTC 19/WG 2 Environmental sustainability.

← ISO/TC 307

Participation



This map is designed to visually demonstrate the geographic distribution of our Members. The boundaries shown do not imply an official endorsement or acceptance by ISO.

Source: https://www.iso.org/committee/6266604.html?view=participation accessed January 2025

6. Examples of published Blockchain Standards by ISO TC 307

- ISO/TR 3242:2022 Blockchain and distributed ledger technologies – Use cases
- ISO/TR 6039:2023 Blockchain and distributed ledger technologies — Identifiers of subjects and objects for the design of blockchain systems
- ISO/TR 6277:2024 Blockchain and distributed ledger technologies — Data flow models for blockchain and DLT use cases
- ISO 22739:2024 Blockchain and distributed ledger technologies — Vocabulary
- ISO/TR 23244:2020 Blockchain and distributed ledger technologies — Privacy and personally identifiable information protection considerations
- ISO/TR 23249:2022 Blockchain and distributed ledger technologies – Overview of existing DLT systems for identity management
- ISO 23257:2022 Blockchain and distributed ledger technologies — Reference architecture
- ISO/TS 23258:2021 Blockchain and distributed ledger technologies — Taxonomy and Ontology
- ISO/TR 23455:2019 Blockchain and distributed ledger technologies — Overview of and interactions between smart contracts in blockchain and distributed ledger technology systems
- ISO/TR 23576:2020 Blockchain and distributed ledger technologies — Security management of digital asset custodians
- **ISO/TS 23635:2022 Blockchain and distributed ledger technologies — Guidelines for governance**
- ISO/TR 23644:2023 Blockchain and distributed ledger technologies (DLTs) — Overview of trust anchors for DLT-based identity management

6. Example: ISO/TS 23635:2022 Blockchain and distributed ledger technologies — Guidelines for governance

- ISO/TS 23635:2022 is a standard proposed by experts at ISO TC307 WG 5 Governance, who recognised that for organisations and broader industries, it is difficult to engage in the development of DLT systems in the absence of effective DLT-governance mechanisms.
- In the case of permissionless public distributed ledgers, they can comprise an unrestricted number of potentially pseudonymous DLT users and nodes. In permissioned public blockchains they can have hybrid governance structures.
- In the absence of a central governing authority, several governance questions regarding ownership, decision rights, responsibilities and accountabilities, and incentive structures emerge that cannot be addressed by applying traditional mechanisms.
- This standard is was published in 2022.

Thank your for your attention!

List of abbreviations

- 3GPP: 3rd Generation Partnership Project
- AAP: Alternative Approval Process
- AD: Area Director
- ANSI: American National Standards Institute
- ARSO: African Organization for Standardization
- BGP: Border Gateway Protocol
- CEN: Comité européen de normalization - European Committee for Standardization
- CENELEC: Comité européen de normalization en électrotechnique - European Committee for Electrotechnical Standardization
- CERN: Centre Européen pour la Recherche Nucléaire - European Organization for Nuclear Research
- DVD: Digital Versatile Disk
- ECMA: European Computer Manufacturers' Association
- ETSI: European Telecommunications Standards Institute
- IEC: International Electrotechnical Commission
- INCITS: InterNational Committee for Information Technology Standards
- ISO: International Organization for Standardization
- ITU: International Telecommunication Union
- JEDEC: Joint Electron Device Engineering Council

List of abbreviations

- HD DVD: High Definition Digital Versatile Disc
- HTML: HyperText Markup Language
- IEEE: Institute of Electrical and Electronics Engineers
- IETF: Internet Engineering Task Force
- IP: Internet Protocol
- IPsec: IP security
- HDMI: High Definition Multimedia Interface
- ICT: Information and Communication Technology
- LTE: Long Term Evolution
- M2M: Machine to Machine
- NSDO: National Standard Development Organization
- OSPF: Open Shortest Path First
- PASC: Pacific Area Standards Congress
- PDF: Portable Document Format
- SDO: Standard Development Organization
- TAP: Traditional Approval Process
- UMTS: Universal Mobile Telecommunications System
- VESA: Video Electronics Standards Association

List of abbreviations

- W3C: World Wide Web Consortium
- WG: Working Group
- WI: Work Item
- XML: eXtensible Markup Language

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