2 Introduction to Standards

○ The learning objectives of this section are:

∨ To identify what the purpose of standards is and how standards impact people's everyday life

∨ To learn what a standardization process is

∨ To distinguish between SDO and de facto standard

∨ To understand benefits and risks of standards

∨ To acquire a basic knowledge of the international, regional and national standardization landscape

∨ To have an overview the international, regional and national standardization landscape

∨ To understand the basic concepts of the SDOs' processes and the characteristics of the main deliverables

2.1 Basics of standardization
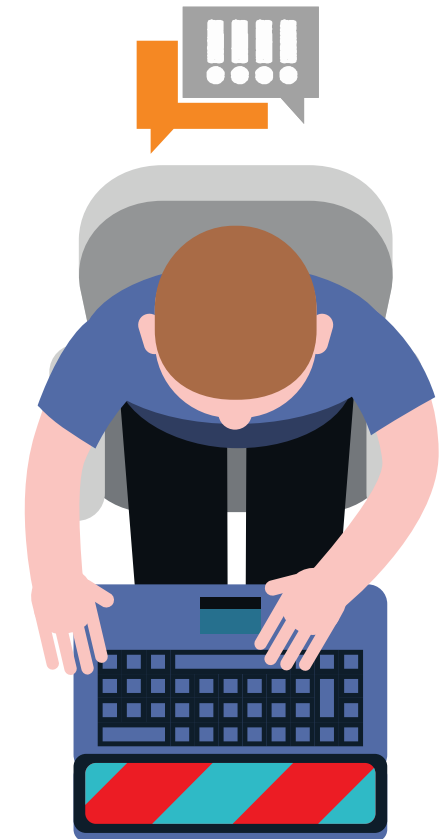## What standards are (in a wide sense) and why they're needed

The most general definition for a «standard» may be

«a widely agreed way of doing something» .....

.... where, depending on the specific area of application, "doing something" may be replaced by, e.g., "designing a product", "building a process", "implementing a procedure" or "delivering a service".

«Standard» (i.e. agreed and common) ways of doing things bring lot of benefits; our technological world without «standards» simply would not work (or, at least, it would be harder to make it work)

2.1 Basics of standardization
What standards are (in a wide sense) and why they're needed

For instance, what if

each computer had its own type of keyboard

each smartphone and PC had its own specific set of connectors and charger (though some have by choice ... more on this in next slides)
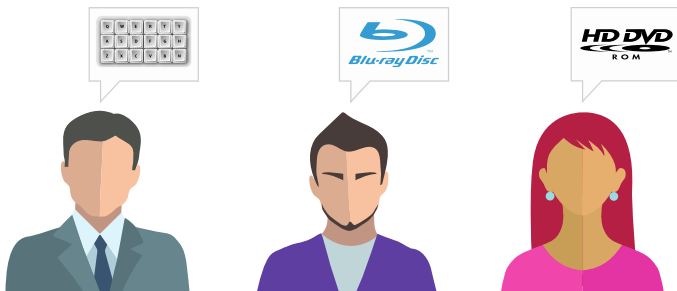
each device had its own protocol for interoperation

2.1 Basics of standardization
Two main different types of "standards"

Different types of standards according to the development process (standardization)

De facto standards, or standards in actuality, are adopted widely by an industry and its customers. These standards arise when a critical mass simply likes them well enough to collectively use them.

SDO standards are produced by devoted organizations, called Standards Development Organizations (SDOs). SDOs are organizations whose purpose is to develop standards and that put in place formal well-defined procedures to guarantee a fair development process.

De facto standards can become formal standards if they are approved by a SDO. Examples: HTML PDF
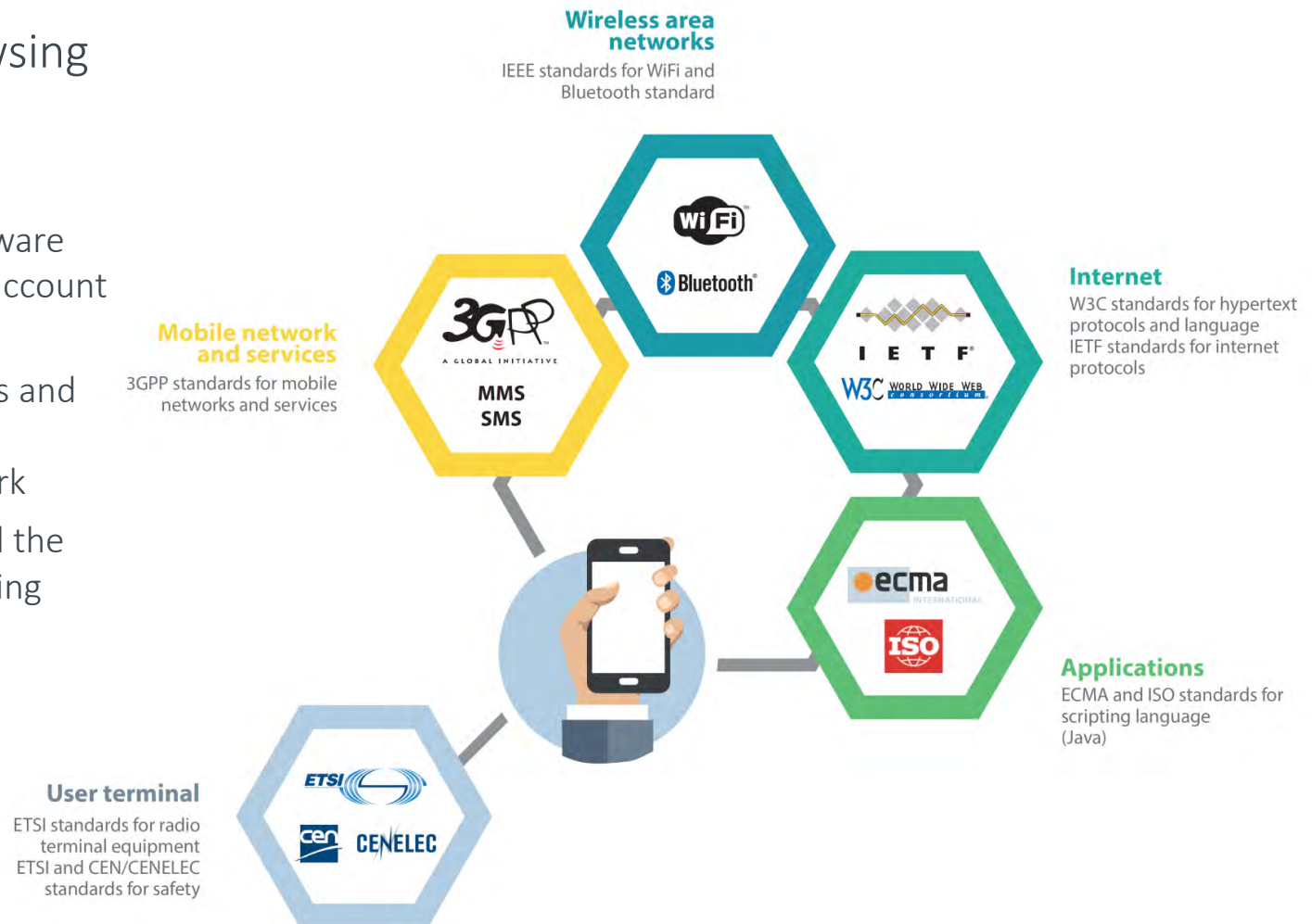
2.1 Basics of standardization
Standards in everyday life

Using a Smartphone for browsing (some of possibly involved standards):

- User equipment regarding hardware characteristics, also taking into account safety issues
- Connectivity among user devices and wireless network as well as the functionality of the same network
- Functionality of the Internet and the protocols to support web browsing

Wireless area networks
IEEE standards for WiFi and Bluetooth standard

Internet
W3C standards for hypertext protocols and language
IETF standards for internet protocols

Mobile network and services
3GPP standards for mobile networks and services

Applications
ECMA and ISO standards for scripting language (Java)

User terminal
ETSI standards for radio terminal equipment
ETSI and CEN/CENELEC standards for safety

2.1 Basics of standardization
Standards in everyday life

Using a Personal Computer
 (some of possibly involved standards)

A 2010 paper (Biddle & al., 2010) identifies 251 technical interoperability standards implemented in a laptop computer, but total number estimated to be over 500

Out of the 251 identified standards, "202 (80%) were developed by SDOs and 49 (20%) by individual companies"

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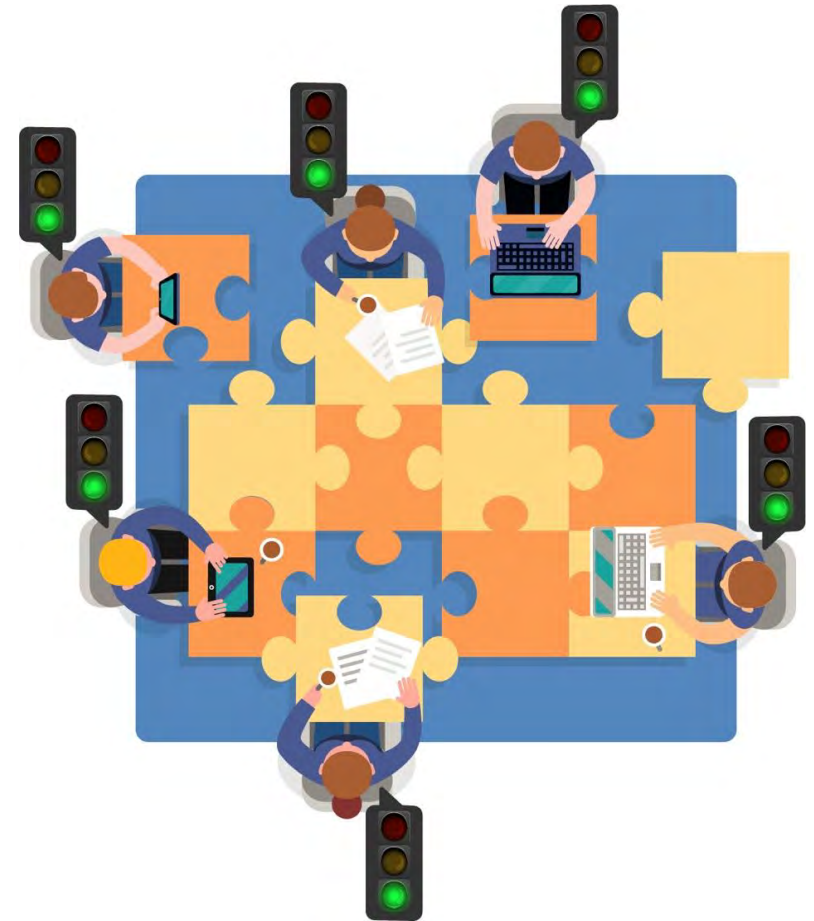
2.1 Basics of standardization
Standards in everyday life

Switching on lights
(some of the standards involved)
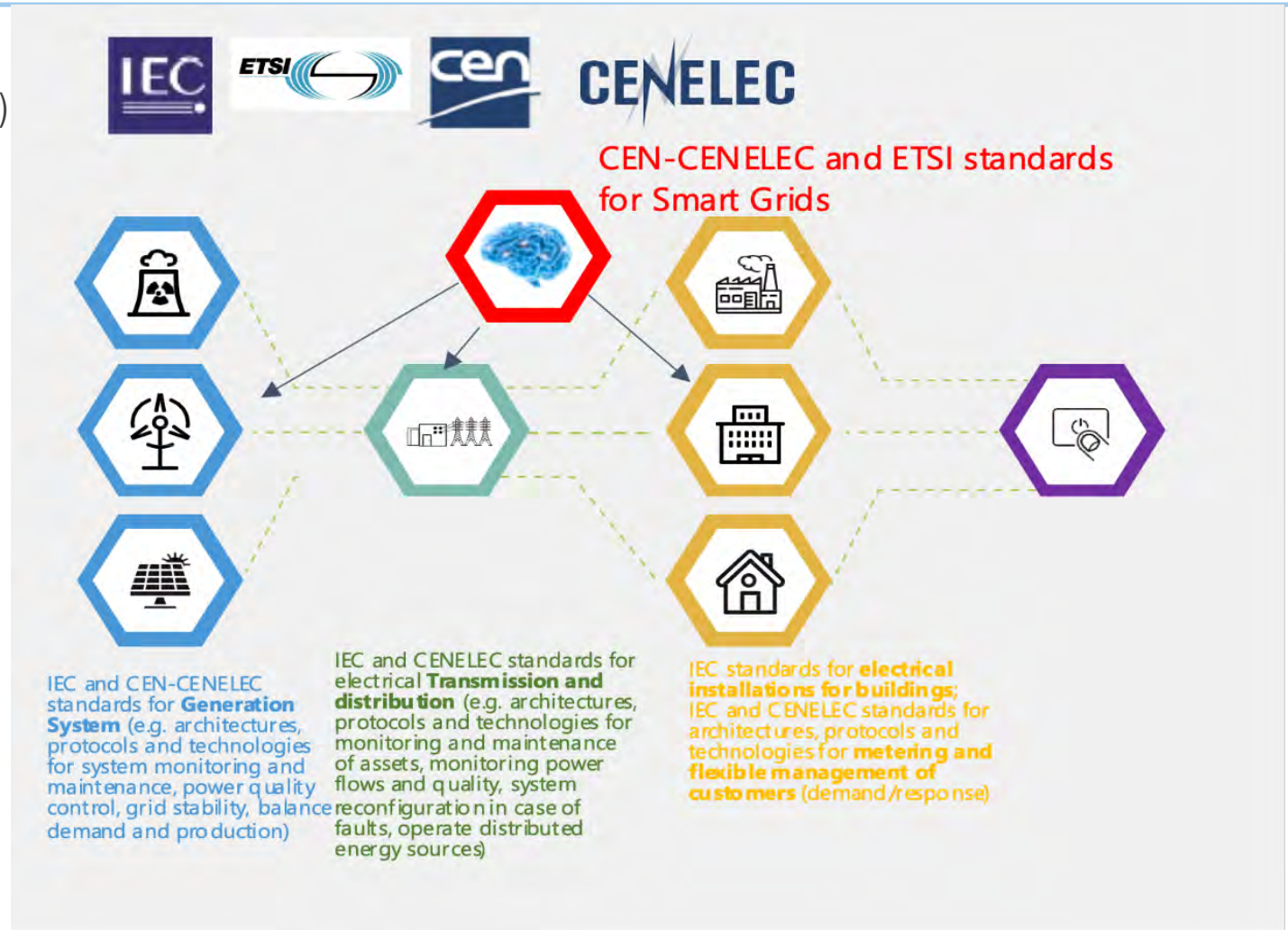
2.1 Basics of standardization
Formal standardization, SDO standards, and regulation

- **Formal standardization** is a well-defined process, open to any individual or organization, and its results are produced in consensus with all interested parties.

- Formal standardization is inspired by international directives on standardization, the most important being the principles produced by the Technical Barriers to Trade (TBT) Committee of the Word Trade Organization (WTO).

- Formal standardization is the process adopted by SDOs to produce standards. Hence, we refer to these standards as **SDO standards**

- SDOs put in place formal standardization procedures to guarantee a **fair standard development process**, which is aimed at **building consensus among involved stakeholders** (e.g., manufacturers, providers, consumers, and regulators) and guaranteeing the **quality** of the final deliverables.

2 Introduction to Standards

2.1 Basics of standardization
Formal standardization, 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"

2.1 Basics of standardization
Formal standardization, SDO standards, and regulation

- Standards are NOT regulations.

- Standards are NOT a set of thorough design rules.

- Standards are voluntary NOT compulsory

- Yet, they may inspire both
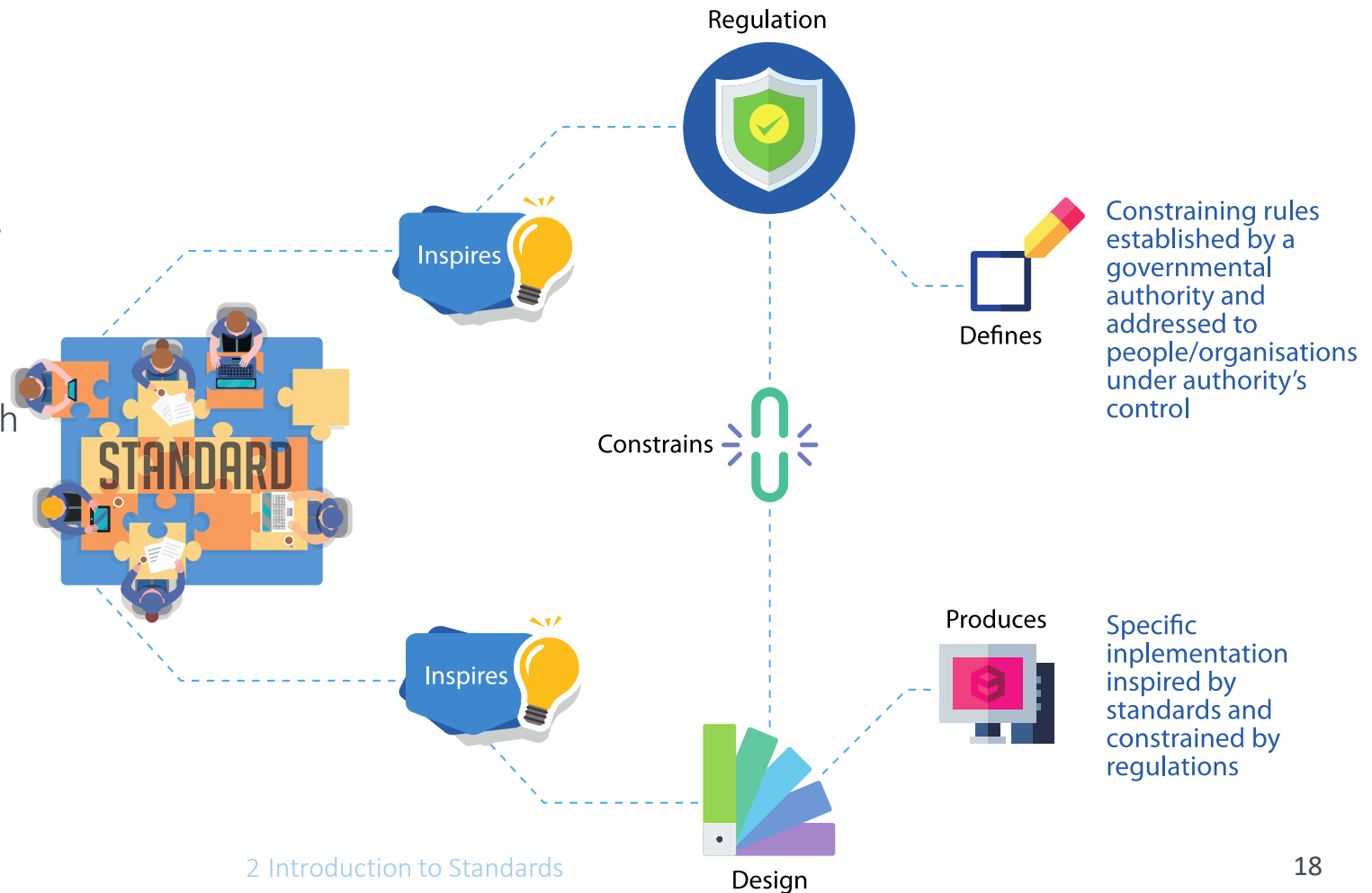
Regulation

Inspires

Constrains

Defines

Constraining rules established by a governmental authority and addressed to people/organisations under authority's control

Inspires

Produces

Specific inplementation inspired by standards and constrained by regulations

Design

2 Introduction to Standards

2.1 Basics of standardization
Formal standardization, 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 of the item are possible

2.2 Benefits and risks of standardization
Examples of benefits from Standards

As a consensus-built set of rules for doing something, a Standard

Benefits the economy by

- Incentivizing investments, as standards ensure the stability of the technology in a reasonable time frame
- Enabling economy of scale
- Facilitating trade thanks to common approaches among Countries
- Encouraging larger and fairer competition
- Consolidation of new technologies and identifying evolution paths that are able to preserve past investments
- Increasing collaboration opportunities among the companies, especially for small and innovative enterprises
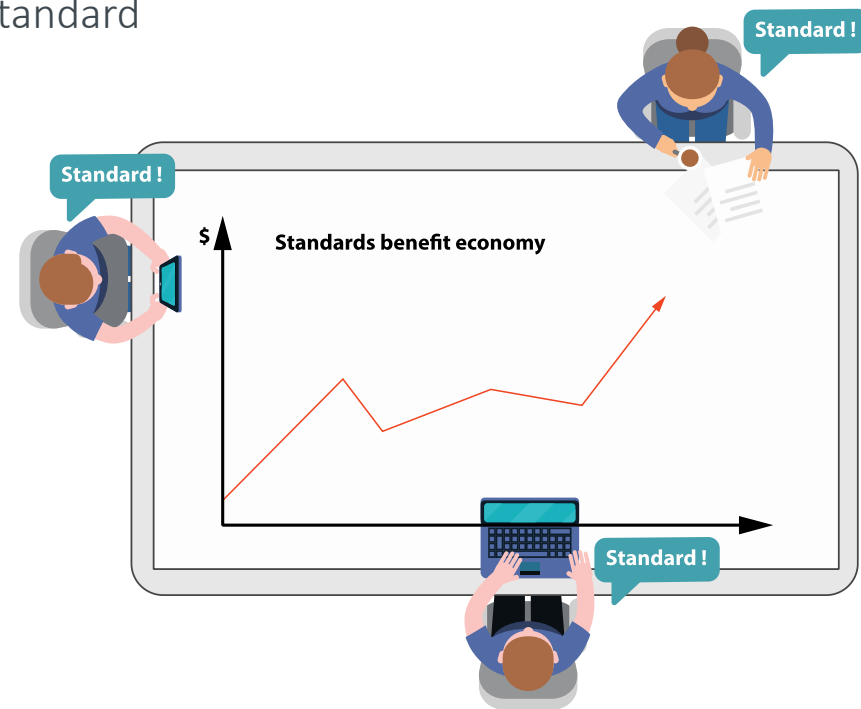
Benefits the environment by

- Supporting environmental sustainability
- Enhancing the safety of products
- Informing consumers in a clear unambiguous way, promoting company and product image at the same time

STANDARD

2.2 Benefits and risks of standardization
Examples of benefits from Standards

As a consensus-built set of rules for doing something, a Standard benefits innovation, by
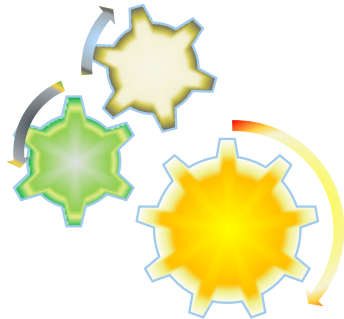
reducing development time, costs and risks, by steering designers' activity, which facilitates the uptake of innovation in the marketplace

- Improving quality
- Decreasing time to market
- Promoting the interoperability of products, services and processes
- Attract customers

2.2 Benefits and risks of standardization
Examples of benefits from Standards

Benefits of standards for industries (especially for newly established ones and SMEs)
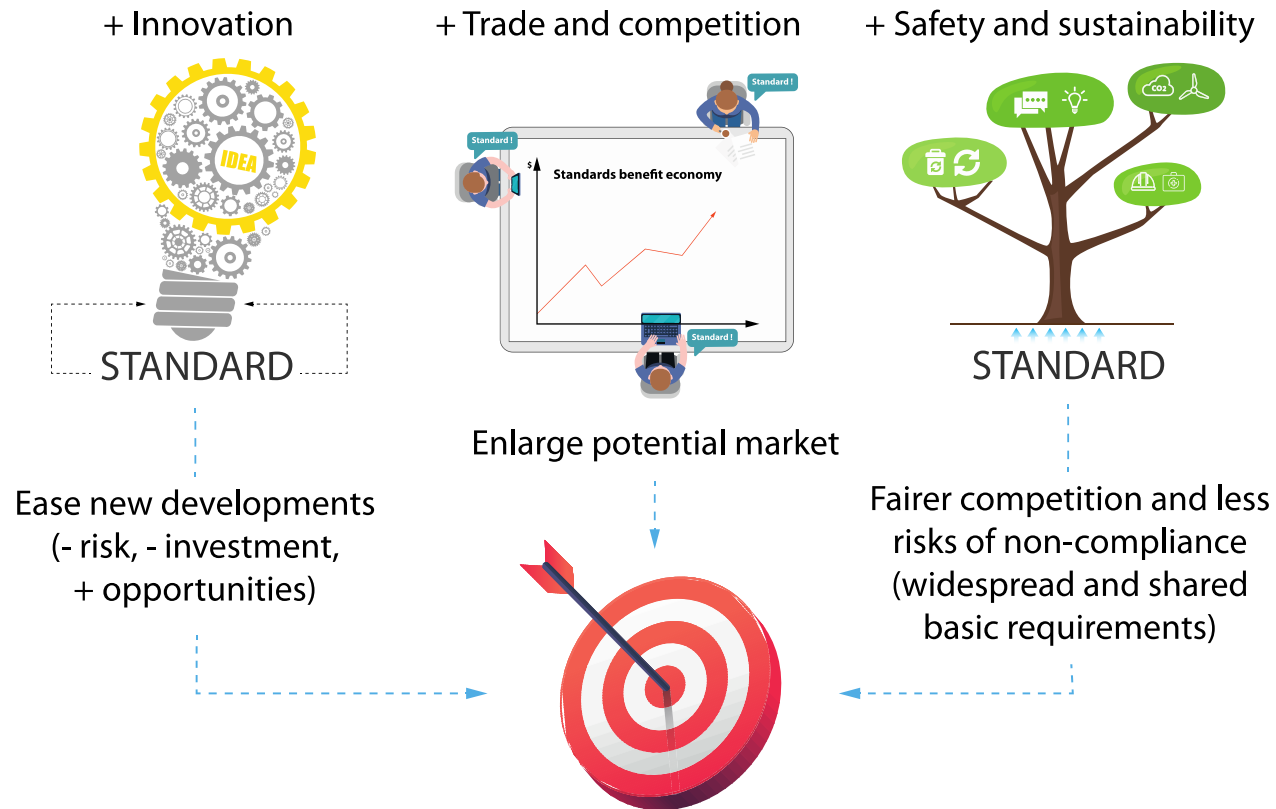
+ Innovation   + Trade and competition   + Safety and sustainability

STANDARD

Standards benefit economy

STANDARD

Enlarge potential market

Ease new developments
(- risk, - investment,
+ opportunities)

Fairer competition and less
risks of non-compliance
(widespread and shared
basic requirements)

2.2 Benefits and risks of standardization
Examples of benefits from Standards

Benefits of standards for communities and individuals
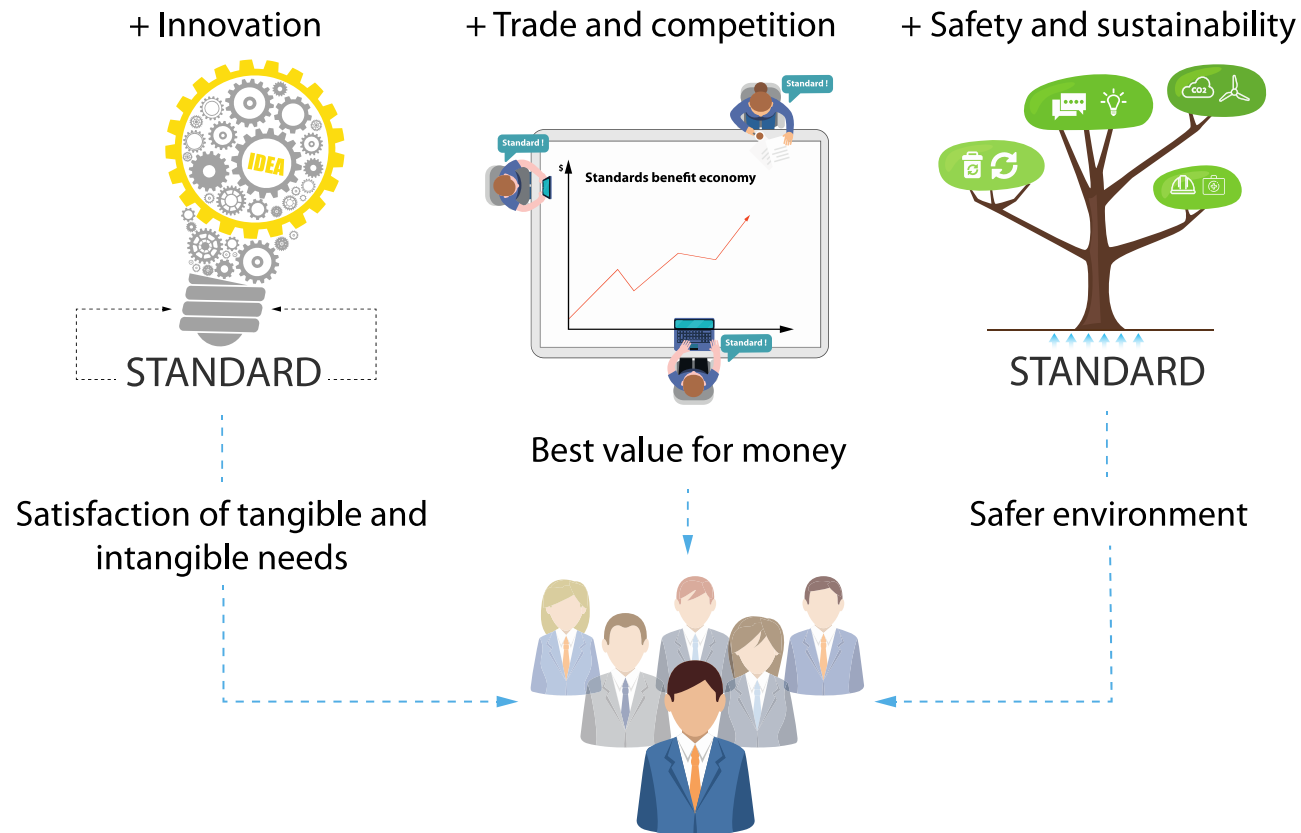
+ Innovation

+ Trade and competition

+ Safety and sustainability

STANDARD

Standards benefit economy

STANDARD

Best value for money

Satisfaction of tangible and intangible needs

Safer environment

2.2 Benefits and risks of standardization
Possible risks of Standards

- Standards may jeopardize innovation, as:
  - When established, standards may limit or delay the introduction of innovative (disruptive) solutions in the market
  - Introducing innovation into standards may take a long time

- Measures SDOs put in place to minimize risks:
  - Effectively managing the standardization processes by being open and responsive to the market innovation trends and to research impulses from the experts involved in the standardization activities
  - Establish open expert groups to explore innovation

2.2 Benefits and risks of standardization
Possible risks of Standards

- Standards may jeopardize fair competition among industries and Countries, as:
  - SDOs may be politicized, or unduly influenced by special interests

- Measures SDOs put in place to minimize risks:
  - Enlarge contributor base
  - Right balance between effectiveness and fairness

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DAILY NEWS

BIG NEWS
DOLOR SIT AMET

Influence of special interests on standards

One of the penalties for refusing to participate in ~~politics~~ standards is that you end up being governed by your inferiors.

Plato

WORLD NEWS
LOREM IPSUM
DOLOR SIT AMET

NEW DEAL
DOLOR SIT AMET

$$$$

2.2 Benefits and risks of standardization
Possible risks of Standards

- Varied standardization landscape may carry to inconsistencies, as:
  - Standards produced by different SDOs may be in competition or partially overlap; consequent production of inconsistent or, at least, redundant requirements may strongly jeopardize standardization benefits
  - Risk of unfairness as some SDO may be misused for local or specific interests

- Measures to put in place to minimize risks
  - Users and contributors to standards must select the most appropriate SDO
  - SDOs need to promote liaisons and collaboration among themselves

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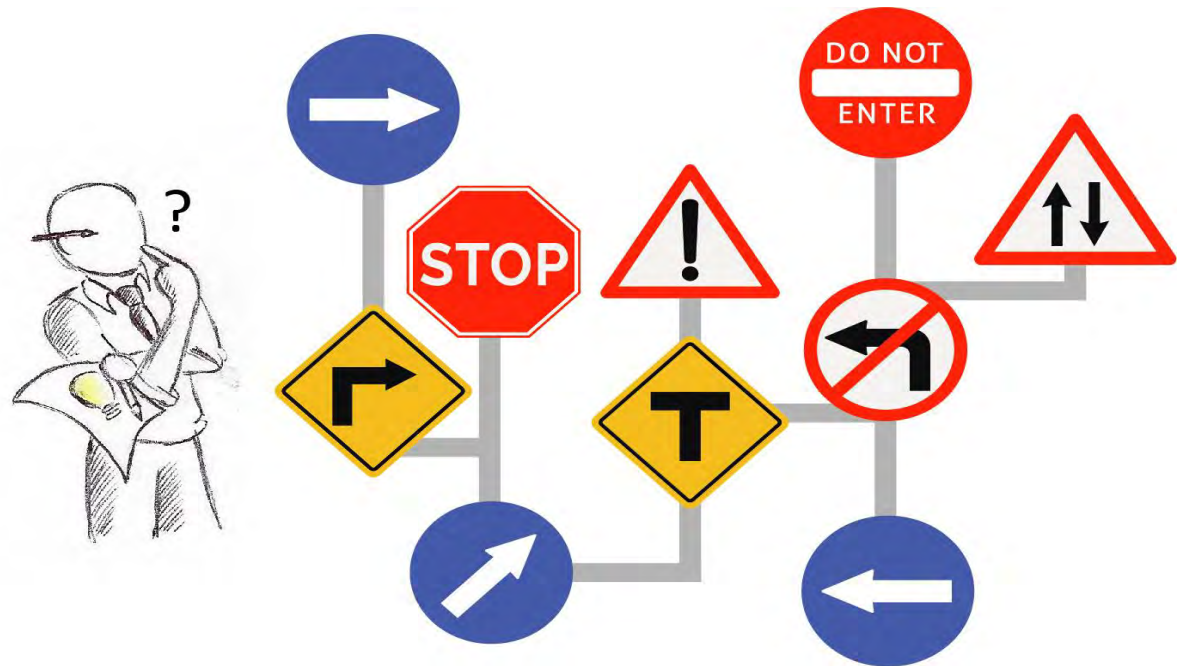
2.3 ICT Standardization Landscape
Classification of SDOs

- Standardization landscape 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 organizations

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

2.3 Standardization 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 countries that usually share, or are interested in promoting common practices and regulations.

2.3 Standardization Landscape
Classification of SDOs – International SDOs (examples)

- **ITU**
  - Since 1947 it's a specialized agency of UN, with study group made up by state members, sector members, associates from industry, international and regional standard organizations, and academia.
  - ITU sectors: ITU-T (electronic design and test specifications), ITU-R (global radio spectrum, satellite orbits), ITU-D (promotion of fair and affordable access to telecommunications)

- **ISO**
  - Independent, international non-governmental organization founded in 1946
  - Members from 160 country divided into hundreds of technical committees and subcommittees
  - ISO standards covers ICT, healthcare, energy and automotive.

- **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

2.3 Standardization Landscape
Classification of SDOs – Regional SDOs (examples)

● ETSI

ᐁ ETSI is a European Standards Organization (ESO), recognized regional standards body dealing with telecommunications, broadcasting and other electronic communications networks and services.

ᐁ 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

ᐁ 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

ᐁ 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

2.3 Standardization Landscape
Classification of SDOs - Geographical coverage

- **National Standard Development Organizations (NSDO)**
  - National SDOs (NSDOs or NSB) operate at the single country level and issue country-specific standards; they often collaborate with International and Regional SDOs.
  - Some relevant NSDOs outside Europe are:

2.3 Standardization Landscape
Classification of SDOs - Examples of scope of activities

- A non exhaustive overview of the ICT ecosystem, where International, Regional and National SDOs, Professional Organizations and Industrial Consortia operate

Organization	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, Wireless LANs WLAN, e.g. WiFi)
IETF	All internet related specifications including protocols, generic applications, addressing rules (IP, url)

2.3 Standardization Landscape
Classification of SDOs – Examples of liaisons among SDOs
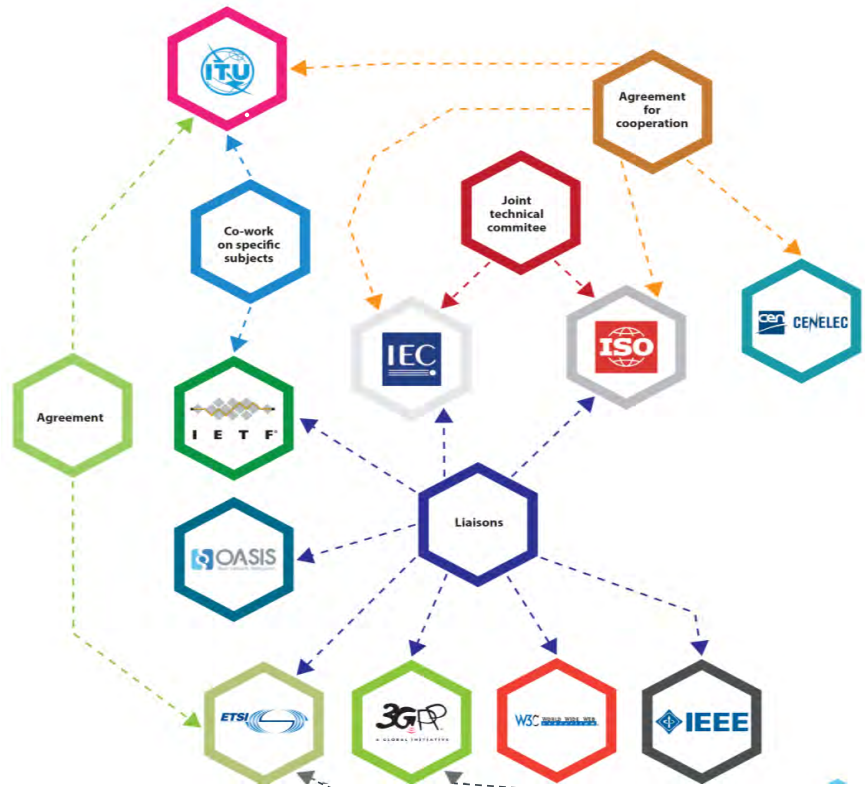
- A non exhaustive overview of the ICT ecosystem, where International, Regional and National SDOs, Professional Organizations and Industrial Consortia collaborate through liaisons and Standard Initiatives
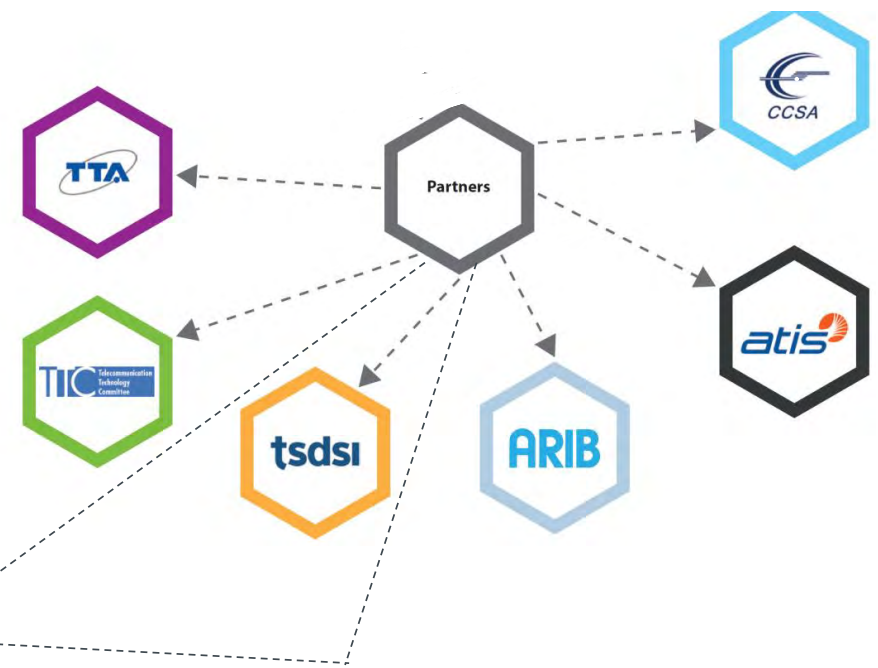
2.3 Standardization Landscape
Classification of SDOs

- **Recognized SDOs**
  - These are officially recognized by regulation systems or political bodies
  - ITU, UN specialized agency for information and communication
  - UE regulation 1025/2012 rules the standardization 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)
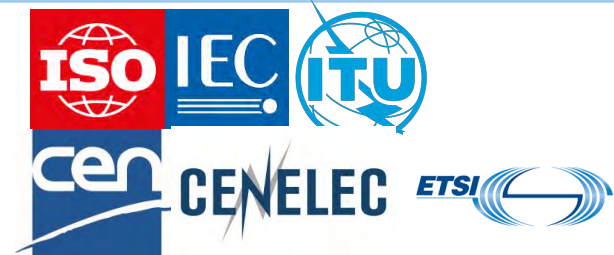
- **Not Recognized Organizations**
  - These are not recognized by any political bodies
  - IEEE is a primary SDO with a large number of active technical standards, ranging from wireless communications and digital health to cloud computing, power and energy, 3D video, electrical vehicle standards, and the Internet of Things. It was created by the Institute of Electrical and Electronics Engineers (IEEE), the American association of Electrical and Electronics Engineer and it brings together and organizes members from all over the world

2.3 Standardization 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 organizations from M2M-related business domains, such as telematics and intelligent transportation, healthcare, utilities, industrial automation, smart homes, etc.

2.3 Standardization Landscape
Classification of SDOs - Affiliation

- In addition to SDOs, there are other organizations that do not strictly or entirely use the formal standardization 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 realize, accelerate, complement, or promote the development of standards on them

2.4 The standardization process at a glance
Standard-development process
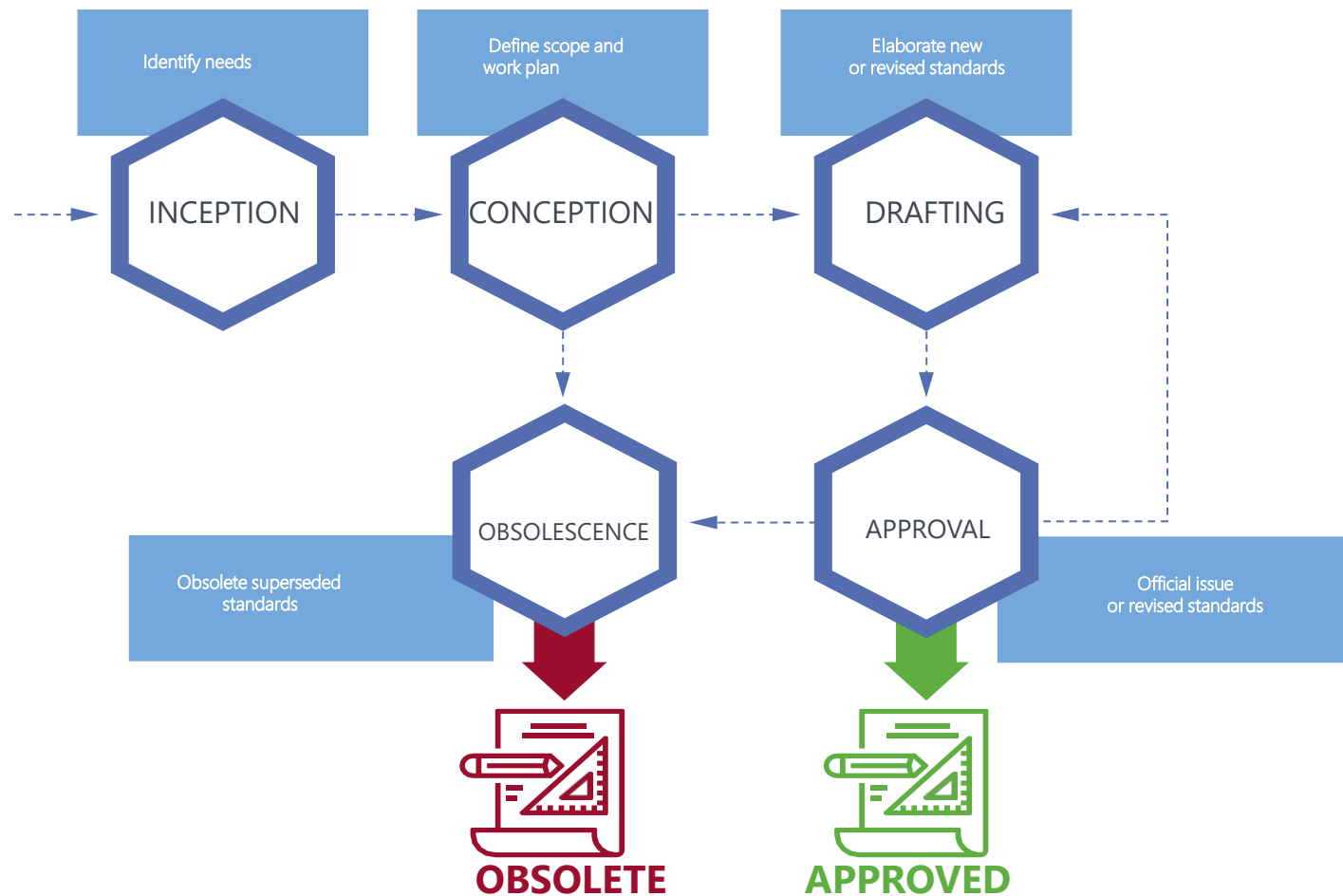
2.4 The standardization process at a glance
Main characteristics of a standard

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

- Standards are not intended to fully specify an item, or to provide a throughout 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)

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2.4 The standardization process at a glance
Main characteristics of a standard

- 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 standardized 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, not redundant and testable

- It shall have well-defined objectives that meet real needs

  - It has NOT to be fruitlessly over-prescriptive

2.5 Using standards
How to find a standard

The procedures described here in order to identify standards related to a specific product/service are a simple example of how a beginner may proceed (depending on seniority, knowledge or specific goals the steps can change)

- Select relevant SDOs
  - by technical scope (which corresponds to the typology that the product/service is targeted for)
  - by geographical scope (which corresponds to the geographical market that the product/service is targeted for)

Note: Evolution of standards needs to be monitored to be informed about SDOs' scope and possible liaisons

- Identify selected SDOs' relevant specification documents and their relevance
  - SDOs may produce different kinds of documents such as technology roadmaps, product/service requirements, product/service technical specifications, regulations produced on behalf of regulatory bodies and product/service test specifications

2.5 Using standards
Select relevant SDOs

First step: to identify relevant SDOs according to geographical scope and technical domain
Example

Organization	Headquarters	Geographical scope	Domain of activity	Affiliate organizations / members
ITU	Geneva (CH)	International	Telecom	National SDO / Industries
ISO	Geneva (CH)	International	ICT	National SDO
IEC	Geneva (CH)	International	Electrotechnical	National SDO
ETSI	Sophia Ant (FR)	Regional (Europe)	Telecom	National SDO / Industries / Research Institutes / Government bodies
CEN	Brussels (BE)	Regional (Europe)	ICT	National SDO
CENELEC	Brussels (BE)	Regional (Europe)	Electrotechnical	National SDO
IEEE	New York (US)	International	ICT Electrotechnical	Professionals
IETF	Fremont (US)	International	ICT	Professionals

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2.5 Using standards
Identifying and accessing SDO documents

All SDOs make their documents available on line
Access may be restricted to authorized users
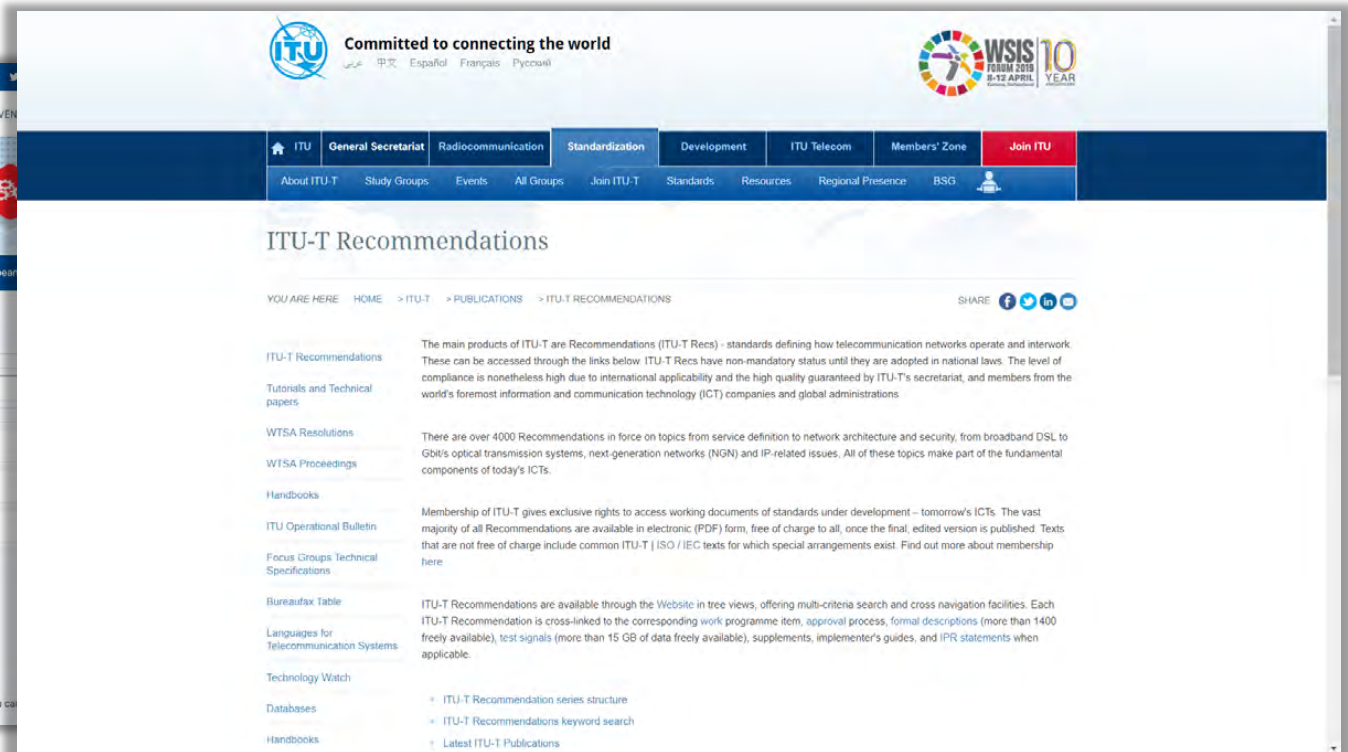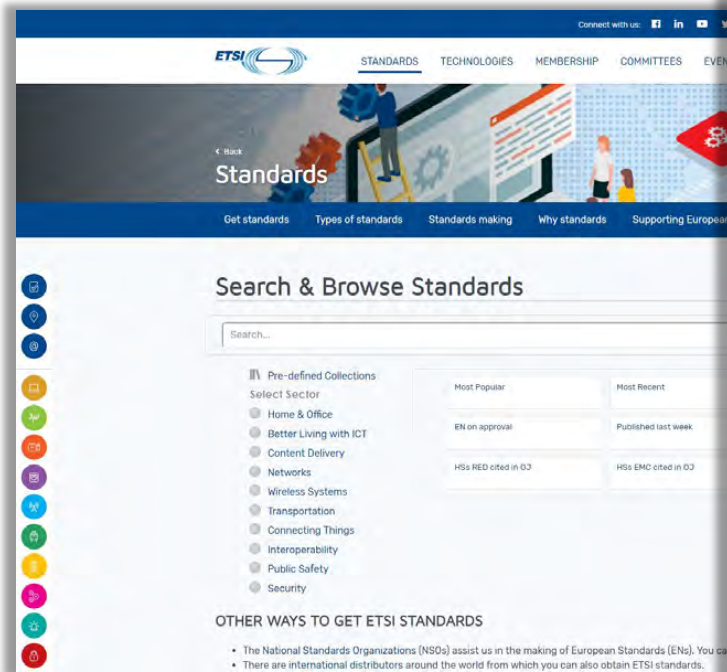
2.5 Using standards
Identifying and accessing SDO documents

Clearly identify standard document's scope and objectives

Assigned standard document code may include information about document scope and applicability

Examples

ITU	ETSI	IETF
Publications from ITU Telecommunication standard sector (ITU-T) are coded with format X.nnn, where X describes document domain, such as, e.g.: A - Organization of the work B - Means of expression: definitions, symbols, classification C - General telecommunication statistics D - General tariff principles E - Overall network operation, telephone service, service operation and human factors F - Non-telephone telecommunication services G - Transmission systems and media, digital systems and networks …… etcetera ..	ETSI produces a range of publications, each with its own particular purpose, which is encoded in the first two letters of document's code; e.g.: EN – the document is intended to meet needs specific to Europe and requires transposition into national standards, or the document is required under a mandate from the European Commission (EC)/European Free Trade Association (EFTA). ES and TS and GS – the document contains technical requirements (the difference between ESs and TSs lies in different approval rules) EG – identifies guidance to ETSI in general on the handling of specific technical standardization activities TR and GR –the document contains explanatory material … etcetera ..	The IETF's official documents are named RFCs. "RFC" stands for Request for Comments, and this name expresses IETF's approach to standardization: "the Internet is a constantly changing technical system, and any document that we write today may need to be updated tomorrow". IETF doesn't code documents' scope and objectives in RFC identifier, which is simply a progressive number.

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- IETF, Web page «Info for Newcomers», https://www.ietf.org/newcomers.html#officialdocs; accessed in 2017

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2.5 Using standards
Understanding structure and formalism of the standards

⊙ Clearly identify standard document's objectives and area of application

Standard documents explicitly claim scope and applicability, usually in introductory sections of the document

| Examples | ITU | ETSI | IETF |

Only RFCs that open with words like "This document specifies an Internet standards track protocol" are normative documents approved by the IETF. Others are informative documents

2.5 Using standards
Understanding structure and formalism of the standards

⦿ Identify the list of other reference documentation.

Standard documents may have a very narrow scope as they can define only specific parts of a complex item; to get the actual relevance of the standard, it has to be correlated with provided other standard references (usually, they're explicitly quoted in the document itself)

ITU ETSI IETF

⦿ Note

To fully get the context of a standard document and build a comprehensive picture of the production of standards on a specific area, it may be useful referring to specific informational documents provided by SDOs and to additional documentation (such as, technical white papers, scientific journals and books)

2.5 Using standards
Understanding structure and formalism of the standards

- Discriminate document sections and between normative and informative parts

Examples

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2.5 Using standards
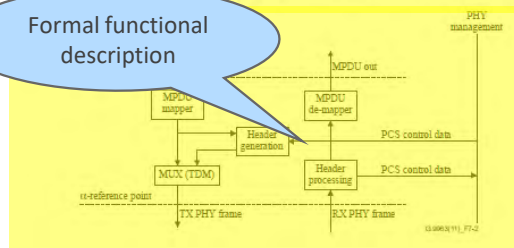## Understanding structure and formalism of the standards

○ Capture standard specific 'language' and 'formalisms' to express requirements and clearly discriminate between normative and informative statements

Examples

List of abbreviations: Chapter 2

- 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: Chapter 2

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

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List of abbreviations: Chapter 2

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

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