

How is 3GPP setting ICT standards for 6G enabled future technologies?

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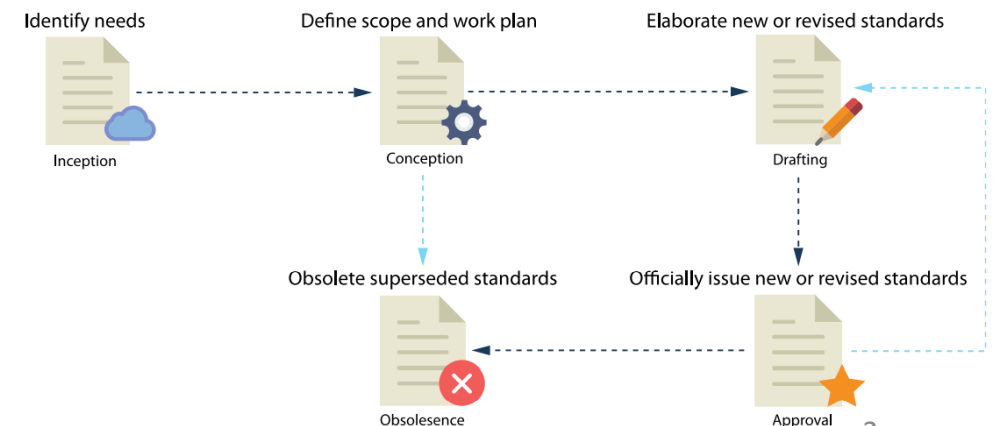
What is standardization & why do we need them?

- A standard defines **requirements, specifications, guidelines** or **characteristics** for a determined material, product, process or service.
- Standards are defined by **Standard Development Organizations (SDOs)**, which involve selected stakeholders in the standardized item (among e.g., manufacturers, providers, consumers and regulators, with possible contributions from academics and professionals).
- SDOs' put in place procedures to guarantee a **fair standard development process**, which is aimed at building **consensus** among involved stakeholders and **guaranteeing the quality** of the final deliverables.



Standard document main characteristics

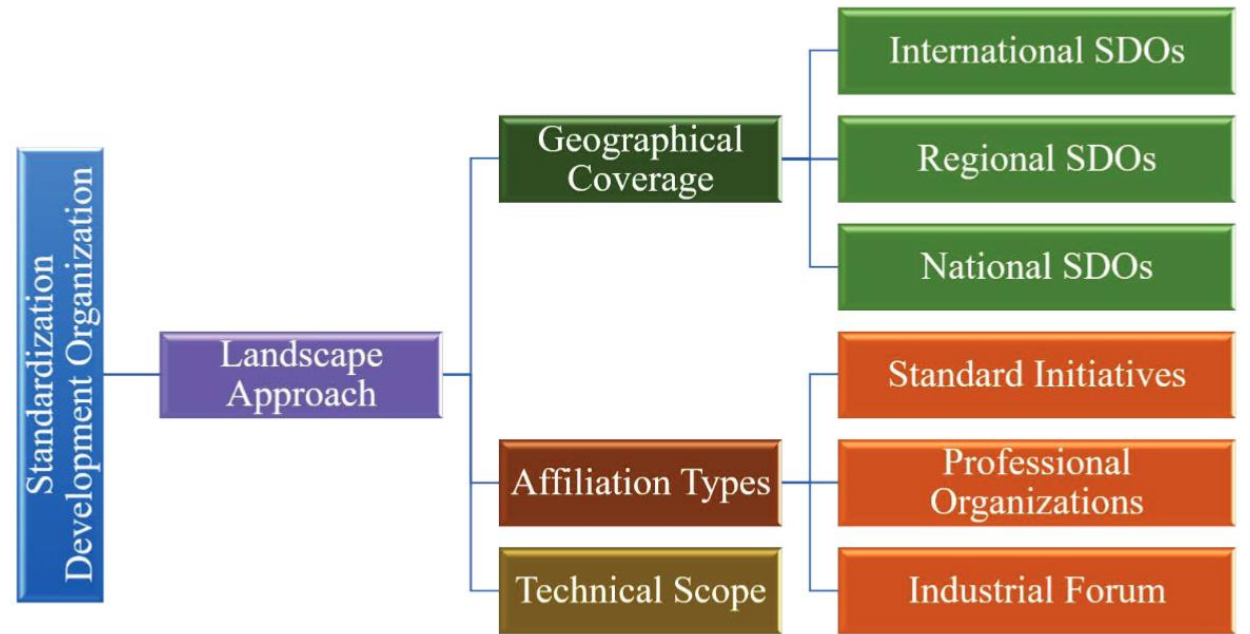
- The ultimate goal of standardization is the implementation of **complete, stable, interoperable** standards resulting in products and services, for the benefit of users and industry as a whole.
- It shall be written in a **plain language**, clear and unambiguous about what is essential to ensure compliance and 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 have well-defined objectives that meet real needs
 - It has NOT to be over-prescriptive
- What a Standard is NOT
 - Standards are NOT regulations.
 - Standards are NOT a set of thorough design rules.
 - Yet, they may inspire both



How are standards made? [ETSI2021]

Classification of SDOs










- Standardization landscape includes multiple SDOs that may differ in **Geographical coverage**
Typology of **affiliate** organizations, **Technical** scope of activities.
- SDOs often establish **liaisons** or set up common working groups to generically coordinate their activities or to join efforts on specific items.



SDOs classification: [ETSI2021]

Classification of SDOs - Geographical scope

- Sometimes, SDOs produce standards with a scope that goes beyond their alleged geographical adscription.
 - For instance, ETSI is an official SDO within the European Union, but the ETSI family of GSM standards (3GPP) for mobile communications was adopted globally.

	National level e.g. Germany	Regional level e.g. Europe	International
General			
Electrotechnology			
Telecommunications			

Standardization structures: [ETSI2021]

Classification of SDOs - Affiliation

- **Standard Initiatives:** built by standard bodies to coordinate standardization efforts on peculiar subjects
- **Professional Organizations:** collect independent professionals to promote best practices and innovation in specific areas
- **Industrial Forums/ Alliances / Consortia:** are primarily established by industries that coordinate their efforts on specific subjects



Classification of SDOs - Technical Scope

- 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	Interoperable telecom specifications incl. architecture, services
CEN	ICT architecture (OSI model) services, protocols incl. application protocols
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)
ECMA	Media specifications, ICT specifications fed into ETSI, ISO/IEC, IEEE, etc.

- Standards organizations typically are Non-Governmental Organizations (NGO), association without profit objectives (Exception is the ITU which is a United Nations organization).

3GPP Standardization- 6G example

- **3GPP** standardization are the sets of standards for mobile networks 2G, 3G, 4G, 5G (with 6G under development) with a wide acceptance in the global markets.
- Initial efforts on identifying future service needs for the next decade, as the ones performed by **ITU-T** with the Focus Group on Network 2030, have fostered the definition of evolutionary steps from **5G** networks being deployed nowadays.
- **Beyond-5G** solutions research and innovation activities such as Horizon 2020 programme Hexa-X as the flagship project, research proposals to Horizon EU SNS joint undertaking calls, and other industrial initiatives such as NGMN, will provide valuable inputs to standardization bodies fostering the development of advanced **6G** solutions.
- **ITU-R** has formed a vision group on **IMT towards 2030** and beyond (6G) targeting to complete its task by end of 2023.
- Early standards for "**6G Basic**" technology are expected to be released in 2027.



How does 3GPP work with other SDOs?

- 3GPP communicates with other SDOs via Liaison Statements or LSEs for short.
- LSEs – which are also contributions incoming or outgoing from group meetings – are the official means to request feedback, actions or just to inform other entities or bodies about topics that are subject to collaboration.
- LSEs are not specific to 3GPP and are also used internally within 3GPP to facilitate collaboration between the different groups.

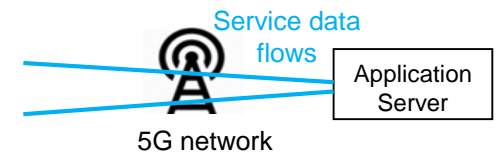


3GPP Multimodality & XR and Media services

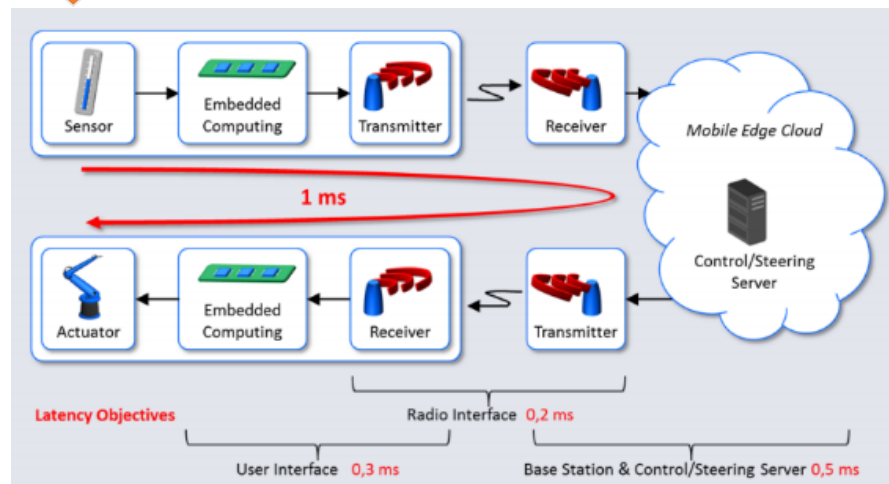
6G related features

2014
2016
2017
2021

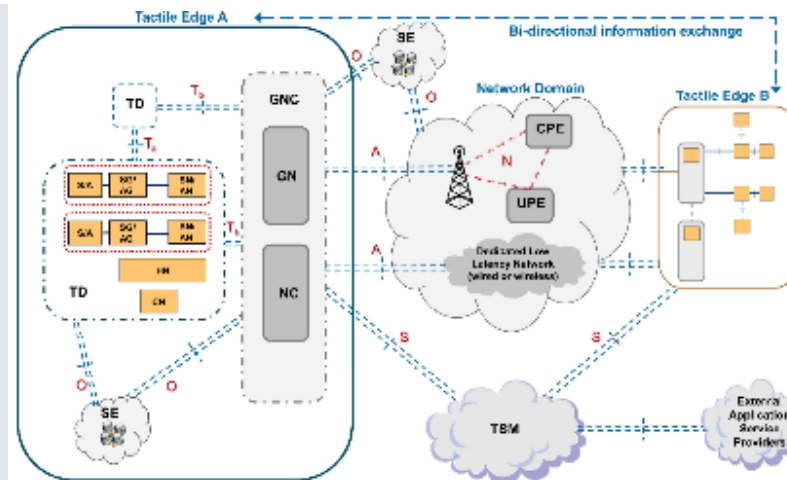
- 1) ITU-T Technology Watch Report (August 2014)
- 2) Tactile Internet (IEEE 1918.1) (2016) [Haptic codec WG, Architecture WG]
- 3) 3GPP –URLLC Rel 15 (2017)
- 4) Immersive multi-modal VR application with multiple 5G UEs directly connected to 5G network [3GPP SA 22.847] (2021)
- 5) IETF INTAREA: Tactile Internet Service Requirements (2021)
IETF MEDIAMAN: The 'haptics' Top-level Media Type (2021)
- 6) Haptics in ATSC 3.0: Broadcast/Broadband Media Experience (2021)



3GPP- TACMM



ITU-T -2014



IEEE 1918.1

SDO and affiliated professional organizations

6G related feature examples

IEEE SA Working Groups

- IEEE 1918.1 SA WG (Tactile Internet: **TI***)
- IEEE 802.1 SA **TSN**



3GPP SA1

- TR 22.847** Supporting tactile & multi-modality comm services (**TACMM**)^{A GLOBAL INITIATIVE}
- TS 22.104** Service requirements for cyber-physical control applications in vertical domains (Cyber-CAV)
- TR 22.804** Study on Communication for Automation in Vertical domains (CAV)
- S1- 220210** Study on Network of Service Robots with Ambient Intelligence (SOBOT)
- TR 22.856** Study on Localized Mobile Metaverse Services. (MetaVerse)



3GPP SA2

- Study on architecture enhancement for XR and media services (**XRM**)
- Study on 5G System (5GS); Device-Side TSN Translator (DS-TT) to Network-Side TSN Translator (NW-TT) protocol aspects; Stage 3 (TS 24.535); AI/ML (**AMMT**);

3GPP SA3

- TR 33.861 Evolution of Cellular IoT security for the 5G System (mMTC)
- TR 33.819 Security for 5GS Enhanced support of Vertical & LAN Services
- TR 33.813 Security aspects of Enhancement of Network Slicing

3GPP RAN2, SA4, SA6

- NR multi connectivity (RAN2), MBMS for IoT (SA4), UAV (SA6)

ISO

- ISO/TS 15066:2016 Robots and robotic devices – Collaborative robots



IETF/IRTF

- COINRG IRTF** : Computing In the Network Research Group
- DETNET IETF** : deterministic L2/L3 paths
- INTAREA IETF** : Tactile Internet Service Requirements
- MEDIAMAN**: The 'haptics' Top-level Media Type



ITU-T Focus Groups/Study Groups

- FG- Autonomous Networks
- FG- NET2030 Technologies for Network 2030 (concluded)
- FG- Environmental Efficiency for Artificial Intelligence and other Emerging Technologies
- SG-17 Security



ETSI ISGs

- ZSM, PDL, ENI, SAI, and NFV (NFV sec), DECT2020



NGMN

- 6G Drivers and Vision White Paper
- Verticals URLLC Use Cases and Requirements



Networld2020

- Enabling Technologies for Future Vertical Ecosystem Transformation
- Horizon Europe** "Smart Networks and Services"



5G-ACIA Alliance for connected industry automation (WG1 & WG3)

5G-IA Infrastructure Association



- IEC** IEC 61907 IEC 61907, "Communication network dependability engineering".



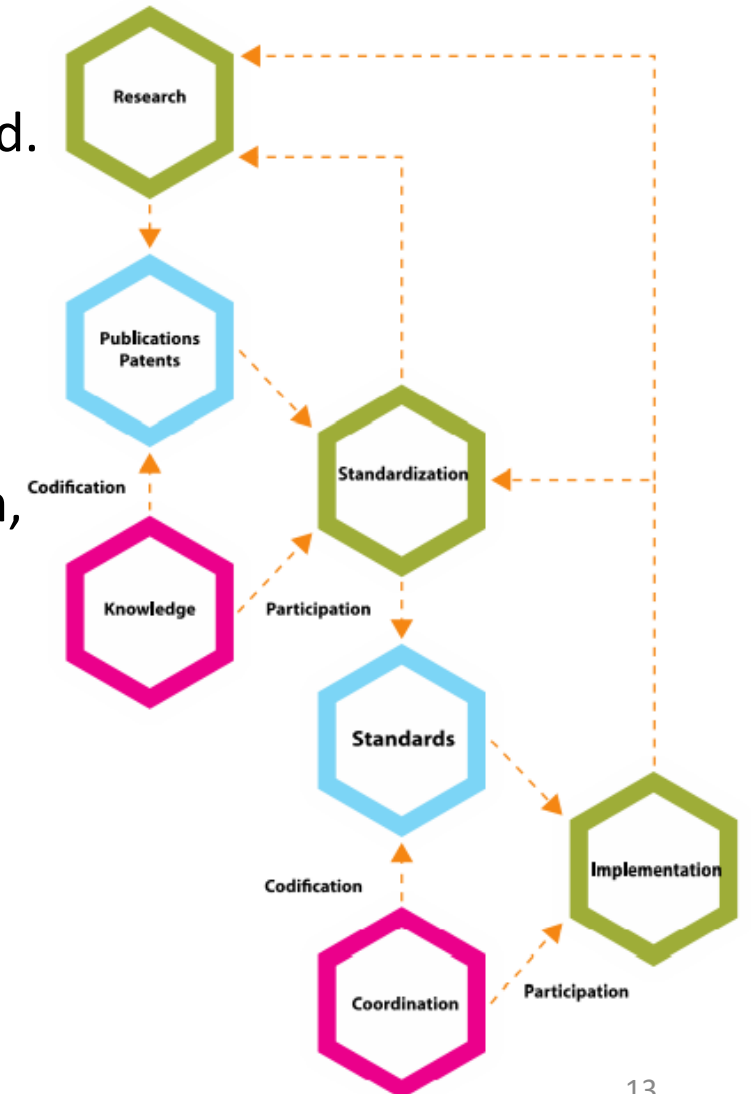
Standardization steps of an ICT system

Example : 3GPP

- 3GPP follows a three-stage methodology as defined in ITU-T Recommendation I.130.
 - Stage 1 is an overall **service description from the user's standpoint**
 - Stage 2 is an overall **description of the organization of the network functions to map service requirements into network capabilities.**
 - Stage 3 the **definition of switching and signalling capabilities** needed to support services defined in stage 1.
- Who are the professionals involved in the standard development process?
 - In the committee / working group: Chairman (vice-chairman) of the group; Standardization experts; Standard proposer; Rapporteur; Liaison representative in the SDO
 - Permanent staff: Technical Officer, Final editor

IPR and SDO-supported standardization

- Standardization, research and innovation are highly interlinked.
- Patent: “A government authority or license conferring a right or title for a set period, especially the sole right to exclude others from making, using, or selling an invention.”
- Companies can choose between different protection mechanisms: Invention secrecy, Patenting (national, European, international), Standard-Essential Patents (SEPs)
- **Standard Essential Patents (SEPs) claim:** an invention that must be applied by all companies in order to comply with a technical standard
 - Most of the formal SDOs (such as IEEE) only allow the inclusion of patented technology in a standard, if patent holders disclose the presence of patented technology



Strategic perspectives on standardization

- An organization may have a differentiated approach and may participate in different domains with different objectives:
 - the protection of its business interest,
 - early warning for technological and market developments,
 - promotion of IPR and internal as well as proprietary standards,
 - avoiding duplication between countries or continents, etc.
- In deciding in which SDOs to participate, the interrelations between the SDOs, and the status of an SDO with respect to public authorities, may play an important role.
- The geographical location,
 - in which continent, and where meetings take place also plays a role in the decision.
 - may create complications, as it may not coincide with the organization's geographic organization.

Technology strategies

- Apart from showing presence, there are also technology related considerations for participation:
 - The “radar” function: a view on technologies and applications that may become important in the future.
 - The activity of others, as indication of R&D activity, location, priority and importance of developments.
 - It may be used for activities towards the formation of consortia, interest groups, forums, etc.
 - It may help promote ideas and solutions, including IPR.
 - It may incite dialogue with public authorities, giving a preview on public support, measures and concerns

Leading, i.e. early standardization, not all issues understood
In sync, i.e. ‘just in time’ needs agility of the process
Following developments, i.e. ‘late’ standardization.

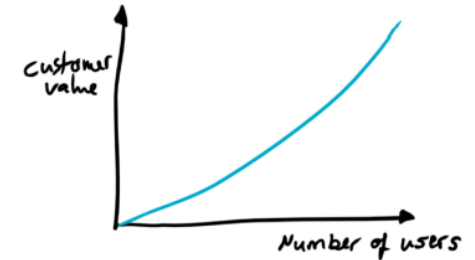
Economic strategies

- The economic effects of standardization:

- Compatibility (Coexistence/Interoperability)
- Open standardization
- Minimum Quality/ Safety

- Economic contribution of standards

- Total Factor Productivity (TFP): A country's technical progress increases with the number of companies that incorporate the technological knowledge
 - Technological knowledge generated in a country (number of patents)
 - Technological knowledge imported from abroad (number of technological license payments abroad)
 - The diffusion of this technological knowledge (number of standards)
- Financing of standardization: Standards can also work as barriers to trade (e.g. if set at an unreasonable level- **Fair, reasonable and non-discriminatory (FRAND)**)



Source: Greenstein and Stango (2008)

Concluding remarks

- Effective standardization requires sound regulation and governance that surround the technical work of the SDOs and ensure proper legal frameworks among different geo-areas
- Intellectual Property Regime (IPR) for 6G might need a re-fresh, taking into consideration the ongoing geostrategic trends of indigenous agendas and bring-back-home approach
- Several SDOs are expected to work on 6G, e.g., 3GPP, ETSI, IETF and IEEE, in a much tighter way than they did for 5G, as 6G intends to merge and make work together different technologies
- 3GPP has dealt with setting the standards for all relevant functions needed to handle the use cases of the respective communications generations.
- While in the current phase of fundamental research and exploitation of 6G technical components, various local initiatives exist, at some point it is important that a global standard (such as 3GPP) continues to be the main driver of 6G.

References & related materials

- [ETSI-2021] C.J. Lanting and A. Rodriguez-Ascaso, “**ETSI: Understanding ICT Standardization: Principles and Practice**,” 2021. ([pdf](#))
- Nidhi, Bahram Khan, Albena Mihovska, Ramjee Prasad and Fernando J. Velez, **Trends in Standardization Towards 6G**, [Journal of ICT Standardization](#), 2021
- [5G-PPP] Overall roadmap for 6G development: [WhitePaper-6G-Europe.pdf \(5g-ppp.eu\)](#)

Related Links:

- [Ericsson suggests '6G Basic' standards could be released in 2027 | Light Reading](#)- Oct 2021
- [ETSI Technology Radar](#)- April 2021
- [Presentations and White Papers \(3gpp.org\)](#)
- [Standards | 6G Futures](#)
- [IEEE](#), [ETSI](#) and [3GPP](#)

Thank you.

[Mona Ghassemian](#)

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每个组织，构建万物互联的智能世界。

Bring digital to every person, home, and
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