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TECHNICAL REPORT

**Human Factors (HF);
Smart cities and communities;
Standardization for citizens and consumers**

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00   Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Human Factors (HF).

Modal verbs terminology

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Executive summary

The present document provides an analysis and evaluation of the current requirements for citizen-related standards actions in relation to smart cities and communities. A *citizen* is an inhabitant of, or visitor to, a smart city or community.

To assess the current standardization landscape, the analysis has leveraged an online survey, distributed across the many smart city networks. 52 % of survey responses were from citizens or organization which represent citizens. Six specific citizen requirements were identified, having been ranked by the online survey respondents, from the most important through to the least important, with the top three being: facilitating citizen participation in decisions, access to services online and offline and effective measurement. Other priorities not proposed at first, but suggested by respondents as needing to be included, were internet availability and the need for cities to co-design services with citizens.

The present document assesses the different citizen-related issues that smart city-related standardization in the ICT domain needs to address. The present document lists relevant current and proposed standards and other related activities such as indicators and certification, identifying their limitations. Regarding smart city standardization, the major issues for improvement relate to the unawareness from cities or their unavailability to participate in standardization, along with the incoherence of where to start or find the right information. Moreover, city services need to be better designed, accessible for citizens, and provide better solutions for privacy and personal data management.

The present document provides recommendations to the standards organizations, first from an organizational perspective, so cities can overcome the issues listed above, and with more specific proposals grouped into three categories: Guidance (high-level approach that smart cities could adopt in order to deal with a number of citizens requirements), Codes of Conduct (precise approaches to the development of solutions for specific issues) and Standards (defining new work items that Standards Developments Organizations could potentially integrate within their standards development plans).

Introduction

The present document concerns the standardization requirements from the perspective of the citizen, in the context of being an inhabitant of, or visitor to, a smart city or community.

The smart community offers considerable opportunity not only for citizens to have an improved living environment in which they can benefit from effective services, but also for them to influence matters affecting their daily lives. At the same time, equal treatment for all citizens needs to be ensured and account needs to be taken of data privacy concerns relating to their personal information. Thus far the needs of the citizens themselves have been somewhat set aside in the debates concerning smart communities, but, more than ever in a post-Coronavirus world, it will be important to keep these needs at the forefront of societal development.

Since industrialization, our world has been considerably weakened by unsustainable development and rampant over-consumption. Humanity faces several environmental sustainability challenges including, but not limited to, declining biodiversity, degraded land and soil, depleting natural resources, polluted air and water, and increasingly severe climate changes. Closely interlinked are issues of population increase and rural-to-urban migration, which is occurring at an extraordinary pace: since 2008, more than half of the global population has been and is living in cities. By 2050 the global population is forecast to grow to 9 billion, 80 % of which will inhabit cities.

Adapting to these challenges will require increased cooperation among local actors, along with comprehensive systems that can create and maintain synergies for sustainable urban societies in which people want to work, live, and maximize their well-being. Cities can also be seen as one of the driving forces in generating European economic and sustainable growth, given, for example, the opportunities provided by the green economy. Linking and upgrading infrastructures, technologies, and services in key urban sectors (transport, buildings, energy, ICT, etc.) in a smart way will improve quality of life, competitiveness, and sustainability of our cities.

Cities are becoming more and more of a focal point for our economies and societies at large, particularly because of on-going urbanization, and the trend towards increasingly knowledge-intensive economies, as well as their growing share of resource consumption and emissions. To meet public policy objectives under these circumstances, cities need to change and evolve, but in times of ever tighter budgets this change needs to be achieved in a smart way: our cities need to become smart and sustainable cities and communities. In addition, though, improving the lot of the city-dweller should not be at the expense of the citizens living in rural communities, smart communities should be available to everyone.

Digitization in a smart community offers extensive opportunities for the introduction of citizen-centred design processes and for citizens to become more involved in the decisions affecting their daily lives. Enormous benefits can derive from this, for example, from consultation concerning the way services are designed and made interactive and available to all members of the community.

At the European level, the CEN-CENELEC-ETSI Smart and Sustainable Cities Co-ordination Group (SSCC-CG) originally proposed the development of a Technical Report on these citizen-related issues, later taken up in the European Commission ICT Standardization Rolling Action Plans for 2016 and 2017.

The present document is intended to clarify whether further standardization is needed on citizen issues related to smart cities (e.g. on what, where, when, etc.), and to take full account of other standards activities under way. The present document also supports recommendations that are being made at policy levels.

1   Scope

The present document assesses the different citizen-related issues that smart city-related standardization in the ICT domain needs to address. These include fundamental aspects such as accessibility, usability, interoperability, personal data protection and security, and how services to citizens are to be designed to maximize benefits to the community.

For each of these issues, the present document:

- provides a short statement of the subject area;

- makes a short statement of the key citizen concerns (for example accessibility or privacy) related to the subject;

- lists relevant current standards and ongoing relevant standards activities;

- assesses whether it appears the activities are in practice taking reasonable account of the smart city/community dimension from the perspective of citizen welfare, and if not, what might be needed to rectify the position;

- identifies any further general legal and ethical issues that require attention outside the standardization domain, or other issues not covered.

The issues which the present document assesses are grouped into the following:

- citizens' general needs - smart cities should have citizen welfare at their core. The needs of the citizens should therefore be properly considered in every standardization activity relevant to smart cities;

- citizens and their local authorities - the standards aspects of citizens' day-to-day interfaces with their local authorities;

- citizens and their local services - the standards aspects of citizens' day-to-day interfaces with the providers of their local services;

- citizen indicators - how the impact of smart city solutions on the citizens can be measured;

- recommendations - to improve citizen outcomes, filling gaps in, or making adjustments to, existing standards; aspects not related to standardization, including policy aspects.

2   References

2.1   Normative references

Normative references are not applicable in the present document.

2.2   Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long-term validity.

The following referenced documents are not necessary for the application of the present document, but they assist the user with regard to a particular subject area.

[i.1]   ETSI EG 201 013: "Human Factors (HF); Definitions, abbreviations and symbols".

[i.2]   CEN EN ISO 9241-11:2018: "Ergonomics of human-system interaction - Part 11: Usability: Definitions and concepts".

[i.3]   ETSI EN 301 549: "Accessibility requirements for ICT products and services".

[i.4]   European Commission: "Public Procurement".

NOTE: Available at https://ec.europa.eu/growth/single-market/public-procurement_en.

[i.5]   "Convention on the Rights of Persons with Disabilities (CPRD)".

NOTE: Available at https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities.html.

[i.6]   European Commission (2017): "E-procurement".

NOTE: Available at https://ec.europa.eu/growth/single-market/public-procurement/e-procurement_en.

[i.7]   Directive 2013/11/EU of the European Parliament and Council of 21 May 2013 on alternative dispute resolution for consumer disputes and amending Regulation (EC) No 2006/2004 and Directive 2009/22/EC.

[i.8]   Directive (EU) 2016/1148 of the European Parliament and of the Council of 6 July 2016 concerning measures for a high common level of security of network and information systems across the Union (known as the NIS Directive).

[i.9]   BSI PAS 185:2017: "Smart Cities. Specification for establishing and implementing a security-minded approach".

[i.10]   Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation).

[i.11]   BSI PAS 183:2017: "Smart cities. Guide to establishing a decision-making framework for sharing data and information services".

[i.12]   ISO 37156:2020: "Smart City infrastructures - Guidelines on data exchange and sharing for smart community infrastructures".

[i.13]   ISO 37160:2020: "Smart City infrastructures - Measurement methods for quality of thermal power station infrastructure and requirements for plant operations and management for smart community infrastructures".

[i.14]   Directive (EU) 2019/882 of the European Parliament and Council of 17 April 2019 on the accessibility requirements for products and services (known as the European Accessibility Act).

[i.15]   Regulation (EU) No 1025/2012 of the European Parliament and the Council on European standardisation, amending Council Directives 89/686/EEC and 93/15/EEC and Directives 94/9/EC, 94/25/EC, 95/16/EC, 97/23/EC, 98/34/EC, 2004/22/EC, 2007/23/EC, 2009/23/EC and 2009/105/EC of the European Parliament and of the Council and repealing Council Decision 87/95/EEC and Decision No 1673/2006/EC of the European Parliament and of the Council.

[i.16]   ISO 37106:2018: "Sustainable cities and communities. Guidance on establishing smart city operating models for sustainable communities".

[i.17]   ISO 37120:2018: "Sustainable cities and communities - Indicators for city services and quality of life".

[i.18]   ISO 37122:2019: "Sustainable cities and communities - Indicators for smart cities".

[i.19]   ISO 37123:2019: "Sustainable cities and communities. Indicators for resilient cities".

[i.20]   ETSI TS 103 463 (all parts): "Access, Terminals, Transmission and Multiplexing (ATTM); Sustainable Digital Multiservice Communities; Key Performance Indicators for Sustainable Digital Multiservice Areas".

[i.21]   ETSI GS OEU 019: "Operational energy Efficiency for Users (OEU); KPIs for Smart Cities".

[i.22]   European Commission (2017): "Making public procurement work in and for Europe".

NOTE: Available at https://ec.europa.eu/docsroom/documents/25612.

[i.23]   United Nations Sustainable Development Goals: "Goal 11: Make cities inclusive, safe, resilient and sustainable".

NOTE: Available at https://www.un.org/sustainabledevelopment/cities/.

[i.24]   European Commission (2018): "Smart Cities".

NOTE: Available at https://ec.europa.eu/info/eu-regional-and-urban-development/topics/cities-and-urban-development/city-initiatives/smart-cities_en.

[i.25]   ETSI (2015): "Smart Cities".

NOTE: Available at https://www.etsi.org/technologies/smart-cities.

[i.26]   ITU-T (2014): "Smart Sustainable Cities".

NOTE: Available at https://www.itu.int/en/ITU-T/focusgroups/ssc/Pages/default.aspx.

[i.27]   ISO/TC 268 (2012): "Sustainable cities and communities".

NOTE: Available at https://iso.org/committee/656906.html.

[i.28]   EU SCIS: "Smart Cities and Community Lighthouse projects".

NOTE: Available at https://smartcities-infosystem.eu/scc-lighthouse-projects.

[i.29]   UN-HABITAT: "Cities and Pollution contribute to climate change".

NOTE: Available at https://www.un.org/en/climatechange/cities-pollution.shtml#:~:text=Cities%20are%20major%20contributors%20to,cent%20of%20the%20Earth's%20surface.

[i.30]   The Sector Forum on Smart and Sustainable Cities and Communities.

NOTE: Available at https://www.cencenelec.eu/standards/Sectorsold/SmartLiving/smartcities/Pages/default.aspx.

[i.31]   Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement and repealing Directive 2004/18/EC.

[i.32]   United Nations: "Sustainable Development Goals".

NOTE: Available at https://www.un.org/sustainabledevelopment/sustainable-development-goals/.

[i.33]   UNE 178105 (2017): "Universal Accessibility in Smart Cities".

[i.34]   OASC (2019): "What Will Keep the Smart City Industry Busy in 2019?".

NOTE: Available at https://oascities.org/what-will-keep-the-smart-city-industry-busy-in-2019/.

[i.35]   EIP-SCC: "Initiatives".

NOTE: Available at https://eu-smartcities.eu/initiatives.

[i.36]   EUROCITIES: "About Us".

NOTE: Available at http://eurocities.eu/eurocities/about_us.

[i.37]   Major Cities of Europe: "About Us".

NOTE: Available at https://www.majorcities.eu/.

[i.38]   OASC: "About OASC".

NOTE: Available at https://oascities.org/about-oasc/.

[i.39]   Cities4Europe (2018) About.

NOTE: Available at http://cities4europe.eurocities.eu/eu-campaign/index.html#/about.

[i.40]   Major Cities of Europe (2019), Annual conference - Channelling Change.

NOTE: Available at https://www.majorcities.eu/conferences/2019-venice/.

[i.41]   CEN-CENELEC-ETSI: "Smart and sustainable cities and communities; a role for European
                standardization".

NOTE: Available at https://www.cencenelec.eu/News/Publications/Publications/Smart_cities.PDF.

[i.42]   CITYkeys indicators for smart city projects and smart cities.

NOTE: Available at http://www.citykeys-project.eu/.

[i.43]   ITU-T Work Programme. .

NOTE: Available at https://www.itu.int/ITU-T/workprog/wp_search.aspx?sg=20.

[i.44]   U4SSC KPIs.

NOTE: Available at https://www.itu.int/en/publications/Documents/tsb/2017-U4SSC-Collection-
                Methodology/index.html#p=10.

[i.45]   The European Innovation Partnership on Smart Cities and Communities (EIP-SCC): "Action
                Clusters".

NOTE: Available at https://eu-smartcities.eu/clusters.

[i.46]   CITYkeys D1.1: "Overview of the needs".

NOTE: Available at http://nws.eurocities.eu/MediaShell/media/CITYkeys%20D1.1%20-
                %20Cities%20and%20citizens%20needs.pdf.

[i.47]   Active and Healthy Aging: related standards.

NOTE: Available at https://ec.europa.eu/eip/ageing/standards_en.

[i.48]   CEN-CENELEC-ETSI Smart and Sustainable Cities Sector Forum (SF-SSCC): Overview of
                Standards and Specifications relevant to Smart Cities..

NOTE: Available at ftp:/cencenelec.eu/EN/EuropeanStandardization/Fields/SmartLiving/City/SF-
                SSCC_Overview_of_Standards_for_SmartCities.pdf.

[i.49]   United Nations: "68% of the world population projected to live in urban areas by 2050".

NOTE: Available at https://www.un.org/development/desa/en/news/population/2018-revision-of-world-
                urbanization-prospects.html.

[i.50]   EN 17161:2019: "Design for All - Accessibility - following a Design for All approach in products,
                goods and services". Produced by CEN.

[i.51]   W3C Recommendation 05 June 2018: "Web Content Accessibility Guidelines (WCAG) 2.1".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI EG 201 013 [i.1] and the following apply:

accessibility: extent to which products, systems, services, environments and facilities can be used by people from a population with the widest range of user needs, characteristics and capabilities, to achieve identified goals in identified contexts of use (from CEN EN ISO 9241-11:2018 [i.2])

NOTE 1: Context of use includes direct use or use supported by assistive technologies.

NOTE 2: The context in which the ICT is used may affect its overall accessibility. This context could include other products and services with which the ICT may interact

access space: space intended to be occupied by the person, including their Assistive Technology, while they are using the product

assistive technology: hardware or software added to or connected to a system that increases accessibility for an individual

NOTE 1: Examples are Braille displays, screen readers, screen magnification software and eye tracking devices that are added to the ICT.

NOTE 2: Where ICT does not support directly connected assistive technology, but which can be operated by a system connected over a network or other remote connection, such as telecare or voice assistants can also be considered assistive technology.

citizen: design and delivery of city services driven by the needs of citizens rather than the functional structures of a city's silos (from ISO 37016:2018 [i.16])

NOTE: The term citizen in this context includes residents, visitors and businesses within the city.

consumer: natural person who is acting outside the scope of an economic activity (trade, business, craft, liberal profession)

cyber-physical system: system which comprises interacting digital, analogue, physical, and human components engineered for function through integrated physics and logic

NOTE: These systems will provide the foundation of our critical infrastructure, form the basis of emerging and future smart services, and improve our quality of life in many areas.

Information and Communication Technology (ICT): technology, equipment, or interconnected system or subsystem of equipment for which the principal function is the creation, conversion, duplication, automatic acquisition, storage, analysis, evaluation, manipulation, management, movement, control, display, switching, interchange, transmission, reception, or broadcast of data or information

NOTE: Examples of ICT are web pages, electronic content, telecommunications products, computers and ancillary equipment, software including mobile applications, information kiosks and transaction machines, videos, IT services, and multifunction office machines which copy, scan and fax documents

smart city: City that increases the pace at which it provides social, economic and environmental sustainability outcomes and responds to challenges such as climate change, rapid population growth, and political and economic instability. By fundamentally improving how it engages society, applies collaborative leadership methods, works across disciplines and city systems, and uses data information and modern technologies to deliver better services and quality of life to those in the city (residents, businesses, visitors), now and for the foreseeable future, without unfair disadvantage of others or degradation of the natural environment.

NOTE 1: A smart city also faces the challenge of respecting planetary boundaries and taking into account the limitations these boundaries impose.

NOTE 2: There are numerous definitions of a smart city. This one is used by ISO Technical Committee 268, whose work is dedicated to the topic.

3.2   Symbols

Void.

3.3   Abbreviations

For the purposes of the present document, the following abbreviations apply:

ADR	Alternative Dispute Resolution
AHA	Active and Healthy Ageing
ANEC	European Association for the Co-ordination of Consumer Representation in Standardisation (*French acronym*)
BSI	British Standards Institution
CEN	Comité Européen de Normalisation (European Standards Committee)
CENELEC	Comité Européen de Normalisation Electrotechnique (European Electrotechnical Standards Committee)
DESI	Digital Economy and Society Index
EC	European Commission
EFTA	European Free Trade Association
EN	European Norm
ETSI	European Telecommunications Standards Institute
EU	European Union
GDPR	General Data Protection Regulation
ICT	Information and Communication Technology
IEC	International Electrotechnical Commission
IoT	Internet of Things
ISG	Industry Specification Group
ISO	International Organization for Standardization
IT	Information Technology
ITU	International Telecommunication Union
ITU-T	ITU Telecommunication Standardization Sector
JTC 1	Joint Technical Committee 1 [of ISO and IEC]
NIS	Network and Information Security
OASC	Open and Agile Smart Cities
PAS	Publicly Available Specification
SDO	Standards Development Organization [nowadays used to describe both formal standards bodies and consortia]
TC	Technical Committee
U4SSC	United 4 Smart Sustainable Cities
UNECE	United Nations Economic Commission for Europe
UN-Habitat	United Nations Human Settlements Programme

4   Setting the scene

4.1   Citizens and cities

The United Nations estimate that over half of humanity, approximately 4,2 billion, lives in cities today, projecting an increase of this number to 7,5 billion by 2050 [i.49]. Due to this overwhelming growth of population, cities are struggling to continue creating jobs and prosperity without straining land and resources and are responsible for around 78 % of the global energy consumption and produce more than 60 % of the greenhouse gas emissions [i.29].

Many countries will face challenges in meeting the needs of their growing urban populations, including for housing, transportation, energy systems and other infrastructure, as well as for employment and basic services such as education and health care. Integrated policies to improve the lives of both urban and rural dwellers are needed, while strengthening the linkages between urban and rural areas, building on their existing economic, social and environmental ties.