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TECHNICAL SPECIFICATION

Access, Terminals, Transmission and Multiplexing (ATTM); Sustainable Digital Multiservice Cities (SDMC); Broadband Deployment and Energy Management; Part 1: Overview, common and generic aspects of societal and technical pillars for sustainability

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Access, Terminals, Transmission and Multiplexing (ATTM).

The present document is part 1 of a multi-part deliverable covering Sustainable Digital Multiservice Cities (SDMC), as identified below:

Part 1: "Overview, common and generic aspects of societal and technical pillars for sustainability";

Part 2-1: "Multiservice Networking Infrastructure and Associated Street Furnitures; Sub-part 1: General requirements";

Part 2-2: "Multiservice Networking Infrastructure and Associated Street Furniture; Sub-part 2: Femtocell 5G connectivity on light poles".

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Executive summary

The main objectives of cities are to improve citizens' lives, local economy dynamics and to attract new residents and companies to establish locally. Strong evolutions in the fixed and mobile Internet connectivity have impacted the expectations and behaviours of the people and the enterprises they are working for.

Digital services have become an important part of the daily life, crossing many activities within the day from personalized morning news, through latest updates on the transportation schedule (bus, train, road traffic), the operations at work or schools even up to shopping at the supermarket. This digital revolution has also entered the area of services and operations delivered by public services such as the city. To adopt this evolution, the Information Communication Technology (ICT) platforms of the city services should be rethought and changed from the silo strategy to an integrated approach. To achieve this goal, the ICT of the city should rely on a unified digital multi services infrastructure that combines cable-based and wireless networks.

This digital multi services infrastructure is supposed to be economic, safe, multi purposed and future proof to enable the sustainability of the city with regard to its digital services strategy and roadmap.

Up till now silo and vertical ICT have been mainly taken into consideration to deploy services. For a few years, various smart city efforts and initiatives suggest to strongly adopt a transversal approach in which services share a common Internet Protocol (IP) network, co-operate between each other and furthermore enable third parties to leverage the value offered by the power of data mining and big data processing.

A common and shared multi services architecture for the city's digital services is therefore needed to achieve the city's goals and ambitions at reasonable cost of ownership and of operation while strongly taking into consideration the eco efficiency of the different elements of the ICT deployments.

Introduction

Today digital life is leading major evolutions in the expectations that people and enterprises have towards public administrations. As the local representative and interface, the municipality is on the front line. The boom of the mobile Internet economy has created many new types of services which requires the city to evolve and adapt to such new behaviours from their target audiences.

City parking or tourism attractiveness are two simple examples of the digital revolution. In both cases, one expects to have access to digital services which respectively facilitates the discovery of an available parking place or to the accessibility of a local public transportation facility such as buses, trams and even city bikes.

These digital services have increased the requirements of the ICT infrastructures of the city and amplified the need for a more sustainable Information Technology (IT) design. Smart digital city parking service requires sensors to be deployed within the field, that their real-time status (busy or available parking place) is transmitted through a data network and that a digital service leverages this information to be made available to the driver but also to the financial department in case the parking usage has to be charged.

Today many city applications are to be seen as island or silo applications and have their own networks, own software platforms and as a result have different operations and maintenances. A common architecture will reduce this multiplication of networks and software solutions while improving the economical and energy efficient costs.

The present document contains information which covers topics such as Data Governance, cross-domain information, Open Data, Key Performance Indicators, digital network divide, user security and privacy which constitutes the theoretical pillars behind any network and services deployments of a digital multiservice city.

1 Scope

The present document introduces the common and generic aspects of the societal and technical pillars to achieve sustainability objectives behind the deployment of smart new services within the IP network of a single city or an association of cities administratively clustered.

Clause 4 identifies and presents a general overview of a city from small entity to significantly large municipality clustering several cities and villages.

Clause 5 presents the pursued objectives behind the concept of smart city.

Clause 6 describes the general theoretical pillars which bear the engineering requirements to deploy a digital multi service city.

Clause 7 identifies the general needs from the cities.

2 References

2.1 Normative 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.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference.

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The following referenced documents are necessary for the application of the present document.

[1] CENELEC EN 50173-2: "Information technology - Generic cabling systems - Part 2: Office spaces".

[2] CENELEC EN 50173-4: "Information technology - Generic cabling systems - Part 4: Homes".

[3] CENELEC EN 50174-1: "Information technology - Cabling installation - Part 1: Installation specification and quality assurance".

[4] CENELEC EN 50174-2: "Information technology - Cabling installation - Part 2: Installation planning and practices inside buildings".

[5] CENELEC EN 50174-3: "Information technology - Cabling installation - Part 3: Installation planning and practices outside buildings".

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 TS 105 174-5-1: "Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment and Energy Management; Part 5: Customer network infrastructures; Sub-part 1: Homes (single-tenant)".

[i.2] ETSI TR 105 174-5-2: "Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment - Energy Efficiency and Key Performance Indicators; Part 5: Customer network infrastructures; Sub-part 2: Office premises (single-tenant)".

[i.3] ETSI TS 105 174-5-4: "Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment - Energy Efficiency and Key Performance Indicators; Part 5: Customer network infrastructures; Sub-part 4: Data centres (customer)".

[i.4] ETSI TR 105 174-2-1: "Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment - Energy Efficiency and Key Performance Indicators; Part 2: Network sites; Sub-part 1: Operator sites".

[i.5] ETSI TR 103 290: "Machine-to-Machine communications (M2M); Impact of Smart City Activity on IoT Environment".

[i.6] ETSI TR 102 898: "Machine to Machine communications (M2M); Use cases of Automotive Applications in M2M capable networks".

[i.7] ETSI TR 102 935: "Machine-to-Machine communications (M2M); Applicability of M2M architecture to Smart Grid Networks; Impact of Smart Grids on M2M platform".

[i.8] ETSI TR 102 857: "Machine-to-Machine communications (M2M); Use Cases of M2M applications for Connected Consumer".

[i.9] European Innovation Partnership on Smart Cities and Communities: "Operational Implementation Plan".

NOTE: Available at http://ec.europa.eu/eip/smartcities/files/operational-implementation-plan-oip-v2_en.pdf.

[i.10] European Innovation Partnership on Smart Cities and Communities: "Strategic Implementation Plan".

NOTE: Available at http://ec.europa.eu/eip/smartcities/files/sip_final_en.pdf.

[i.11] European Innovation Partnership on Smart Cities and Communities: "Humble Lamppost".

NOTE: Available at https://eu-smartcities.eu/commitment/6670.

[i.12] ETSI GS OEU 009: "Operational energy Efficiency for Users (OEU); Global KPI Modelling for Green Smart Cities".

[i.13] ETSI GS OEU 019: "Operational energy Efficiency for Users (OEU); KPIs for Smart Cities".

[i.14] ETSI TS 103 463: "Access, Terminals, Transmission and Multiplexing (ATTM); Key Performance Indicators for Sustainable Digital Multiservice Cities ".

[i.15] IEEE 802.11: "Wireless LAN; 802.11-2012 -- IEEE Standard for Information technology -- Telecommunications and information exchange between systems Local and metropolitan area networks--Specific requirements -- Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications".

[i.16] Market Place of the European Innovation Partnership on Smart Cities and Communities.

NOTE: Available at http://eu-smartcities.eu.

[i.17] European Innovation Partnership on Smart Cities and Communities "s[m2]art".

NOTE: Available at https://eu-smartcities.eu/commitment/7434.

[i.18] Recommendation ITU-T Y.4900: "Overview of key performance indicators in smart sustainable cities".

[i.19] Recommendation ITU-T Y.4901: "Key performance indicators related to the use of information and communication technology in smart sustainable cities".

[i.20] Recommendation ITU-T Y.4902: "Key performance indicators related to the sustainability impacts of information and communication technology in smart sustainable cities".

[i.21] Recommendation ITU-T Y.4903: "Key performance indicators for smart sustainable cities to assess the achievement of sustainable development goals".

[i.22] ISO 37120:2014: "Sustainable development of communities -- Indicators for city services and quality of life".

3 Definition of terms and abbreviations

3.1 Terms

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

digital multiservice cities: cities using digital infrastructure which consists of a single unified high-speed networking infrastructure that allows the ICT systems of the complete city services departments to interconnect seamlessly and securely to each other

street furniture: collective term for objects and pieces of equipment installed on city streets, city roads, and public areas under responsibility of the city for various purposes. These objects and equipment belong to the wider terminology of the urban assets as named by cities

urban asset: collective term to qualify the physical assets which belong to a city and which are located across its territory, in streets, roads, public parks and associated urban constructions

3.2 Abbreviations

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

API	Application Programming Interface
ATTM	Access, Terminals, Transmission and Multiplexing
CCTV	Closed-Circuit TeleVision
EIP	European Innovation Partnership
EIP-SCC	European Innovation Partnership on Smart Cities and Communities
GS	Group Specification
ICT	Information and Communication Technology
IEEE	Institute for Electrical and Electronics Engineers
IoT	Internet of Things
IP	Internet Protocol
ISG	Industrial Specification Group
ISO	International Organization for Standardization
ISP	Internet Service Provider
IT	Information Technology
ITS	Intelligent Transportation Systems
ITU	International Telecommunication Union
KPI	Key Performance Indicator
LAN	Local Area Network
M2M	Machine to Machine
MAC	Media Access Control
OEU	Operational energy Efficiency for Users
SME	Small and Medium Enterprise
SOHO	Small Office Home Office

TR	Technical Report
Wi-Fi	Wireless Fidelity
WLAN	Wireless LAN

4 General overview of a city

4.1 Reaching sustainability through digital multiservice city networks

Municipality facilities range from a single premise to multiple buildings located across the city territory. Single premise municipality comes from the origin of this administrative facility: "the city house" where the mayor was living and where all government administrative duties were performed.

Through the centuries, the mayor has been supported by more and more complementary staff creating by purposes respective services departments. Along this employment growth, city property availabilities or acquisitions, services offices started to span either across several physical building facilities within the city area either across larger geographical areas when the administrative entity spanned on multiple contiguous cities or villages.

Municipalities nowadays have also undertaken several other responsibilities such as safety, education, waste management, recycling, healthcare, water and electricity distribution, public transportation and potentially many more.

Most of today's municipalities are supported by Information and Communications Technologies to help the city staff to perform the daily work, communicate with each other and with the higher authorities. In that concern, municipalitie's operations should be considered as an enterprise ranging from a Small Office Home Office (SOHO), a Small and Medium Enterprise (SME) up to large enterprise. According to the respective type of enterprise the city can be matched to, technical recommendations which apply to homes and offices ICT deployments such as ETSI TS 105 174-5-1 [i.1], ETSI TR 105 174-5-2 [i.2] and ETSI TS 105 174-5-4 [i.3] or to telecommunication services providers such as ETSI TR 105 174-2-1 [i.4] should be considered to improve the energy management of the city ICT deployment.

Indeed, from a networking perspective municipalities have various challenges to face.

4.2 Inside-building connectivity cabling infrastructure

Regularly the buildings which host the municipal staff are not contemporary and have not been designed with IT in mind. Furthermore, in important cities, these buildings are often classified heritage buildings and construction works are heavily constrained.

The result is that network cabling is regularly a concern. It is common to see physical deployments where rooms are not correctly equipped with appropriate network access sockets, that network cables are inappropriately installed, that technical facilities such as cable patch panels are imperfectly installed or simply missing, etc. Finally, poor cross-domains vision leads often to the installation of several independent physical network cabling setups such as:

- Network cablings for analog/digital telephony services.
- Network cablings for emergency (e.g. alarms, elevators) services.
- Network cabling for IT data networking service.
- Network cabling for IP telephony service.
- Network cabling for analog/digital video surveillance service.
- Network cabling for IP video surveillance service.

There is a clear need to unify these ICT independent infrastructures through a common multi-services physical engineering architecture.

Requirements, specifications and best practices for the deployment of these physical cabling infrastructures are covered by various norms such as CENELEC EN 50173-2 [1], CENELEC EN 50173-4 [2], CENELEC EN 50174-1 [3] and CENELEC EN 50174-2 [4].

4.3 Inter-buildings connectivity cabling infrastructure

Nowadays, in many cases municipal facilities are spread across many buildings which may or may not be near to one another. Besides the constraint of classified heritage buildings, distances between facilities may be large. In that regard and according to the capabilities, municipalities either opt to deploy their own inter-building cablings or either opt for contracting external service provider(s).

Similarly to the local cabling, poor cross-domains vision regularly leads to the installation of several independent physical network cabling setups thus establishing multiple service contracts with service providers.

There is a clear need to improve the engineering architecture which interconnects the various facilities spread across the territory.

Requirements, specifications and best practices for the deployment of these physical cabling infrastructures are covered by various norms such as CENELEC EN 50174-1 [3] and CENELEC EN 50174-3 [5].

4.4 Digital services availability

IP networking technology leverages numerous IT services such as data transfer, digital telephony, video surveillance, IoT operation and monitoring, etc. IT staff availability within the municipality shall be taking into account and due to financial constraints regularly missing (small cities, villages) or outsourced to external services providers. The consequence is that there is limited or a missing engineering view on the deployment of the digital services. It is a common situation where the IP data network is unfortunately fragmented into multiple independent IP networks isolated from one another and even requires to pass through externals service providers for internal communications.

By example, when migrating from analog/digital telephony or video security to IP telephony or video security, lack of technical engineering and poor global networking views often lead to mirror traditional POTS (Plain Old Telephone Service) or situation. Municipalities often deploy independent and isolated IP networks per service and per site (even per building) whereas technically engineered design would suggest to architecture the deployment as a single unified IP voice or video platform leveraging a multi service network spanning across the building facilities.

The engineering of a multi-services network would also open the way to innovative IT solution such as voice and video convergences while also enabling communication between:

- physical IP phones and softphone running on municipal employee's computer,
- access to IP camera video streams from authorized computer within the network.

4.5 Network access coherence

Local or inter-buildings physical networking connectivity has constrained the municipal authorities to fragment their local IP networks into isolated networking areas. Access to the Internet, or specific national network resources, with such engineering implies to install a dedicated physical connection to a network service provider (e.g. ISP) within each local network. Unfortunately, it is also common to have cities where Internet connections are even physically linked to single agent computers therefore removing the capability to share the service provider access with the agent department.

The engineering of a multi-services network would also improve the accessibility to the Internet as well as to other specific external services (e.g. national citizen or enterprise's registries) such as those provided by higher authorities of the government.

5 General considerations about digital multiservice city

Renowned technology organizations such as the ITU-T describes the concept of the sustainable city with the following terms:

"A smart sustainable city is an innovative city that uses ICT and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects".

This definition has been developed based on the work carried out by FG-SSC and UNECE in ITU-T SG5.