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Impact of Smart City Activity on IoT Environment

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Smart Machine-to-Machine communications (SmartM2M).

Modal verbs terminology

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1 Scope

The present document would undertake compilation and review of activities taking place in the area of Smart City. It will analyse the relevance of Smart City applications, and possible underlying network architecture. The present document will describe use case descriptions for Smart City applications in context of but not limited to IoT communications.

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 reference document (including any amendments) applies.

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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] Toward a framework for Smart Cities: A Comparison of Seoul, San Francisco & Amsterdam.

NOTE: Available at http://iis-db.stanford.edu/evnts/7239/Jung_Hoon_Lee_final.pdf

[i.2] Gordon Falconer Shane Mitchell: "Smart City Framework A Systematic Process for Enabling Smart+Connected Communities".

NOTE: Available at https://www.cisco.com/web/about/ac79/docs/ps/motm/Smart-City-Framework.pdf

[i.3] The Role of Standards in Smart Cities Issue 1.

[i.4] http://www.gartner.com/technolog.

[i.5] http://www.idc.com.

[i.6] CleanTechnica: "Predictive Energy Optimization: Smart Buildings, Smart Grids, Smart Cities".

NOTE: Available at http://cleantechnica.com/2014/02/12/predictive-energy-optimization-smart-buildings-smart-grids-smart-cities/#OkeRr1jvH9JBiACL.99

[i.7] IBM: "Smarter Buildings".

NOTE: http://www.ibm.com/smarterplanet/us/en/green_buildings/overview/

[i.8] http://www.smartsantander.eu/.

[i.9] SmartSantanderRA: "Santander Augmented Reality Application".

NOTE: Available at http://www.smartsantander.eu/index.php/blog/item/174-smartsantanderra-santander-augmented-reality-application.

[i.10] Ojo et al.: "Designing next generation smart city initiatives - Harnessing findings and lessons from a study of ten smart city programs".

NOTE: Available at http://ecis2014.eu/E-poster/files/0575-file1.pdf.

[i.11] CEN/CENELEC: "Smart cities".

NOTE: Available at http://www.cencenelec.eu/standards/Sectors/SmartLiving/smartcities/Pages/default.aspx

[i.12] "A vision of a smarter city".

NOTE: Available at www.foresightfordevelopment.org/sobipro/download-file/46-155/54.

[i.13] "Smart cities in Europe".

NOTE: Available at http://www.smartcitiesineurope.com/category/best-practices/?orderby=title&order=ASC.

[i.14] ANSSC: "Directory of Smart and Sustainable Cities Standardization Initiatives and Related Activities".

NOTE: Available at http://bit.ly/1hVCr1Y.

[i.15] ETSI TS 103 264: "SmartM2M Smart Appliances Common Ontology and SmartM2M/oneM2M mapping".

[i.16] ETSI TS 103 267: "SmartM2M Smart Appliances Application of ETSI M2M Communication Framework".

[i.17] Smart Grid Task Force EG2 deliverable: "Proposal for a list of Security Measures for Smart Grids (EnisaSG)".

[i.18] ETSI TS 118 102: "Requirements".

[i.19] ETSI TS 118 101: "Functional Architecture".

[i.20] ETSI TS 102 689: "Machine-to-Machine communications (M2M); M2M Service Requirements".

[i.21] ETSI TS 102 690: "Machine-to-Machine communications (M2M); Functional architecture".

[i.22] European Parliament: "Mapping Smart Cities in the EU".

NOTE: Available at http://issuu.com/aie_eur_electrical_contractors/docs/ipol-itre_et_2014_507480_en/1.

[i.23] BS 25999-1: "Business continuity management -Part 1: Code of practice".

[i.24] ISO 22301: "Business Continuity Management System Self Assessment Questionaire".

[i.25] Hatzelhoffer, L. et al.: "Smart City in Practice". Jovis Verlag, Berlin, 2012.

[i.26] CEN-CENELEC-ETSI Smart Grid Coordination Group: "SG-CG/M490/F-Overview of SG-CG Methodologies", Version 3.0, November 2014 (Annex 5 to CENELEC BT149/DG9624/DV).

[i.27] ISO/IEC 27001: "Information technology -- Security techniques -- Information security management systems -- Requirements".

[i.28] ISO/IEC 29100: "Information technology -- Security techniques -- Privacy framework".

3 Abbreviations

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

ADSL	Asymmetric digital subscriber line
AKA	Also Known As
API	Application Programming Interface
APTS	Advanced Public Transportation Systems
ATIS	Advanced Traveller Information Systems
ATMS	Advanced Traffic Management Systems
BCM	Business Continuity Management
BSI	British Standards Institute
BUTLER	uBiquitous secUre inTernet_of_things with Location and contEx-awaReness
COSEM	Companion Specification for Energy Metering
CSE	Common Services Entity
DSL	Digital Subscriber Line
EC	European Commission
ENISA	European Network and Information Security Agency
EnisaSG	European Network and Information Security Agency Security Group
GPRS	General packet radio service
HSDPA	High Speed Downlink Packet Access
IBM	International Business Machines
ICT	Information and Communication Technology
IDC	International Data Corporation
IEC	International Electrotechnical Commission
IP	Internet protocol
ISO	International Organisation for Standards
ITS	Intelligent Transport Systems
LTE	Long Term Evolution
M2M	Machine-to-Machine
M-bus	Meter - Bus
NFC	Near Field Communication
NGN	Next Generation Network
NGO	Non Governmental Organisation
NRW	Non - Revenue Water
PLT	Power Line Telecommunication
POI	Points Of Interest
QoE	Quality of Experience
QoS	Quality of Service
SAP	Smart Appliances
SAR	Special Administration Region
SCADA	Supervisory Control and Data Acquisition
SCL	Service Capability Layer
SGAM	Smart Grid Architecture Model
URI	Universal Resource Identifier
VDSL	Very high speed Digital Subscriber Line
Wi-Fi	Wireless Fidelity
WLAN	Wireless Local Area Network

4 Definition of Smart City

A city can be defined as 'smart' when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic development and a high quality of life, with a wise management of natural resources, through participatory governance. Figure 1 shows the elements involved in making a City Smart.

Figure 1

Some other definitions of Smart cities are the following:

"A smart city is based on intelligent exchanges of information that flow between its many different Subsystems. This flow of information is analysed and translated into citizen and commercial services.

*The city will act on this information flow to make its wider ecosystem more resource-efficient and Sustainable. The information exchange is based on a smart governance operating framework Designed for cities sustainable." (Gartner, 2011 [*i.4*])*

*"Smart city" [refers to] a local entity - a district, city, region or small country - which takes a Holistic approach to employ[ing] information technologies with real-time analysis that encourages Sustainable economic development." (IDC, 2011 [*i.5*])*

Smart city is about connecting users and data across multiple domains to share information. It can be described as a City described by the many technologies see figure 2 (from [i.1]) this shows the main domain covered in Smart city:

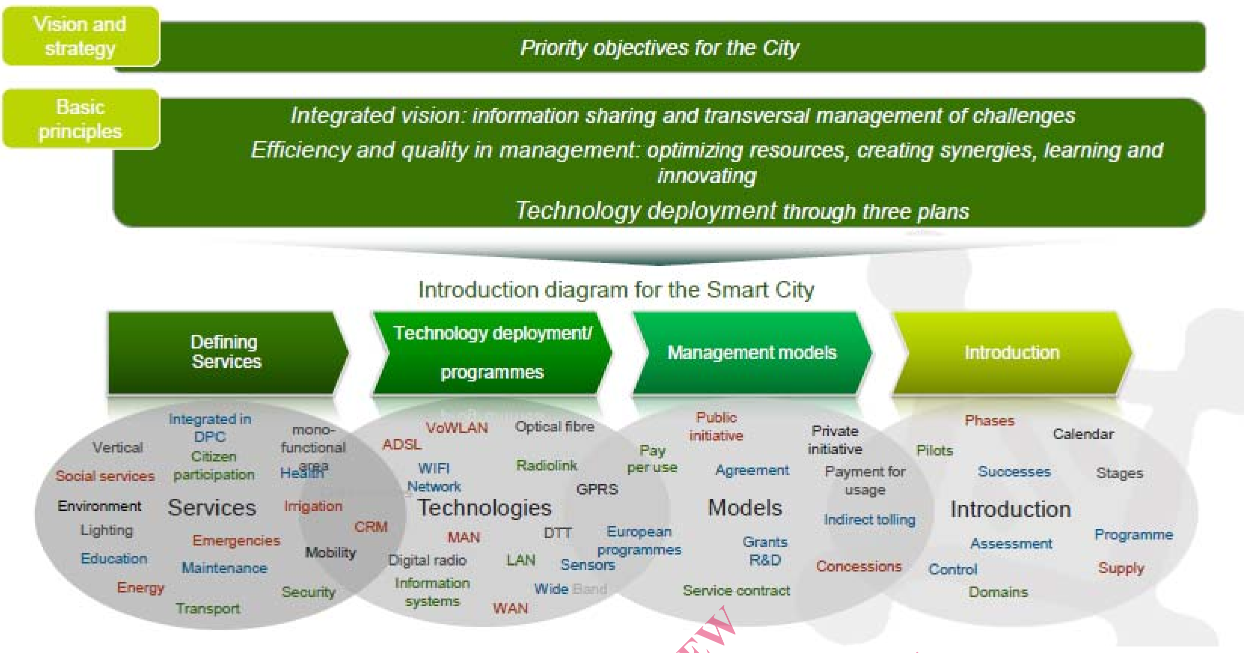

Figure 2

5 Stakeholders involved in Smart City

There are many interpretation of a Smart city Framework, however the key stakeholders that should be covered in any framework should be according to the following list [i.2]:

- ***Government or City authorities*:** should support the initiative of smart city for it to work. The government will be able to bring multiple groups together to establish common language for Smart Cites. For example in the UK the British Standards Institution backed by the government is developing standards for Smart Cities [i.3].
- ***Private Sector*:** the private sector need to be educated on "how"-policies and business models necessary for implementing Smart City solutions works, without the private sector the whole community does not get a buy in.
- ***Public Sector:*** Smart cities are not likely to develop without initiative and involvement from the local public authorities to federate all actors (water, energy, waste utilities; Healthcare and emergency services; Public transport and traffic regulation; and telecommunication service providers), whether they are public or privately operated.
- ***Service providers:*** Smart cities need to accommodate the involvement of multiple service providers, as it is likely that the multiple sectors to aggregate will not accommodate a universal choice, especially if services are to be offered to citizens on their own devices. Furthermore, to support a viable ecosystem, the diversity of services involved in the aggregation, which are each of significant complexity, can potentially be operated by specialized actors: Telecommunication, M2M data dissemination, Analytics, Security and Trust, etc.
- ***Academics and NGOs*:** are stakeholders that focusing on the "how" rather than on the "why". Both, of course, are important, but focusing too much on the "why" will hinder quick adoption of solutions and initiatives.
- ***Residents of the city:*** this group of stakeholder are the recipient of Smart city services.

6 Use case examples of communities that have created Smart Cities in the following areas

6.1 Transport

With the boom in motorization, urbanization and population growth over the last century, transport has played a fundamental role in the development of the economy and society, and as a direct consequence has shaped daily life. However, transport supply has often been unable to fulfil the rapidly increasing demand for it, and has itself contributed to a number of problems including congestion and pollution. Solving these problems by suppressing demand or expanding supply is not realistic as in either case there are constraints in place. However, the rapid development of information and communication technology in the last few decades provides new opportunities to manage and perhaps alleviate such problems. Intelligent transport systems (ITS) in which knowledge of transport patterns, preferences of the transport users, the status of the transport infrastructure and other factors are brought together may help in better managing the factors that cause these problems. The beneficial impacts are expected to be centred on more efficient use of the available transport infrastructure on behalf of its users with additional benefits in improved safety, and reduced vehicle wear, improved journey transportation times, and reductions in the overall energy consumption of the transport infrastructure.

Intelligent Transport Systems (ITS) are a specialized subset of machine-to-machine communications in a software driven and all-connected world. There are a number of dimensions of ITS as indicated in the following list:

- Advanced Traveller Information Systems (ATIS);
- Advanced Traffic Management Systems (ATMS);
- ITS-Enabled Transportation Pricing Systems;
- Advanced Public Transportation Systems (APTS);
- Vehicle-to-Infrastructure Integration (VII); and
- Vehicle-to-Vehicle Integration (V2V).

Supporting each of these capabilities both separately and together is a crucial aspect of Smart City. Integration of ITS to Smart City can be viewed from a number of perspectives: Data integration; Communication integration. In practical use data integration (syntactic and semantic) enables the sharing of data from multiple sources and is key to the development of new economic models in Smart City through the merging of data - this may be seen in ITS services such as multi-modal routing and multi-modal congestion monitoring.

6.2 Smart Cites, Smart Water

One of a city's most important pieces of critical infrastructure is its water system. With populations in cities growing, it is inevitable that water consumption will grow as well. The term "smart water" points to water and wastewater infrastructure that ensures this precious resource - and the energy used to transport it - is managed effectively. A smart water system is designed to gather meaningful and actionable data about the flow, pressure and distribution of a city's water. Further, it is critical that that the consumption and forecasting of water use is accurate.

A city's water distribution and management system has to be sound and viable in the long term to maintain its growth and should be equipped with the capacity to be monitored and networked with other critical systems to obtain more sophisticated and granular information on how they are performing and affecting each other. Additional efficiencies are gained when departments are able to share relevant, actionable information. One example is that the watershed management team can automatically share storm water modelling information which indicates probable flooding zones and times based on predictive precipitation intelligence. The transportation department can then reroute traffic accordingly and pre-emptively alert the population using mass notification.

Incorporating smart water technologies allows water providers to minimize non-revenue water (NRW) by finding leaks quickly and even predicatively using real-time SCADA data and comparing that to model network simulations. Reducing NRW also allows municipalities to recover costs incurred in treatment and pumping - this can be significant.