DELIVERABLE

D2.6 – Interoperability Pilot Deployment & Test Plan
Revised 2017.04.03

Project Acronym: ESPRESSO

Grant Agreement number: 691720

Project Title: systEmic Standardisation apPRoach to Empower Smart citieS and cOmmunities

Revision: 0.6

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Project co-funded by the the Horizon 2020 Framework Programme of the European Union		
Dissemination Level		
P	Public	X
C	Confidential, only for members of the consortium and the Commission Services	

1. Revision history and statement of originality

1.1. Revision history

Rev	Date	Author	Organization	Description
0.1	19/07/16	Matteo Tranquillini	TRILOGIS	Template preparation
0.2	12/08/16	Irene Facchin	TRILOGIS	First version of document
0.3	12/08/16	Poll-van Dasselaar Rob	ROTTERDAM	Contribution on Rotterdam Use cases
0.4	31/08/16	René Tõnnisson	TARTU	Contribution to Tartu Use Cases
0.5	31/08/16	Irene Facchin	TRILOGIS	Quality check
0.6	17/04/17	Irene Facchin	TRILOGIS	Updated document

1.2. Statement of originality

This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

2. List of references

Number	Full Reference

3. Table of Acronyms

Acronym	Description
API	*Application programming interface*
CIOP	*SmartEnCity City Information Open Platform*
FME	*Feature Manipulation Engine*
HW	*Hardware*
ICT	*Information and communications technology*
SW	*Software*

4. Executive Abstract

The goal of Task 2.5 *Design of testbeds for interoperability experiments* is to design the operational aspects of the interoperability experiments to be carried on in the context of T4.4 *Pilot activities* to be started at M10.

In particular, this document, D2.6 *Interoperability Pilot Deployment and Test Plan* represents the final outcome of the analysis carried out in the context of T2.5 aiming at identifying the main technical and data transfer standardization requirements, at assessing the pilots' operational conditions, and at planning an agenda for onsite deployment and field test activities.

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N.A.

9. Introduction

The present document offers an overview of the Use cases that have been identified for both the pilot sites, Rotterdam and Tartu.

The document in divided in 3 sections: the first one presents the Use Cases identified for the pilot sites, described using a common template that can be seen also in Annex 1. The second section presents a tentative agenda of onsite deployment and field test activities, while the last section presents the definition of the test final evaluation.

Following the reviewers' comments, this document has been updated. In particular, the pilots' use cases sections have been revised by adding a link with the D2.4 *Details of CASSIOPEiA (*Use of Management standards, maturity models, standard sets of indicators, and standard information models).

A further objective of the D2.6 is to identify the technical details of later interoperability Pilot to be carried on within T.4.5, including, but not limited to: specific features, applications, services, stakeholders involved, different datasets to be harmonized and integrated, existing technologies, regulatory aspects in place at the city level, etc.

For the technical description, the consortium follows on the different aspects of IoT described in AIOTI WG03, as described in the chapter 8 of the D3.1 *Cross-SDOs analysis on harmonisation of Smart City standards report* and that will be also the baseline for D2.5 *Gap & SWOT analysis*.

At the same time, the consortium has reviewed the pilot's self-description in order to see how CASSIOPEiA can link with the different use cases:

- **Rotterdam** suggests the following standards which may be of use to the pilot:
    - Information Model: The pilot had already chosen to use CityGML as their information model
    - Management standards identified:
        - ISO 37101:2016 Sustainable development in communities -- Management system for sustainable development -- Requirements with guidance for use
        - BSI PAS 184 Smart Cities – Developing project proposals for delivering Smart City solutions – Guide
        - PAS 183 Guide to establishing a decision-making framework for sharing data and information services
    - Maturity model: There is a maturity model in an informative annex of ISO 37101
    - Indicators: City keys for each particular domain

  - Additionally Rotterdam suggests other standards which may be of use to the pilot (LORA, Sensor Things API, CityGML Dynamizer..)

- **Tartu** suggests the following standards which may be of use to the pilot:
  - Information Model: The pilot had already chosen to use CityGML as their information model, with the Table Join Service to attach non-spatial information
    - OGC
    - ISO 30182 (available as BSI PAS 182
  - Management standards identified:
    - ISO 37101:2016 Sustainable development in communities - Management system for sustainable development - Requirements with guidance for use
    - BSI PAS 184 Smart Cities – Developing project proposals for delivering Smart City solutions – Guide
    - PAS 183 Guide to establishing a decision-making framework for sharing data and information services
  - Maturity model: There is a maturity model in an informative annex of ISO 37101
  - Indicators: City keys, the 'quality of open data' measure in the Prosperity theme, or some of the innovation measures and the Planet theme, energy & mitigation sub-theme, "reduction in annual final energy consumption" indicator
  - Additionally Tartu suggests other standards which may be of use to the pilot (OpenStreetMap, WebGL, IFC)

In particular, the purpose of this report is to act as a deliverable of year 2 of the project, and to introduce the smart city interoperability concept. In order to narrow the scope of the work, the focus is put on four smart city sectors: mobility, water management, energy and building environment and in particular on four use cases introduced in more detail later in the report. However, the goal is to create the smart city interoperability concept in such a way that it can be further developed and deployed to other smart city sectors.

In the aforementioned initiatives, interoperability is an explicitly stated goal. It is promoted by the provision of open public data in standard formats. It is also pushed forward by the vision of a marketplace of data, tools, and applications, which are produced by a variety of firms and public sector actors.

At the end is about to provide a guidance to other cities that would set up similar pilots/projects; what are the standards most used in Europe, main problems to overcome and the description of all the steps/tasks needed, such as:

- Address all administrative issues related to pilots, from legal requirements to collection of signed acceptance from stakeholders (whenever required).
- Assess pilots' operational conditions. Including preliminary activities that may be needed to ensure it can fit with operational technical and service requirements.
- Plan an agenda for onsite deployment and field test activities at the different city locations, with a precise definition of the technical deployment tasks and of their coordination. Each pilot will have to follow agreed steps that are part of the activity plan, to be reported in the so-called "roll-out agenda".

This description of the pilots will help ESPRESSO to identify gaps in the interoperability arrangements (D 2.4 Gap and SWOT analysis) and validate the reference architecture to support the urban platform (D 4.2).

Finally, Cities point of view is crucial to understand what are the steps to follow in order to set up the pilot (data sets to use, format, privacy issues to overcomes, administrative permissions to ask, Netherlands and Estonia regulatory aspects affecting this pilots, standards used, as starting point and this previous feedback (bottom up) will be enriched with the (top down) sectorial analysis that we will deliver in the D 2.2 The Scope of Smart City Standardization by M16 (April).

10. Use cases requirements

Starting from the work carried out within D2.2 *The scope of Smart City use cases*, both the pilot sites of Rotterdam and Tartu have been invited to fill in a short module for defining the requirements for each use case.

10.1. Rotterdam

The pilot city in Rotterdam has originally envisaged to follow four use cases, namely:

- Rotterdam 3D Digital City
- Automatic parking control
- Groundwater level measurement
- Waste paper containers

The last one, namely the waste paper containers management, has been lately excluded because of the impossibility to have the needed data.

10.1.1. Rotterdam 3D Digital City [ROTTERDAM_UC00_3D]

The basic use case for the pilot city of Rotterdam is the 3D Digital City.

The overall current smart development is the 3D Digital City project, which is an information- and communication platform for everybody with an interest in Rotterdam. In the end, it enables all kinds of virtual interactions between organizations and people throughout the 3D city. Indeed, integrating it with several different other data bases and information layers can expand tremendously the range of tasks which can be achieved through the Digital City Rotterdam project. The 3D model should be applied in a multitude of application domains for environmental simulations, running scenarios, decision support, people and assets tracking, communication with stakeholders.

Figure 1. Rotterdam 3D city model.

The plan for the pilot is to, first, populate the platform with dynamic parking- and groundwater level info from sensors combined with the new open 3D city model. Then, to add virtual shopping, gaming, art, social events, digital neighbourhood communities etc. Based on the 3D model of the city, all kinds of information can be allocated and found by others.

Indeed, this infrastructure does not exist yet. The scope of the first use cases is to setup and technically test the central datahub and connect it to the online 3D city model using open standards. In a later stage, other parts of the infrastructure, like the data exchange market and decision support tools will be connected/developed.

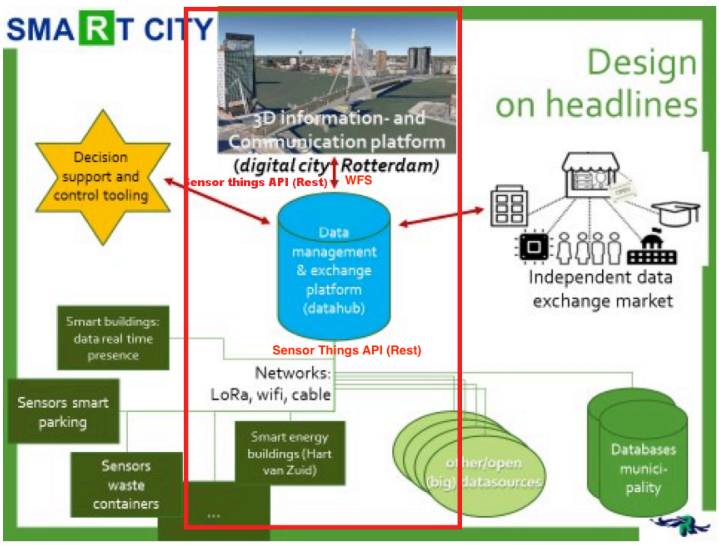
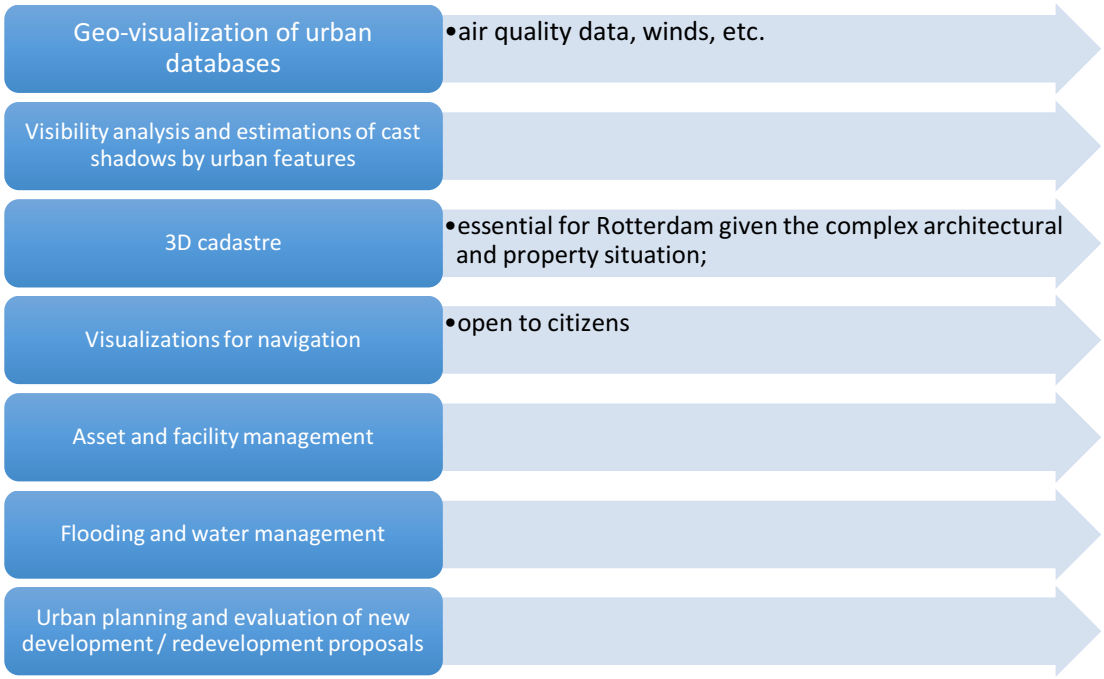


Figure 2. Infrastructure.

Thus, the main objective of this first phase of the project is to build up knowledge about the entire workflow from connecting to the sensor data in order to make it available to the public through the online 3D city. The lessons will be both on technical and organizational level.

This will be an overall infrastructure serving as a base for all **smart sectorial systems**, among which:

Sub-use cases include:



10.1.1.1. Expected objectives/benefits

This use case will have a **series of objectives and benefits**. The main objective is to make all kind of information available for the city in an easy, open and transparent way for both the internal municipal organization and the external stakeholders. By setting up an open infrastructure to make available all kind of smart information like for example sensor data, 3D models, and

geospatial data in a standardized way, the data can be used for multiple purposes and applications. In particular:

- To provide the municipality with an open interface supporting the display of Rotterdam as well as new urban development proposals in 3D.
- To allow an open, transparent, real-time communication on the main topics of importance (e-government, energy, transportation), state of art and proposals between the local administration (decision makers), citizens (beneficiaries of local community plans) and companies (stakeholders in the building industry, service providers, utility companies).
- To allow for multiple uses in city planning, traffic management, energy planning etc., under an interoperable framework with other proprietary, vendor-specific solutions pre-existing in the City Hall.
- To provide a single interdepartmental basis of discussion for future projects and state of art in transversal domains (i.e. collaboration of GIS department with planning, parks and green area management departments, etc.).

Expected **benefits** are that because of all these new applications, the current single use effect of the data will be multiplied. This can be in all kind of areas. The infrastructure is currently being setup making use of software components that are already there. Depending the results of the pilots it will be further extended in an agile way.

10.1.1.2. Available data and technologies at the pilot site

See 9.4 Information models in D2.3 Cassiopeia, in which CityGML is described as "the main information model used to underpin city models". This relates to the 'Data semantics' capability in the Smart Cities Reference Architecture (D4.2).

At the pilot site, some data are already available, such as 3D City model (consisting of 3D buildings, 3D pointcloud of Rotterdam, 2D cables and pipes, 2D street furniture dataset, and address database). For sensor information, WFS and the SensorThing API will be used. Sensor readings will be sent over Lora to the data lake. Readings are taken out of the lake using Sensor Things API and linked to the CityGML model using the Dynamizer concept. The readings may be visualized in the 3D city model based on the open specification 3DTiles or the open standard 3D Portrayal Service (3DPS).

For the Data Ingest capability, SensorThings API will bring together information from various sensors, which are accessed remotely using LoRa. The data is kept in a data lake, and SensorThings will provide the interface from there to bring data into the city model, using CityGML's Dynamizer concept.

WFS is in use to provide the Data Publication capability, within a REST architectural pattern. The readings may be visualized in the 3D city model based on the open specification 3DTiles or the open standard 3D Portrayal Service (3DPS).

On this regard, HW and SW technologies are already available. In particular:

Technical Components	Technical Description	Standards applied
Devices and sensor technology: Interoperability of sensor networks, device management, APIs	N.A.	
Communications and Connectivity: Identify type of network communication (Wired, Wifi, Lora…), connection links and the transport protocols.	N.A.	
Infrastructure Identify which urban platform tailored to use for analyzing data, IoT based applications, large scale deployments, distributed computation and storage	The 3D city infrastructure will be based on the open source CityDB database and the Cesium platform. For the datahub for sensor information, WFS and the SensorThing API will be used.	
Integration/Interoperability Common IoT features required to provide integration and interoperability	N.A.	
Applications The support of the applications lifecycle including development tools/models, Analytics, application domain specific activities	N.A.	
IoT Architecture Integrated/complete IoT specifications solutions, including architecture descriptions	N.A.	
Security and Privacy Security and Privacy topics	There will definitely be security and privacy issues. Currently during the closed pilot phase this will not be the focus. But now that we start working with the real data these issues get	

	more concrete already.	

10.1.1.3. Standards to use from D2.3 CASSIOPEA

The pilot had already chosen to use CityGML as their information model. This section suggests other standards which may be of use to the pilot.

Standards applied for	List of standards applied
Management standards	ISO 37101:2016 Sustainable development in communities -- Management system for sustainable development -- Requirements with guidance for use[1] BSI PAS 184 Smart Cities – Developing project proposals for delivering Smart City solutions – Guide[2] PAS 183 Guide to establishing a decision-making framework for sharing data and information services
Maturity models	There is a maturity model in an informative annex of ISO 37101
Indicators	CityKeys
Information models used	CityGML
Sectoral Standardization Initiatives	N.A.

Additionally, Rotterdam suggests other standards which may be of use to the pilot.

- "Sensor readings are send over Lora" (presumably https://www.lora-alliance.org);
- Sensor Things API "(or SOS)";
- CityGML Dynamizer concept.

10.1.1.4. Legal and normative requirements/barriers

The partner Rotterdam has ideintified some possible requirements for the pilot site. In particular:

- The 3D City Model should be used as a base (CityGML format).
- The model should be extendable, replicable and scalable.
- The model should allow adding objects (i.e. for urban insertion analysis).

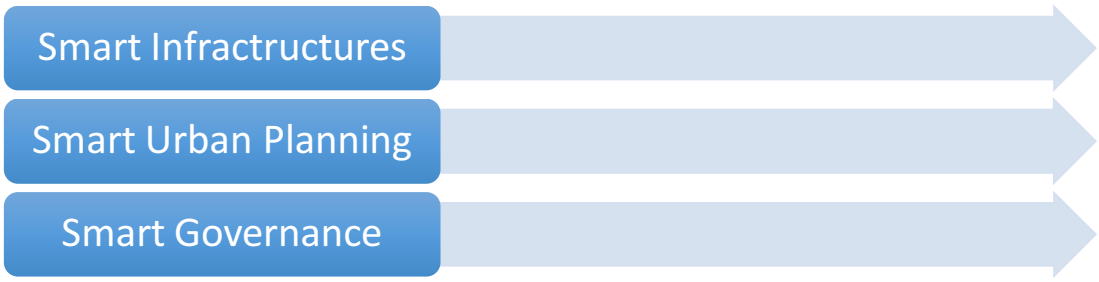
[1] Published since Cassiopeia, which refers to a draft
[2] Published since Cassiopeia, which states it was under development

- There should be the possibility to connect to sensor data, using open standards.
- Data should be easily accessible online for e-government purposes.
- The model should support integration with user interaction services for participation and communication purposes.
- The model should provide export capabilities via CityGML to native / vendor specific applications.

10.1.2. Automatic parking control [ROTTERDAM_UC02_Parking]

The first use case selected for the pilot city of Rotterdam is the Automatic parking control.

The city of Rotterdam is actually working on a smart automatic parking control system. The first tests have been done with two different systems on a small scale (25 to 50 parking spots). In this use case, the aim is to enlarge the scale of the pilot to an entire district where there is a lot of parking nuisance. The information gathered is not only applicable for the inhabitants to be able to find parking spots, but also as input for the municipality to adjust their policy on parking in the city (i.e. Smart Governance).



The test with the parking sensors on the street will be for a small area at the Kruiskade for a total of 59 parking spots.

10.1.2.1. Expected objectives/benefits

The main objective is to better inform the city inhabitants where the sensors are being placed about the availability of parking spaces as to bring down the amount of "searching traffic" in the area.

Other results are reliable numbers on the movement of cars. This can be used in other areas of the city where there is a restriction on parking times.

In the future, the city is aiming to give reliable numbers on the availability of parking spaces in all areas of the city so that traffic coming to the city can already be directed on the orbital motorway.

All data being available online, this can also directly be used in navigation systems.

10.1.2.2. Available data and technologies at the pilot site

For this project, a pilot area of approximately 95 parking spaces is available with underground parking sensors. The protocol being used to send the data is standard http, using JSON. The format of the data is still proprietary to the producer of the system. This issue will be addressed by Rotterdam in the next phase of the pilot.

The common rules in the field of data provision and publication are based on European standard DATEX II, which applies for all smart on street parking detection technologies, payment terminal and other methods of payment and traffic information and control centres data work.

At the pilot site, some data are already available, such as:

- Availability of parking spaces
- Duration of parking

- Error finding in number of available parking spaces in parking garages as indicated on road signs now
- Available data can be used in navigation systems (providing customer fit solutions on visiting the city)
- Available data can be used on traffic signs to improve traffic streams in and around the city

Technical Components	Technical Description	Standards applied
Devices and sensor technology: Interoperability of sensor networks, device management, APIs	Standard APIs are being used, no vendor specific APIs The sensor information will also be shared through the central Rotterdam 3D portal	
Communications and Connectivity: Identify type of network communication (Wired, Wifi, Lora…), connection links and the transport protocols.	LORA network	
Infrastructure Identify which urban platform tailored to use for analyzing data, IoT based applications, large scale deployments, distributed computation and storage	N.A.	
Integration/Interoperability Common IoT features required to provide integration and interoperability	Certification of devices Interoperability between heterogeneous devices and at the data level	
Applications The support of the applications lifecycle including development tools/models, Analytics, application domain specific activities	Service level and application enablers (interoperability between different applications), Unified API for underlying services	
IoT Architecture Integrated/complete IoT specifications solutions, including architecture descriptions	N.A.	
Security and Privacy Security and Privacy topics	Security and Privacy (end to end security), protection of personal data, encryption User authentication	

10.1.2.3. Standards to use from D2.3 CASSIOPEA

The pilot had already chosen to use LoRa as the wireless transport protocol.

This section suggests other standards which may be of use to the pilot.

Standards applied for	List of standards applied
Management standards	ISO 37101:2016 Sustainable development in communities - Management system for sustainable development - Requirements with guidance for use[3] BSI PAS 184 Smart Cities – Developing project proposals for delivering Smart City solutions – Guide[4] PAS 183 Guide to establishing a decision-making framework for sharing data and information services
Maturity models	There is a maturity model in an informative annex of ISO 37101
Indicators	Citykeys, particularly "decreased travel time" in the "competitiveness and attractiveness" group under "Prosperity"
Information models used	N.A.
Sectoral Standardization Initiatives	Domain specific initiatives applied if any

10.1.2.4. Legal and normative requirements/barriers

The envisaged possible barrier was on privacy but, in order not to have any pivacy issues, underground sensors have been chosen. The only signal this sensor provides is occupied/free.

10.1.3. Groundwater level measurement [ROTTERDAM_UC02_Groundwater]

The second use case selected for the pilot city of Rotterdam is the Groundwater level measurement.

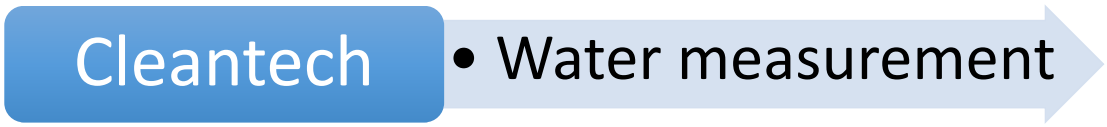
Houses in Rotterdam are built on wooden poles and these need to be kept wet, to avoid that they rot. Groundwater levels are measured at regular intervals

[3] Published since Cassiopeia, which refers to a draft
[4] Published since Cassiopeia, which states it was under development

using both sensors (currently 3) and human readings (approximately 2000 wells in the city manually measured). More sensors are planned so that more accurate, frequent, flexible measurements, less manual labour.

These sensor readings are sent and stored in the Data Lake for retrieval and analysis.

Sensor readings are read from the Data Lake using Sensor Things API (or SOS) and linked to the existing CityGML based 3D model of the city. The readings may be visualized in the 3D city model based on the open specification 3DTiles or the open standard 3D Portrayal Service (3DPS), Governance.



Currently there are approximately 2000 wells in the city of Rotterdam which are being measured manually once a month.

By making them sensor based a lot of time and effort can be saved of course, but moreover much more information will be available about the well.

10.1.3.1. Expected objectives/benefits

Currently there are approximately 2000 wells in the city of Rotterdam which are being measured manually once a month. By making them sensor-based, a lot of time and effort can be saved of course, but moreover much more information will be available about the well.

The current use case is about a first technical test with the groundwater level sensors for a limited number of wells. Depending on the outcomes of the tests decisions will be made about the next steps. This will me made in order to obtain more knowledge and experience about the use of sensors for measuring the groundwater levels.

10.1.3.2. Available data and technologies at the pilot site

Three sensors are in place and already providing data. The data provided is ground water level, measured and relayed in centimeters above or below NAP (sea level).

Technical Components	Technical Description	Standards applied
Devices and sensor technology: Interoperability of sensor networks, device management, APIs		SensorThings (or SOS)

Technical Components	Technical Description	Standards applied
Communications and Connectivity: Identify type of network communication (Wired, Wifi, Lora…), connection links and the transport protocols.		
Infrastructure Identify which urban platform tailored to use for analyzing data, IoT based applications, large scale deployments, distributed computation and storage	CityGML based 3D model of the city	CityGML
Integration/Interoperability Common IoT features required to provide integration and interoperability		
Applications The support of the applications lifecycle including development tools/models, Analytics, application domain specific activities	The readings may be visualized in the 3D city model based on the open specification 3DTiles or the open standard 3D Portrayal Service (3DPS)	3D Tiles, 3D Portrayal service
IoT Architecture Integrated/complete IoT specifications solutions, including architecture descriptions		
Security and Privacy Security and Privacy topics		

10.1.3.3. Standards to use from D2.3 CASSIOPEA

The pilot had already chosen to use CityGML as their information model, SensorThings to acquire the sensor data, and 3D Tiles to transfer the data to a visualization application based on 3D Portrayal Service. This section suggests other standards which may be of use to the pilot.

Standards applied for	List of standards applied
Management standards	ISO 37101:2016 Sustainable development in communities - Management system for sustainable development - Requirements with guidance for use[5] BSI PAS 184 Smart Cities – Developing project proposals for delivering Smart City solutions – Guide[6]

[5] Published since Cassiopeia, which refers to a draft
[6] Published since Cassiopeia, which states it was under development

	PAS 183 Guide to establishing a decision-making framework for sharing data and information services
Maturity models	There is a maturity model in an informative annex of ISO 37101
Indicators	Citykeys, although this use case is distinct from the usual use cases around water management.
Information models used	CityGML
Sectoral Standardization Initiatives	• Domain specific initiatives applied if any

10.1.3.4. Legal and normative requirements/barriers

There are no regulatory boundaries identified for this pilot.

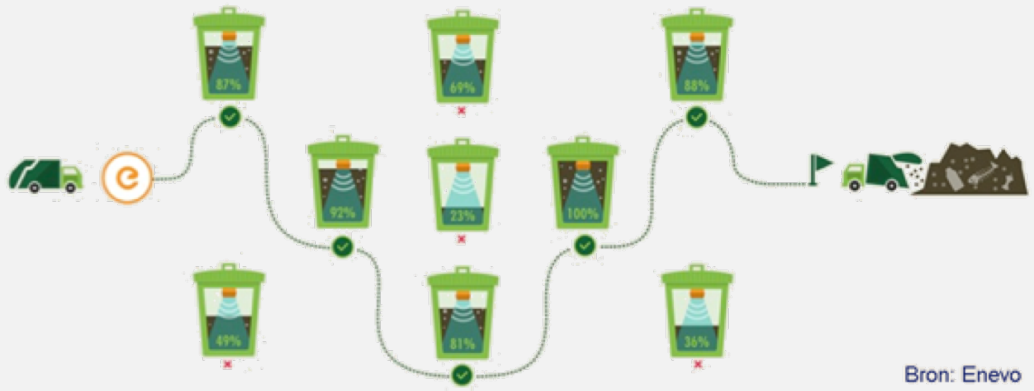
Anyhow, the municipality is obliged by Dutch law to provide information about the ground water level to its citizens. Therefore, the reliability of the sensors is the key. The manual measurements will be needed as long as the automatic readings are not 100% reliable.

10.1.4. Waste paper containers [ROTTERDAM_UC03_WastepaperContainers]

The fourth use case that have been selected for the pilot city of Rotterdam was the Waste paper containers management. Unfortunately, **this use case was dropped from the Rotterdam piloting options as the current private company managing the waste bin sensors and the application has denied the request for access to the data.**

They have another business case based on the data, so they do not want to make it open. Important lesson for the future regarding the procurement procedure to make sure the municipality will be the owner of the data.

Anyhow, the use case was about the route to collect the containers full only, thus avoiding to drive the regular route along all the containers collecting the waste paper. Also, the most optimal route along the full containers is calculated.



10.1.4.1. Expected objectives/benefits

Currently the main objectives of this use case were:

- Optimizing the collection routes
- Registering defects
- Registering demolition

10.1.4.2. Available data and technologies at the pilot site

N.A.

10.1.4.3. Standards applied from D2.3 CASSIOPEA

N.A.

10.1.4.4. Legal and normative requirements/barriers

N.A.

10.2. Tartu

The pilot city in Tartu has originally envisaged to follow two use cases, namely:

- Energy efficiency
- CIM City Information Modelling

10.2.1. Energy Efficiency [TARTU_UC01_Energy Efficiency]

The use case will include the following elements to be included to the advanced 3D City Information Model (data in CityGML) to be developed in the context of the Tartu pilot.

- Data about energy consumption history per building (available by Tartu Regional Energy Agency) serves as a starting point for the model
- Fraunhofer IGD is ready to offer their Heating Demand simulation model to be used in Tartu across the city information model for a demonstrator. The model includes a number of factors influencing heating demand: A user can 'play' with the values related to each factor and see on the 3D map how this influences the heating demand of a specific building. Relevant input data needs to be provided from Tartu´s side (tbs).
- Solar potential analysis information based on using satellite imagery as input in collaboration with another EU project NextGEOSS

The 3D map will outline development as the lighthouse project proceeds, allowing for visualising changes, getting a better comparative overview of different neighborhoods in terms of energy consumption, identifying problematic spots, etc.

The following will contribute to higher energy efficiency in buildings renovated in the context of SmartEnCity:

- State-of-the-art building materials
- Full thermal insulation
- Windows/doors U-factor < 1
- Indoor climate category II
- Heat recovery ventilation
- Heat regulation by each room
- PV panels
- Smart home sensors

The 3D city information model developed as part of the pilot is primarily focused on the SmartEnCity pilot area (42 "khrushchyovkas" and buildings around them). Based on the results of the pilot, the model could be developed

further to involve the entire city. The more specific scope of the use case is integrating all available energy management related information into the model in an interoperable way.

10.2.1.1. Expected objectives/benefits

The main objective is to contribute to the increase of energy efficiency in the new smart district developed in Tartu City centre where a number of old Soviet-era residential buildings will be renovated to meet the contemporary smart city standards in various fields but primarily in terms of energy. The goal is to reach energy consumption level 90 kWh/m2/year - decreasing the energy consumption level three times from the current 270 kWh/m2/year.

The objectives are to:

- Mobilize support and build momentum for Smart Energy Management among the residents of the new smart district in Tartu and the general public via better visualization of positive changes to take place in the context of the Horizon 2020 lighthouse project SmartEnCity
- Make better informed decisions regarding the use of solar energy based on solar potential analysis data integrated in the city information model in the context of the pilot.

Figure 3. Online map of the pilot area available at the webpage of the lighthouse project: http://tarktartu.ee/avaleht/pilootala/.

10.2.1.2. Available data and technologies at the pilot site

Data requirements for this pilot have been developed between the Tartu Regional Energy Agency (TREA) and VirtualCitySystems (VCS) and will be provided by the first:

- Addresses (building IDs), matching an ID in the 3D city model, in order to establish a link between the model and the energy performance data.
- Energy consumption history (in absolute values, kWh/m^2/year) and classified value (A – G): data is available on monthly basis for the last 3 years (36 months)
- CO2 emissions (in absolute values, kg/m^2/year)
- Water Consumption (in absolute values, kg/m^2/year)
- Valid 3D building geometry (solid) in order to develop Fraunhofer's Heating Demand simulation model – minimum input
- Year of construction, building usage
- Building typology can be derived based on building geometry as well, but considered useful.

Technical Components	Technical Description	Standards applied
Devices and sensor technology: Interoperability of sensor networks, device management, APIs	N.A.	
Communications and Connectivity: Identify type of network communication (Wired, Wifi, Lora…), connection links and the transport protocols.	N.A.	
Infrastructure Identify which urban platform tailored to use for analyzing data, IoT based applications, large scale deployments, distributed computation and storage	N.A.	
Integration/Interoperability Common IoT features required to provide integration and interoperability	N.A.	
Applications The support of the applications lifecycle including development tools/models, Analytics, application domain specific activities	N.A.	

IoT Architecture Integrated/complete IoT specifications solutions, including architecture descriptions	N.A.	
Security and Privacy Security and Privacy topics	N.A.	

10.2.1.3. Standards used from D2.3 CASSIOPEA

The pilot had already chosen to use CityGML as their information model, with Dynamizers used to attach volatile information acquired over SensorThings. This section suggests other standards which may be of use to the pilot.

Standards applied for	List of standards applied
Management standards	ISO 37101:2016 Sustainable development in communities - Management system for sustainable development - Requirements with guidance for use[7] BSI PAS 184 Smart Cities – Developing project proposals for delivering Smart City solutions – Guide[8] PAS 183 Guide to establishing a decision-making framework for sharing data and information services
Maturity models	There is a maturity model in an informative annex of ISO 37101
Indicators	Citykeys, particularly the Planet theme, energy & mitigation sub-theme, "reduction in annual final energy consumption" indicator
Information models used	CityGML, with Dynamizer
Sectoral Standardization Initiatives	N.A.

10.2.1.4. Legal and normative requirements/barriers

There is no conflict with local and national regulations.

Additionally, there are no significant administrative barriers in the context of the Espresso pilot, as the key issues have been clarified and taken care of in the context of preparing the SmartEnCity lighthouse project that the current use case mostly builds upon.

[7] Published since Cassiopeia, which refers to a draft
[8] Published since Cassiopeia, which states it was under development

10.2.2. CIM City Information Modelling [TARTU_UC02_CIM]

The second use case for the pilot in Tartu is the CIM City Information Modelling.

On a broader scale, the value of this Use Case is demonstrating the level of effort needed (i.e. how easy or difficult it is) to integrate data currently existing separately in different databases and in different formats to a state-of-the-art 3D city information model based on open standards, facilitating interoperability and data exchange among different platforms. This is a crucial issue for many cities in Europe (and beyond), hindering the development of open standards-based 3D CIM platforms, as cities often see value in such approach to city information management but they consider integrating the existing data to be too difficult and painful.

The pilot activities also help visualising changes taking place in the context of the development of the lighthouse project in the city of Tartu in other fields, in addition to energy (Use Case 1) – this is very important for communicating the importance and value of the project to the residents of involved buildings, various partners, citizens and the general public.

The various existing datasets exist in different databases that are not connected with each other. Therefore, the use of certain data is primarily limited to the "main owner" of the data, while access for other stakeholders is complicated.

The use case demonstrates how an interoperable platform in the form of a 3D City Information Model can be created by:

1) Translating various existing datasets to formats enabling interoperability;
2) Adding new datasets created in the context of SmartEnCity to the platform from the very beginning.

This will also serve as basis for potential future third party engagement (e.g. tech startups) to build new products/services based on different datasets

10.2.2.1. Expected objectives/benefits

The 3D model developed as part of the pilot is primarily focused on the SmartEnCity pilot area (42 "khrushchyovkas" and buildings around them). Based on the results of the pilot, the model could be developed further to involve the entire city.

The more specific scope of the use case is integrating various available city information datasets into the model in an interoperable way. This includes critical assesment of effort needed for translating datasets to standard formats and determining a process for adding new datasets to the model in the future, to continue developing the 3D CIM platform of Tartu.

10.2.2.2. Available data and technologies at the pilot site

The following data are already available:

- Placement / positioning of new smart street lighting (lampposts)
- Existing vegetation in the area (trees)

Expected availability on the following data for the next phase of piloting:

- Architectural changes made in the context of retrofitting
- Design of artworks to be created on the building façades (murals)/ areas near the buildings (sculptures)
- Placement/positioning of electric vehicle rental and charging points
- Existing bus stops in the area (coordinates)

Technical Components	Technical Description	Standards applied
Devices and sensor technology: Interoperability of sensor networks, device management, APIs	No sensor technology Use of Table Join Service to join spatial and non-spatial information and visualize in a 3D City Model	OGC Table Join Service
Communications and Connectivity: Identify type of network communication (Wired, Wifi, Lora…), connection links and the transport protocols.	N.A.	
Infrastructure Identify which urban platform tailored to use for analyzing data, IoT based applications, large scale deployments, distributed computation and storage	N.A.	
Integration/Interoperability Common IoT features required to provide integration and interoperability	Interoperability between heterogeneous devices and at the data level	
Applications The support of the applications lifecycle including development tools/models, Analytics, application domain specific activities	N.A.	
IoT Architecture Integrated/complete IoT specifications solutions, including architecture descriptions	N.A.	

Security and Privacy Security and Privacy topics	N.A.	

10.2.2.3. Standards used from D2.3 CASSIOPEA

The pilot had already chosen to use CityGML as their information model, with the Table Join Service to attach non-spatial information. This section suggests other standards which may be of use to the pilot.

Standards applied for	List of standards applied
Management standards	ISO 37101:2016 Sustainable development in communities - Management system for sustainable development - Requirements with guidance for use[9] BSI PAS 184 Smart Cities – Developing project proposals for delivering Smart City solutions – Guide[10] PAS 183 Guide to establishing a decision-making framework for sharing data and information services
Maturity models	There is a maturity model in an informative annex of ISO 37101
Indicators	Citykeys, perhaps the 'quality of open data' measure in the Prosperity theme, or some of the innovation measures
Information models used	• OGC • ISO 30182 (available as BSI PAS 182)
Sectoral Standardization Initiatives	Domain specific initiatives applied if any

10.2.2.4. Legal and normative requirements/barriers

There is no conflict with local and national regulations.

Additionally, there are no significant administrative barriers in the context of the Espresso pilot, as the key issues have been clarified and taken care of in the context of preparing the SmartEnCity lighthouse project that the current

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11. Agenda of onsite deployment and field test activities

A possible agenda of onsite deployment and field test activities has been herewith presented, with a definition of the technical deployment tasks and of their coordination. Each pilot will have to follow the agreed steps that are part of the activity plan.

This agenda has not to be considered as final, as it can be further revised in case of need.

- M16 April 2017
  - In the context of the ESPRESSO project meeting, update with the pilots
  - Identification of preliminary activities that may be needed to ensure the pilots can fit with operational technical and service requirements.
  - Definition of the technical deployment tasks to be followed and of their coordination.
- M17 May 2017
  - Starting of the testing phase
- M18 June 2017
  - Online meeting for an update about the testing phase
- M20 August 2017
  - Online meeting for an update about the testing phase
- M22 October 2017
  - Online meeting for an update about the testing phase
- M24 December 2017
  - Closing of the testing phase and preparation of D4.7 Smart City 1 pilot activity report and D4.8 Smart City 2 pilot activity report

12. Definition of the test final evaluation

The evaluation of the pilot will be carried on following a multi-dimension scale:

- The mapping of previously existing services onto the actual pilot test. Particular attention will be paid to integration of legacy and specific technology in the context of a broad pilot with the aim of maximizing data accessibility. This will be an important metric to assess cross-domain adoption of specific technologies through introduction of open standards.
- Mapping of data/metadata available to the pilot test site, divided by category and data type.
- Use of open source and proprietary technologies adopted for deployment of the test.
- The use of open standards, within the test site, for the various technologies solutions deployed. Analysis of the use of standard will be compared against the mapping carried on in the context of the project and will include details of each standards adopted (SDO, version, etc.).
- Accessibility of the final solution in terms of channels (e.g. as web-application, as web service, as App, etc.) with a description of the interfaces developed, integrated or adapted and that will be made available to the pilot.
- Reference to existing Service Level Agreement that need to be ensured by the involved organizations in the context of their operational activities and how, the introduction of the selected standards and technologies, has been beneficial or detrimental to meeting these SLAs.
- Number of final users involved in the testing activities, divided by category (citizens, public officers, etc.).

For each of the categories above, a set of indicators will be defined based on the specific need of the pilot site.