D4.3 Urban Sharing Platform Realisation

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Executive Summary

This deliverable provides a progress report on the status of the Urban Sharing Platform (USP) development. In this initial version of the report the focus is on the realisation plan and the design and build progress to date which is the respective USP city pilots for London, Lisbon and Milan.

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1 Introduction

The goal of this deliverable is to provide a progress report on the status of the Urban Sharing Platform (USP) development in each of the core cities of the Sharing Cities project. In this initial version of the report, the focus is on the realisation plan and the design and build progress to date which is the respective USP city pilots for London, Lisbon and Milan.

Each of the three core cities is starting from different points but all are working towards the common USP reference model described in deliverable D4.2. Each city will manage its own platform hosted in the cloud or on premise, building on previous and planned local investment and the local investments scheduled during the Sharing Cities time period. All cities are exchanging knowledge with each other regarding the realisation of the USP, in order to maximize synergies and identify further opportunities of collaboration and reuse.

1.1 Acronyms

API	Application Programming Interface
BEMS	Building Energy Management System
BI	Business Intelligence
EIP	European Innovation Partnership
EMS	Energy Management System
ESB	Enterprise Service Bus
EV	Electric Vehicle
H2020	Horizon 2020
IoT	Internet of Things
IT	Information Technology
KPI	Key Performance Indicator
MQTT	Message Queuing Telemetry Transport
REST	REpresentational State Transfer
SaaS	Software as a Service

SAML	Security Assertion Markup Language
SCC	Smart Cities and Communities
SEMS	Sustainable Energy Management System
SOAP	Simple Object Access Protocol
SSO	Single Sign-On
UC	Use Case
UML	Unified Modeling Language
USP	Urban Sharing Platform
WP	Work Package

1.2 References and Supporting Documentation

The following references and supporting documentation are appropriate for this document.

- Sharing Cities: H2020-SCC-2015 SHAR-LLM Proposal, final version.
- Sharing Cities: D4.2 Urban Sharing Platform Reference Model, R01.

2 USP Plan Approach

The high-level approach for the USP realisation is to utilise and extend the existing IT capabilities in each city in the following key steps:

1. Develop city specific platform pilots as proof of concept for the technical components in each city in the context of the reference model and respective focus modules (see D4.2).
2. Identify potential for sharing of the USP components between the core and follower cities by applying open standards against requirements captured from Sharing Cities case studies.
3. Develop the live USP platform components to meet both individual city requirements and the overall sharing requirements at project level.

2.1 USP Project Plans

Each of the three core cities are working towards the realisation of their local USP according to the common reference model described in D4.2. The following sections illustrate the current USP realisation plan of each city.

2.2 London City Pilot Plan

The following diagrams provide a view on the current Greenwich USP realization plan.

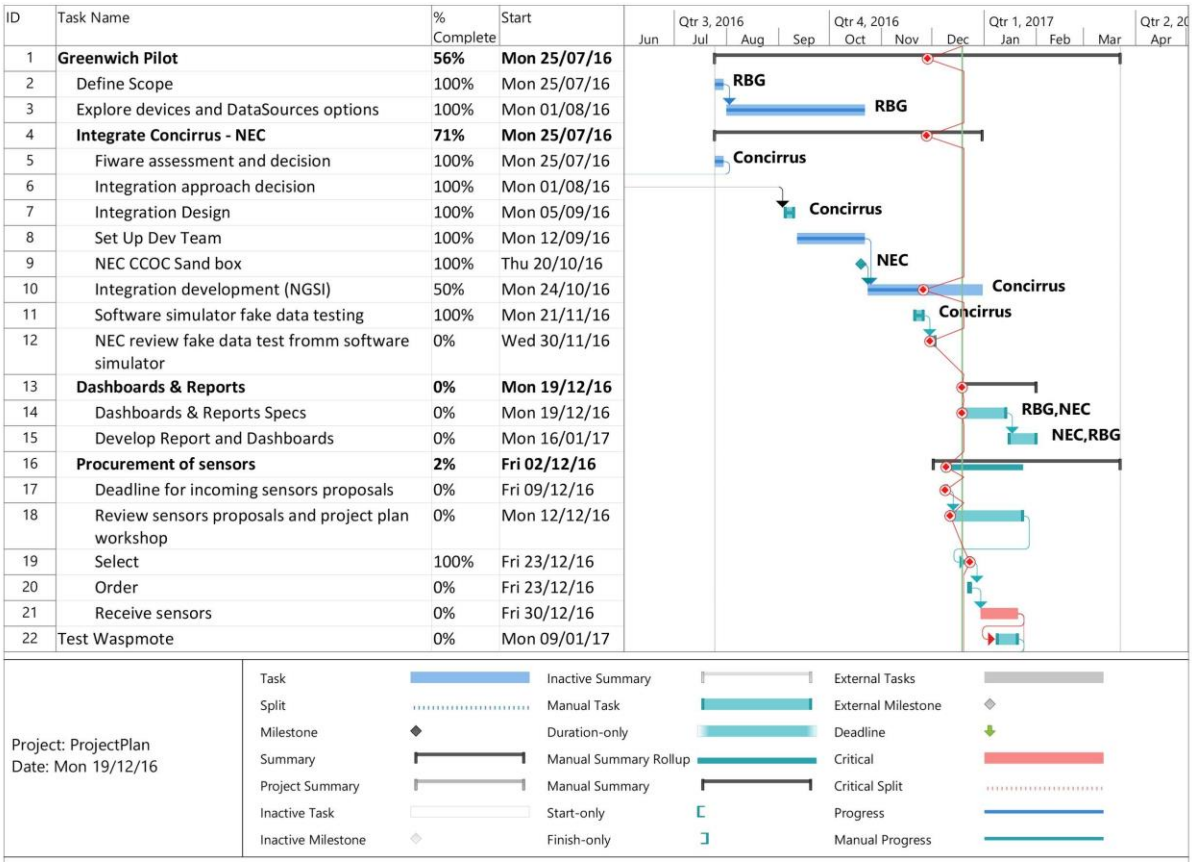


FIGURE 1. GREENWICH USP REALISATION PLAN (1/2)

FIGURE 2. GREENWICH USP REALISATION PLAN (2/2)

2.3 Lisbon City Pilot Plan

The following diagram provides a view on the current Lisbon USP realization plan.

ACTIVITY DESCRIPTION / MONTH	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24
Define Lisbon's USP scope	X	X	X	X	X	X	X	X	X															
Confirm devices and data sources (capture table)							X	X	X	X	X	X												
Use cases and algorithms definition (with WP3)										X	X	X	X	X	X	X	X	X						
Device / asset registration - API specification													X											
Device / asset registration - USP development and integration													X	X										
Event - API speficication													X	X										
Event - API development and integration														X	X									
End-points definition															X									
BI & KPI specificiation and definition													X	X	X	X								
USP data model specification and development															X	X								
Data visualization definition and specification (mockups)																X	X							
API integration (sensing layer > interoperability layer)																X	X	X	X	X	X			
BI Integration (interoperability layer > sharing layer)																	X	X	X	X	X			
Data visualization development (new objects and templates)																	X	X	X	X				
Data visualization integration (real data)																					X	X		
Testing																			X	X	X	X	X	X
Go live																							X	X

FIGURE 3. LISBON USP REALISATION PLAN

The implementation plan for the City of Lisbon follows an incremental and iterative approach. During the first two project years (M1-M24) three iterations are currently planned:

- The activities developed during the first 12 month of the project were focused on defining the scope of Lisbon's USP, to allow a clearer view on how Lisbon planned to comply to the USP high level reference model that was defined to enable processing and sharing information services locally and abroad. By month 12 both WP3 and WP4 were able, in cooperation, to conclude a device data capture table (see Sect. 4) that lists all available data from the identified devices. This table will allow a swifter integration of data within the USP through the sensing layer, resulting therefore in feeding the USP with all necessary data to fully develop the defined UC.
- Between M13-M18 all UCs will be defined, along with the algorithms (data processing) necessary to fulfil each data requirement. This task will be developed in parallel with API specification and development, for both devices/assets (inventory) and well as events (measures).
- BI & data visualization will be developed between M13-M22, in straight relation to the development of each UC, since the KPI and its presentation (per user/role) will have to be taken into account during the specification of the UC. In these tasks an effort of generalization will be made to develop visualizations objects (e.g., specific charts) and templates that fulfil each UC needs while being similar in 'look & feel', to grant a sense of uniformity amongst all reports and dashboards.
- In the last two months extensive testing will be made to allow a stable, responsive and scalable platform – as an IoT platform should be – and the USP will then go live by the end of M24.

2.4 Milan City Pilot Plan

The following diagram provides a high-level view on the current Milan USP realisation plan.

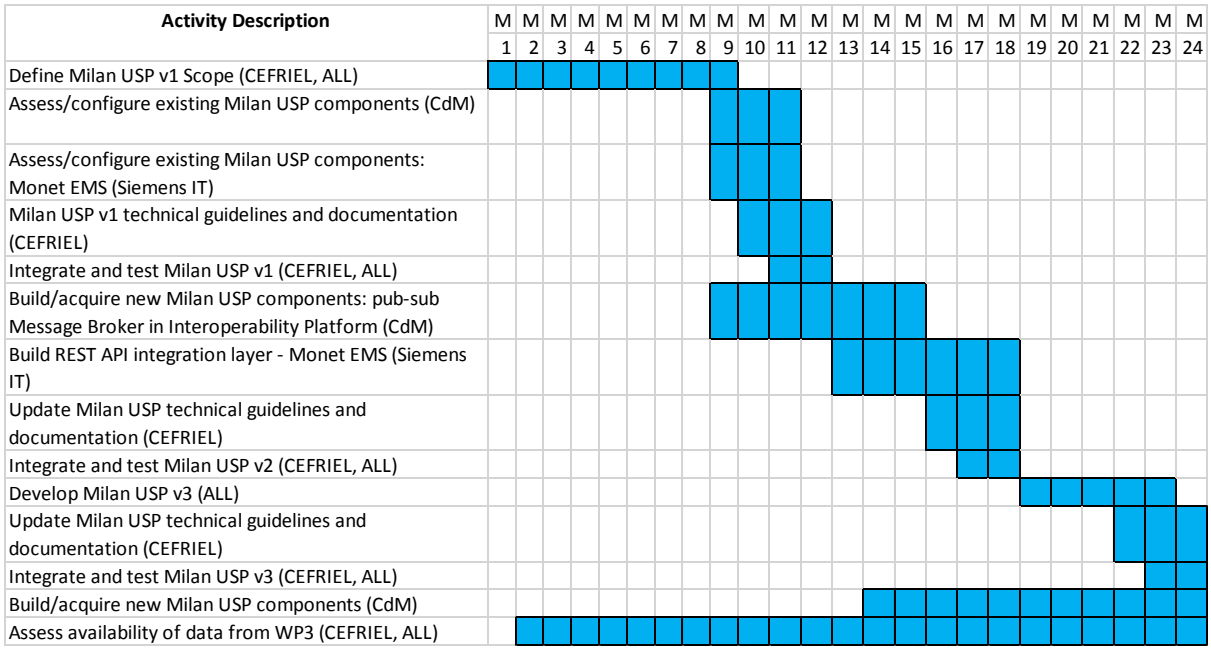


FIGURE 4. MILAN USP REALISATION PLAN

The current USP implementation plan for the city of Milan follows an incremental and iterative approach. During the first two project years (M1-M24) three iterations are currently planned:

- Milan USP v1 (M12). Local activities during the first project year were mainly focused on defining the scope of the USP, i.e., how Milan planned to cover the USP reference model defined at project level, as described in D4.2. This activity mainly took into account IT components and infrastructures already in place (e.g., the Interoperability Platform of the Municipality of Milan, the Monet EMS solution, see Sect. 3.3.3) and related integration and configuration activities. The result at M12 is a core version of the USP, a proof of concept made of different operating components and capable of demonstrating basic API-based integration between the Monet EMS solution (which already acquires data from sensors of the smart district) and the Milan Interoperability Platform. More details about Milan USP v1 can be found in Sect. 3.3.
- Milan USP v2 (M18). The second version of the Milan USP will take advantage of real data provided by WP3 local interventions. API-based integration mechanisms between Monet EMS and the Interoperability Platform will be updated and refined accordingly. In particular, the already defined interfaces and standards for collecting information from the field will evolve in order to convey the payloads of the specific sensors and devices deployed. Moreover, the Interoperability Platform of the Municipality will be enriched by means of a new component supporting the publish-subscribe interaction pattern. In general, the Milan USP will address needs and requirements stemming from other WP activities and related use cases, in particular as for actual data provision (WP3) and usage (WP2 and WP8).

- Milan USP v3 (M24). The next version of the Milan USP will be possibly enriched by means of new components that are currently under evaluation (e.g., identity server, data storage). Moreover, by M24 the USP will have been more extensively used by project end-users, thus enabling further refinement of USP features in order to better meet project and city needs.

3 USP City Pilots

City pilots are the first stage in the development of the USP. Each city pilot is different and is built in conjunction with the other project WPs (WP3 in particular) to test the connection of the various data sources (devices, sensors etc.) needed to deliver the impacts of the Sharing Cities project.

The following sections present the current status (update: December 2016) of USP realization in each core city and provide details about the technical components which deliver the USP functions.

3.1 London City Pilot

The definition of the city pilot in Greenwich is to capture and process data from sensors and smart devices (installed within a residential area) and present the processed data in the form of reports and dashboards. This will act as a proof of concept for the USP, from data ingestion to presentation.

The city pilot is in development and is of a progressive nature. It is intended that this proof of concept will be the first step or phase of the city pilot, and that initial installation of sensors, data ingestion, and data presentation can be built upon by additional pilot phases as more data feeds become available and thus more reports and dashboards are generated. The scope of the pilot will therefore increase progressively so that ultimately the pilot becomes the platform itself.

Geographical location

The city pilot's focus in terms of geographical location is shown in the figures below. This captures the varying environs of the pilot location, and shows particular areas of focus where sensors will be installed. This area was chosen as it includes locations which are of interest to the Royal Borough of Greenwich to monitor internal energy use (e.g., estates); air quality (e.g., dark purple section of Trafalgar Road); movement; and parking. All of which were decided as initial priorities for data capture and ingestion into the USP.

FIGURE 5. THE LONDON SHARING CITIES DEMONSTRATOR AREA WITHIN THE ROYAL BOROUGH OF GREENWICH

FIGURE 6. CITY PILOT SENSOR LOCATIONS, ESTATES AND A MAIN ROAD

1st phase of the pilot

Objectives of the first phase of the pilot more specifically were to:

- Demonstrate progress made with WP3 and WP4 as well as the operational capabilities of the USP in Greenwich by the end of January 2017.

- Show how data uploads into the USP, is processed into useful intelligence and presented in a dashboard by the end of January 2017.

The first phase has focussed on delivering data to the platform from sensors which monitor (1) internal environment and energy use and (2) air quality. This links with retrofit activities in WP3, task T3.1, providing a baseline understanding of energy use and internal environment of dwellings on estates identified for retrofit activities; and also links with task T3.4 activities around the smart lamppost, with environmental monitoring being a use case of the task T3.4 'humble lamppost'. Specific information on amounts of sensors to be installed in the first phase of the pilot are provided below:

- 10 residential units will be retrofitted with smart metering, which will include sensors to measure: heat and electricity consumption, humidity, temperature, and occupancy.

- 1 air quality sensor will be installed in a location along Trafalgar Road (see Figure above). This will provide information on local air quality that is useful for monitoring and evaluation of other WP3 mobility measures, as well as wider air quality monitoring and action in the Royal Borough of Greenwich.

2nd phase of the pilot

The objective of the 2nd phase of the pilot will be to increase the coverage and amount of data feeds into the urban sharing platform. This will involve installation of further sensors which will monitor:

- Movement and movement mode. This will enable the Royal Borough to determine a 'baseline' of how people are moving around in the demonstrator area. It will also aid in monitoring the effect of the e-mobility interventions undertaken within both Sharing Cities and the Low Emission Neighbourhood project (e.g., e-bike hire). In addition it will enable an improved understanding of the impacts of traffic flow, make-up and speed on air pollution.

- Air Quality. Additional and different types of air quality sensors will be installed to aid WP3.4 in determining the most suitable sensor. It is acknowledged that the air quality sensors deployed as part of the pilot project will not produce readings to the same degree of accuracy as the Borough's stationary monitoring sites, but they will offer a more dynamic picture of pollution levels across the borough providing indicative pollution levels that are at a relatively high confidence level.

- Parking. There is a high level of parking stress in the demonstrator area. This phase will explore installation of both camera based and puck based solutions to offer smart parking.

It will also include the adding in of data feeds from other areas of the Sharing Cities programme such as e-mobility, and the inclusion of open data feeds of interest such as from Transport for London.

3.2 Lisbon City Pilot

Lisbon's city pilot aims at providing a full scope process of the information service – capture and store data from sensors and smart devices, process data to comply with the selected UCs and present the processed data in the form of reports and dashboards specific to different users/roles. This pilot will allow testing the platform in all its width and acting as a proof of concept. Further integrations of data, algorithms and visualization outcomes will accommodate the remaining UC defined in the project.

Lisbon's city pilot is under development and will address the specified UC in different cases: a mobility island will allow the geographical integration of both smart mobility and smart lamppost UC while a virtual BEMS will enable the development of both building retrofit and smart energy management. The USP will address both issues in parallel in order to represent all four tasks from WP3. Locations of both subjects are yet to be confirmed.

The Municipality of Lisbon promoted the creation of an interactive exhibition space, a Showroom to introduce innovative smart city solutions, gathering the participation of the Lisbon H2020 Sharing Cities project partners.

The objectives of this action are to promote the Sharing Cites project key initiatives, to demonstrate the effectiveness of new innovative solutions and technologies in sectors such as urban mobility, energy efficiency in buildings, street lampposts, and to display to all citizens the Sharing Cites solutions that the City of Lisbon and all the partners are developing and will implement within the project's scope. This Showroom is located in the Sharing Cities Lisbon´s demonstrator area, precisely in the City Hall Square.

3.3 Milan City Pilot

The purpose of this section is to illustrate the IT solutions currently in place (or planned) in the city of Milan, which are relevant with respect to the realisation of the USP reference model and in particular of the first city pilot.

The following UML component diagram provides a high-level view of the components constituting the USP in Milan. Each USP component is described in more detail in the following sections. In order to support a more complete understanding of the overall USP UCs in Milan, the following sections include also some high-level details about the planned interventions related to field data sources (WP3) and end-users (WP2, WP8), so to recall a brief description of the measures interacting with the WP4 USP.

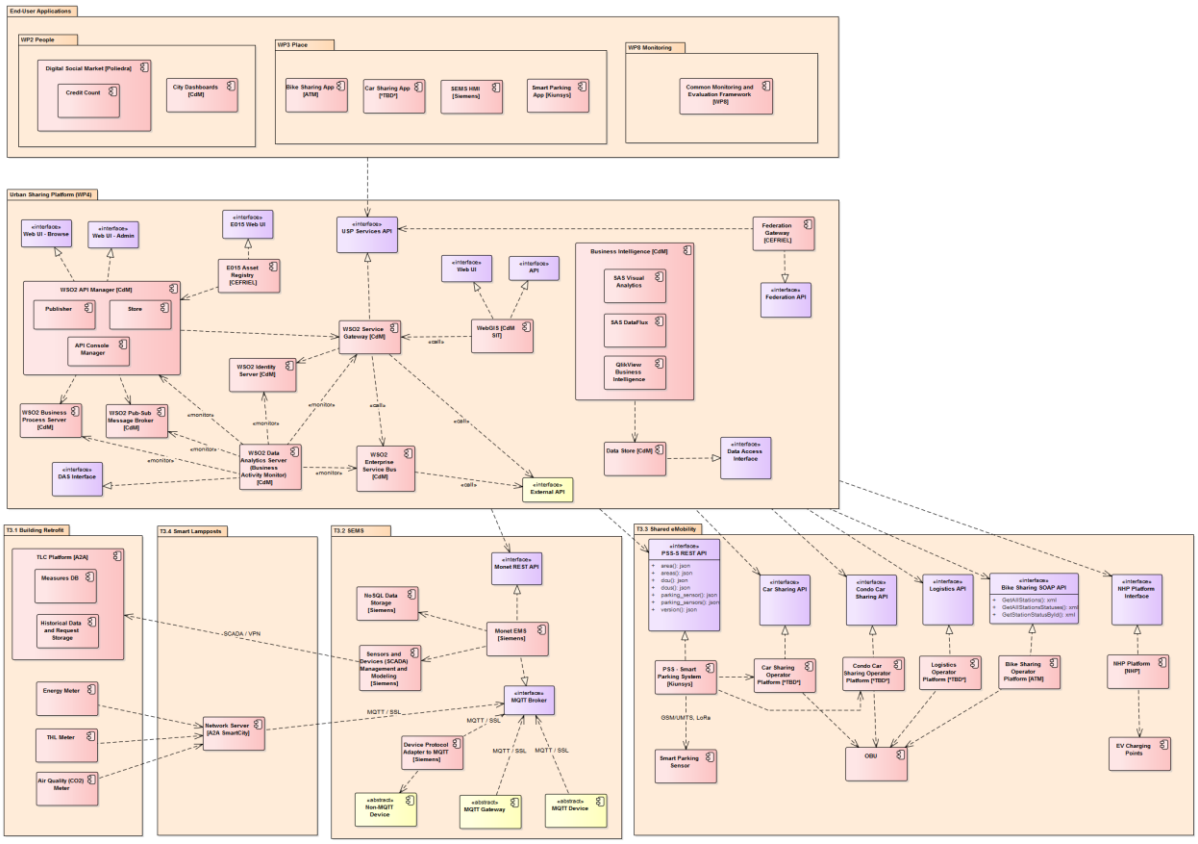


FIGURE 7. EXTENDED VIEW OF MILAN USP COMPONENTS

3.3.1 USP End-User Applications

The purpose of this section is to briefly describe some of the different types of consumers that will access the USP, i.e., in a broad sense the local or global end-user applications that are being built by the project to support interventions in Milan's smart district. These applications mainly belong to the following WPs:

- WP2 "People": End-user applications supporting citizen engagement interventions and other initiatives targeted to final users (e.g., the Digital Social Market).
- WP3 "Place": End-user applications that are part of solutions built and deployed in the context of WP3 (e.g., Monet SEMS user interfaces and dashboards, car/bike sharing apps).
- WP8 "Monitoring and Evaluation": Applications that implement the monitoring and evaluation logic defined and built by WP8 by leveraging on data made available through the USP.

As described in D4.2, other end-user categories may stem from initiatives such as the E015 digital ecosystem (see Sect. 3.3.3.3).

Note: The UML modelling of this part of the diagram is purely indicative of the work being carried out by other WPs.

These components can access the USP through the 'USP Services API' interface. A generic relationship from the 'End-User Applications' package is shown in the current version of the diagram. More details will be added in the next releases of this document.

3.3.2 Field and Data Sources

The purpose of this section is to provide a brief, indicative description of the main IT solutions belonging to the WP3 local interventions which provide data to the USP and integrate with it:

- PSS – Smart Parking System: A solution supporting mobility and parking management. This solution will be deployed in the cloud in order to provide information about the smart parking spots and sensors installed in the demonstrator area in Milan, in correspondence of e-vehicle charging stations. Information provided through a REST API include: parking areas (id, name, geolocation, status etc.), parking sensors (id, geolocation, status, setup date etc.) etc.
- Car/bike sharing and logistics operators' platforms: These components represent the respective IT platforms of different operators, that will be able to provide information such as vehicle position (i.e., geolocalization), vehicle status (free/busy/etc.) etc. and in some case the status of the stations.
- EV charging station operator platform: This platform will be able to provide information about charging points (geolocalization, data about e-vehicles being charged).

These components are accessed by the USP through their respective interfaces/APIs. Generic relationships from the 'Urban Sharing Platform (WP4)' package are shown in the current version of the diagram. More complex interaction patterns (e.g., publish-subscribe) are not modelled in the diagram. More details will be added in the next releases of this document.

Note: The UML modelling of this part of the diagram is purely indicative of the work being carried out by other WPs.

3.3.3 Urban Sharing Platform

This section describes the ICT solutions constituting the USP in Milan in the context of WP4 activities. As described in D4.2, the Milan USP is the result of the integration, enhancement and evolution of:

- The Monet EMS solution by Siemens IT (see Sect. 3.3.3.1).
- The Interoperability Platform of the Municipality of Milan (see Sect. 3.3.3.2).
- The E015 digital ecosystem (see Sect. 3.3.3.3), an institutional initiative active in Italy since 2013.

The following sections describe each component in more details.

3.3.3.1 MONET EMS

Monet (Mastering and Operate Next generation of Energy of Things) is a cloud platform by Siemens IT providing set of services for Energy Monitoring and Energy Management following the SaaS model. It is a solution for monitoring, controlling, and optimizing energy flows inside a specific site or location being a Smart Grid, a Micro Grid, a Smart City or part of it. This EMS solution is able to aggregate data from various sources (e.g., sensors, gateways, devices), process and visualize data. Monet services are accessible via a set of state-of-the-art Web applications. Monet HMI is designed as a dashboard/cockpit to provide to users high-level information through an intuitive user interface to supports business level decision. It supports MQTT devices and is able to adapt other communication protocols.

The following figure summarizes the logical architecture and main features of Monet.

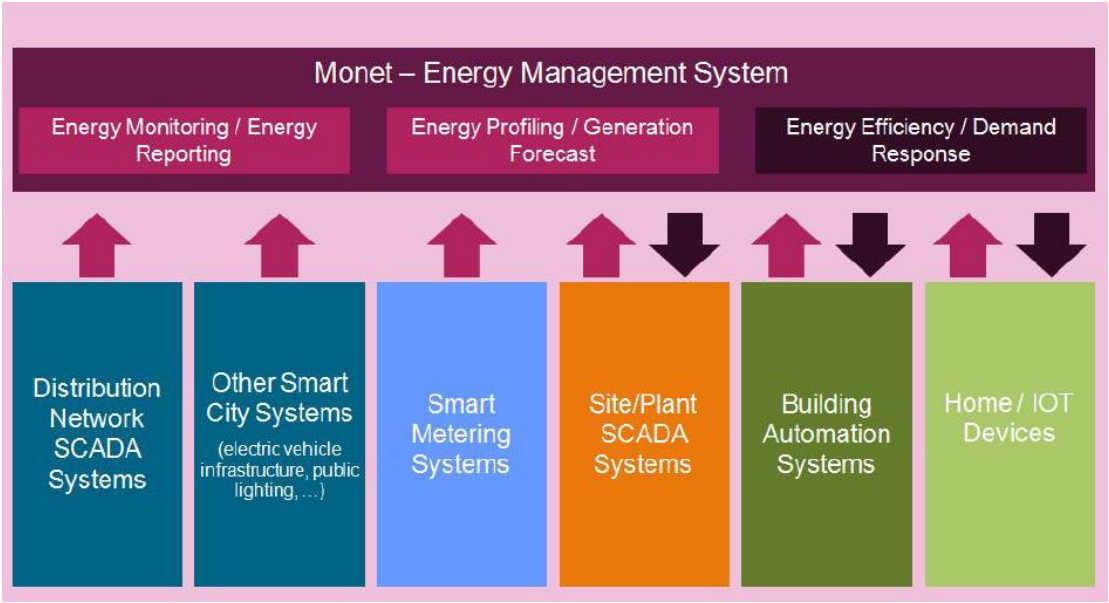


FIGURE 8. SIEMENS'S MONET EMS CONCEPT

Monet EMS is already operational and it is a pillar of Milan USP v1 (see Sect. 2.4). As soon as data from WP3 local interventions is available, Monet will collect and process data mainly related to retrofit of private and public buildings in the "Porta Romana / Vettabbia" smart district.

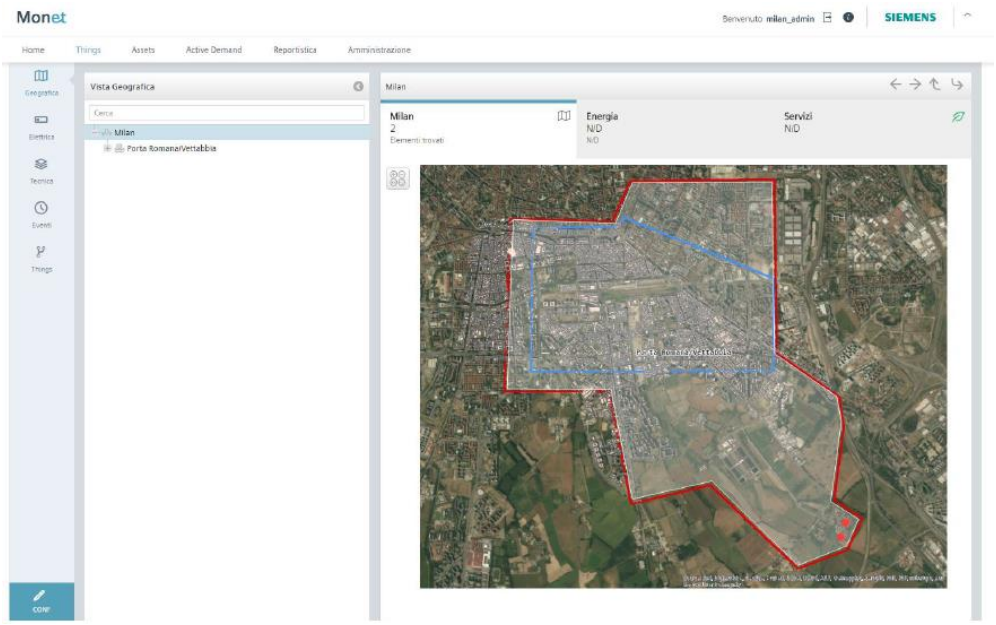


FIGURE 9. MONET FOR MILAN SMART DISTRICT – EXAMPLE OF DASHBOARD

3.3.3.2 INTEROPERABILITY PLATFORM OF THE MUNICIPALITY OF MILAN

The Interoperability Platform of the Municipality of Milan is a set of components enabling, fostering and governing interoperability at the IT level within the Administration and at city level. The platform is able to collect and process different kinds of information from different sources, internal or external. Internal information include, e.g.,

- Master data (e.g., toponymy, registries).
- Data specific to internal "vertical" applications.
- Citizens' opinions gathered through various communication channels.

Based on this data, the Interoperability Platform enables the realization and management of different kinds of APIs. The Interoperability Platform is currently mainly based on a set of selected open source components belonging to the WSO2 product suite, as described in the following sections.

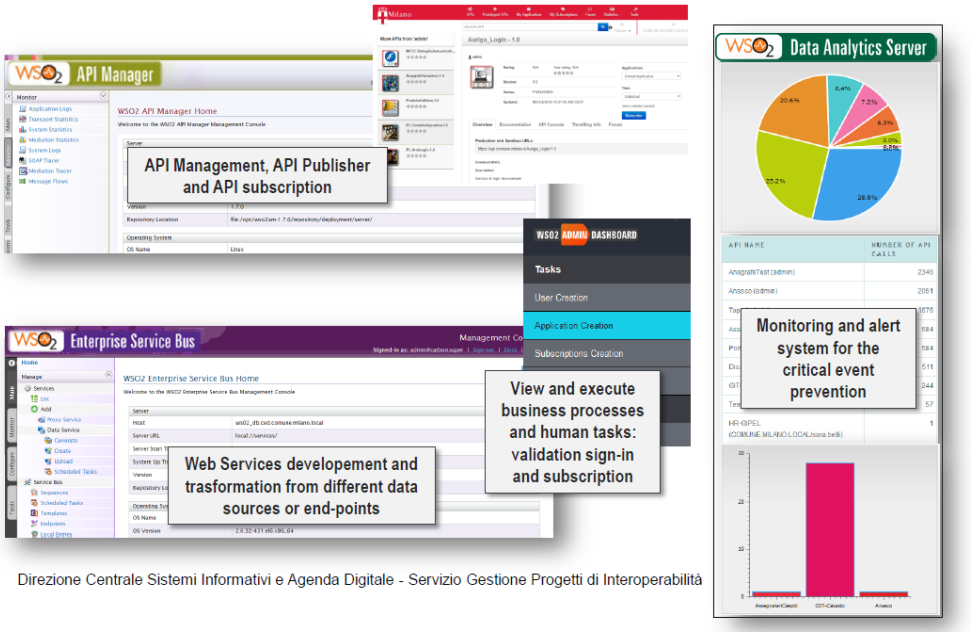
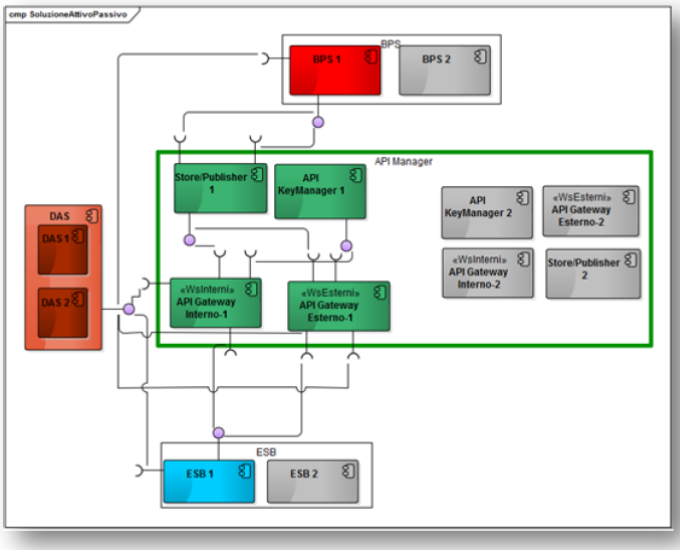


FIGURE 10. MAIN COMPONENTS AND FEATURES OF THE INTEROPERABILITY PLATFORM OF THE MUNICIPALITY OF MILAN

Current platform deployment (on premise, leveraging the IT infrastructure of the Municipality) adopts a failover solution in active-standby configuration. The Municipality has already planned to extend the platform with other components, in particular the WSO2 Identity Server and the WSO2 Message Broker.

Failover solution (active-stanby configuration with 8 istances x 500 transactions per second)



1. fault tolerant redundant environment F5 balancer based.

   Send String Example
   HEAD /services/Version HTTP/1.1\r\nHost: www.wso2cdm.local \r\n\r\n

2. WSO2 Technical Support 24x7x365 for every active istance

Component	N. Active	N. Standby
API Manager	4	3
DAS	2	0
ESB+DSS	1	1
BPS	1	1
	8	5

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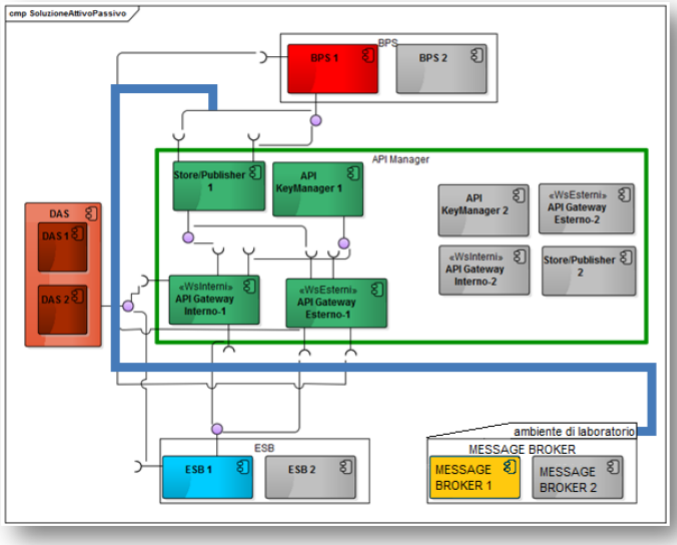
FIGURE 11. MILAN MUNICIPALITY INTEROPERABILITY PLATFORM – CURRENT PRODUCTION ENVIRONMENT

Failover solution (active-stanby configuration with 8 istances x 500 transactions per second)



Municipality is implementing production environment with Message Broker to support a Publish/Subscribe role for Sharing City USP and also for other applications.

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FIGURE 12. MILAN MUNICIPALITY INTEROPERABILITY PLATFORM – TO-BE PRODUCTION ENVIRONMENT (USP V3)

3.3.3.2.1 WSO2 API MANAGER (PUBLISHER AND STORE)

This component enables management of API publication and API subscription. It is based on the WSO2 API Manager tool v1.10.0[1]. APIs can be published through the API Publisher v1.10.0 subcomponent in order to be made available via a self-provisioning Web portal (API Store v1.10.0 subcomponent). APIs can be used by the subscribers through the internal and the external Gateway, under defined security roles and policy. The key manager sub-component supports OAuth2 authentication. REST and SOAP APIs are available with a unique domain end-point. The end-point services can be developed by internal suppliers by means of ESB tools.

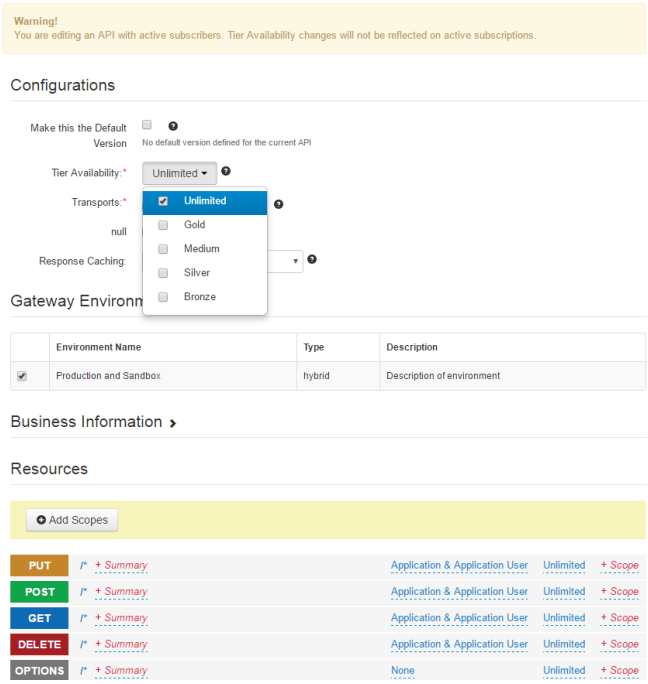

FIGURE 13. WSO2 API MANAGER, PUBLISHER – API CONFIGURATION EXAMPLE

The API Manager is also able to provide some statistics about API usage.

[1] https://docs.wso2.com/display/AM1100/WSO2+API+Manager+Documentation

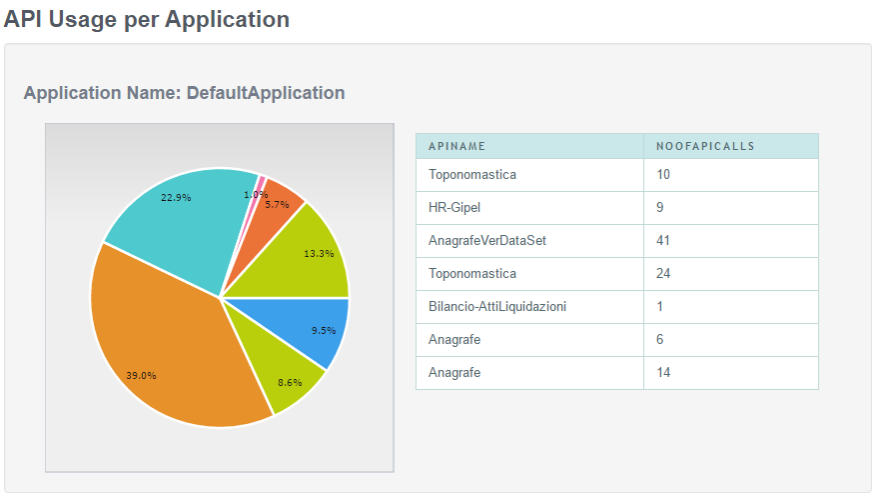

FIGURE 14. WSO2 API MANAGER – API USAGE STATISTICS EXAMPLE

The API Console Manager v1.10.0 subcomponent enables advanced management of API users and roles, including visibility level on published APIs.

3.3.3.2.2 WSO2 Service Gateway

This component acts as an outbound gateway for fruition of external resources (e.g., external APIs). It relies on OAuth2 authentication. It is part of the family of WSO2 open source tools.

3.3.3.2.3 WSO2 Identity Server

This component is the identity server used by the other USP components (the API Manager, Store and Publisher in particular) for authenticating via OAuth2 service/API consumers. It is also used by external applications to authenticate the local "Sharing Cities users" and thus enable SSO to ensure a seamless user experiences. I.e., the component will be in charge of managing the identities and profiles of the users of the Sharing Cities local solutions. It will be based on the WSO2 Identity Server tool v5.2.0[2]. Multiple authentication protocols are supported, including SAML and OpenID Connect. This component will become part of the Milan USP at a later stage (probably v3, see Sect. 2.4).

3.3.3.2.4 WSO2 Business Process Server

This component supports the design and implementation of business processes related to communication management for service fruition (subscription, registration, update etc.). It is based on the WSO2 Business

[2] http://wso2.com/products/identity-server/

Process Server tool v3.5.1[3]. This component can manage and process every activity in which human interaction is needed, e.g., a validation step in a service subscription and registration workflow. It also manages the definition of the throttling tiers for usage of published APIs.

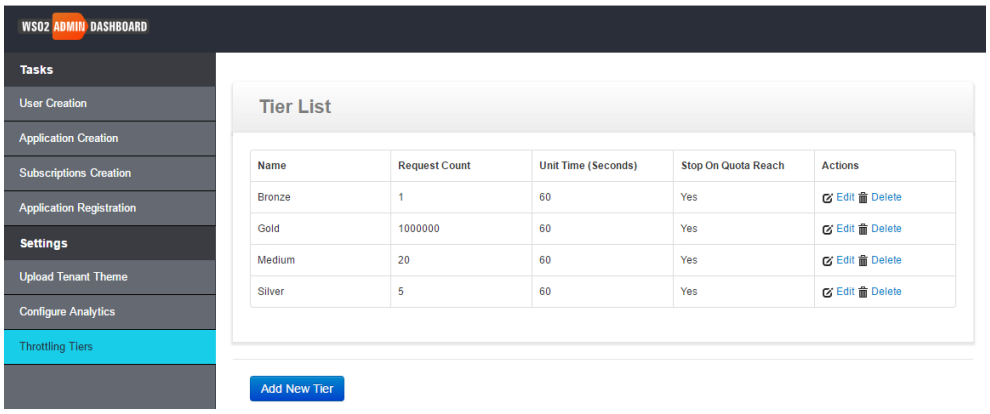

FIGURE 15. WSO2 BUSINESS PROCESS SERVER – SETTINGS EXAMPLE

3.3.3.2.5 WSO2 Publish-Subscribe Message Broker

This component supports the publish-subscribe interaction paradigm. It will be based on the WSO2 Message Broker tool[4]. It will support connection with remote devices and sensors via the MQTT protocol. This component will become part of the Milan USP at a later stage (probably v2, see Sect. 2.4).

3.3.3.2.6 WSO2 Data Analytics Server (Business Activity Monitoring)

This component enables monitoring of service behaviour and smart alerting in case of critical situations. It is based on the WSO2 Data Analytics Server tool v3.0.1[5]. It is currently installed on the same machine that manages the Business Analytics Monitoring server. It constitutes a console for the monitoring of each data transaction. This component analyses data in real time or in batch mode, and plays a fundamental role to control the status of the request load related to the machine request time. The Data Analytics Server is also necessary to locate errors and find the appropriate solutions.

The Data Analytics Server component is the most onerous component to run and maintain due to the resources and the production server support it requests. In fact, for each service request instance between

[3] http://wso2.com/products/business-process-server/
[4] http://wso2.com/products/message-broker/
[5] https://docs.wso2.com/display/DAS301/WSO2+Data+Analytics+Server+Documentation

two end-points, the component tracks all the communication status, producing a great quantity of data that can be used to analyse every possible bottleneck and every process problem.

3.3.3.2.7 WSO2 Enterprise Service Bus

This component enables the realization of advanced services by integrating different data sources exposed via APIs. It is based on the WSO2 Enterprise Service Bus tool[6].

3.3.3.2.8 Business Intelligence

The following components are currently available to the Municipality of Milan to support business intelligence and visualization features:

- SAS Visual Analytics.
- QlikView Business Intelligence.
- SAS DataFlux.

All of these tools adopt a commercial license. Adoption of open source tools is under consideration.

3.3.3.2.9 WebGIS

This component supports cartographic visualization of data made available via REST/SOAP services. In order to be processed, data to be visualized on map should be annotated with proper metadata (guidelines are available).

3.3.3.2.10 Data Store

This component will be in charge of storing part of the data ingested and managed by the USP. Technical details of this solution are under discussion. It could become part of the Milan USP at a later stage (probably v3, see Sect. 2.4).

3.3.3.3 E015 Digital Ecosystem

Service interoperability at regional/national level – and beyond – is achieved through the E015 digital ecosystem[7]. E015 is a multi-stakeholder digital ecosystem developed under the scientific coordination of Cefriel in order to exploit the Expo Milano 2015 event as a major opportunity to introduce disruptive innovations in all aspects of urban life: infrastructures, transportation, cultural and social life, accommodation, services and facilities etc. The ecosystem operates since 2013.

E015 contributes to the Milan USP in different ways, by sharing actual IT components (e.g., the asset registry) as well as technical and process guidelines for participating in the ecosystem.

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[6] http://wso2.com/products/enterprise-service-bus/
[7] http://www.e015.regione.lombardia.it/PE015/ (in Italian).

3.3.3.3.1 E015 Asset Registry

The E015 Asset Registry is the main entry point of the E015 ecosystem. It provides the following features:

- Acts as the showcase Website of the ecosystem, providing all interested visitors with information about the goals and the current status of the Ecosystem initiative, advertising current results achieved in terms of active participants as well as number and kind of services, applications and glossaries published etc.
- Makes publicly available the process and technical guidelines of the ecosystem.
- Provides candidate participants with a Web form for submitting a membership request.
- Provides registered users with Web forms for submitting publication requests for new services, applications and glossaries.
- Supports participants and the Technical Management Boards with workflows and notification mechanisms for managing the different publication processes.
- Provides a Web interface for browsing the Ecosystem registry.

The E015 Asset Registry is composed of:

- The participant registry, listing all the subjects that joined the Ecosystem.
- The service registry, listing all the atomic or composed services published in the Ecosystem, with their respective descriptors.
- The application registry, listing all the end-user applications published in the Ecosystem, with their respective descriptors.
- The glossary registry, listing all the glossaries (data models, taxonomies, ontologies etc.) available in the ecosystem, with their respective documentation.

The Asset Registry also supports the creation of relationships between the instances of E015 entities, e.g.,

- Providers are linked to the services, applications and/or glossaries they published.
- Composed services are linked to the atomic services they use.
- Applications are linked to the services they use.
- Services are linked to the glossaries they use.

The E015 Asset Registry will be populated with a selection of Sharing Cities APIs and glossaries developed in the project. User of Sharing Cities solutions will be listed as application providers as well.

The E015 technical guidelines and best practices, publicly available on the ecosystem Web site, define different aspects of the E015 ecosystem operation, e.g.,

- Ecosystem roles and responsibilities.
- Processes and related activities: how to join E015, how to publish a service, an end-user application or a glossary.

- Technical guidelines, standards and best practices for realizing E015 services or end-user application (taking into account aspects such as security, interaction patterns, caching, exception handling versioning etc.).

3.3.3.3.2 Federation Gateway

The Federation Gateway component will enable interoperability via E015 at international level, e.g., between the Lighthouse Cities, as well as the fellow/link cities. This component will design and implement standard approaches to make available APIs and services present in the USP of one city to the federated USPs of other cities. This component will be developed as part of the Milan USP at a later stage.

3.3.4 Milan USP v1

The Milan USP v1 is a basic version of the Milan USP composed of different operating components, in particular:

- Monet EMS,
- Interoperability Platform of the Municipality of Milan.

This USP realisation as a proof of concept is capable of demonstrating basic API-based integration between the Monet EMS solution and the Interoperability Platform of the Municipality. In particular, the Monet solutions already acquires, stores and elaborates actual data from some test sensors deployed in the smart district of “Porta Romana / Vettabbia”. Such data is made available to the Interoperability Platform via the Monet REST API. Thus such data is available as an API through the Interoperability Platform, taking advantage of the feature of the platform (M2M authentication, monitoring etc.), and can be integrated in a simple dashboard for demonstration purposes.

As soon as other WP3 data sources become available, they will be integrated to the USP in a seamless fashion, so to start populating an API-based ecosystem that enables the creation of advanced services for the end-users.

4 Data Capture Tables

This project initiative relates to engineering the UCs being defined and then refined at project level, i.e., besides describing project UCs in a document, partners have been asked to describe in detail what data sources and data streams are involved in each UC: what specific physical devices and sensors are or will be in place, the kind of data they produce, the data generation frequency, the network and communication methods etc.

Such information is vital for WP4 to better understand and manage interaction and integration scenarios between the field and the USP. We mention this initiative in this deliverable because it provides WP4 teams with a closer insight about city pilots and directly informs the realisation of the USP instances.

The result of this initiative is a “living document” being constantly updated and monitored by project partners. The current version of the data capture table shared on Google Drive project folders can be found here:

https://drive.google.com/open?id=1-NyWkBXu0Evv3eJ7Y94lTSiQX058Z5TDtCfmO7Gi6Ts